A QUANTITATIVE STUDY OF SOUND CHANGE IN PROGRESS

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Chapters 1-7

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T A B L E S

Introduction

The research reported here concerns the instrumental study of sound change in progress, work supported by the National Science Foundation from 1969 to 1972. The work was carried out in two phases: at Columbia University in 1969 and 1970, and at the University of Pennsylvania in 1971 and 1972.

In addition to the authors of the current report, a number of other research workers have contributed a great deal to these findings. Much of the original instrumental analysis of the New York City speakers was done by Benji Wald, who also analyzed a number of speakers in other dialect areas that are part of the focus of this report. Wald also carried out field work in Boston and Chicago; the Chicago interviews with Carol Muehe (Fig. 23) and others play an important part in several sections of our report.

Virginia Hashii also carried out a major portion of the instrumental analysis in the first phase of this project. In addition, she carried out a supplementary series of interviews with older New Yorkers; Margaret Morgan (Fig. 5) is representative of this group.

Marianne Lewin served as secretary-transcriber to our research project in New York City and contributed to the spectrographic analysis. She also carried out exploratory interviews in Rochester; Joyce Norton (Fig. 20) represents this series of interviews.

In the more recent phase of our work at the University of Pennsylvania, David Depue has done a sizeable portion of the spectrographic analysis, particularly for the Southwest and the Detroit areas.

We are also indebted to Teresa Labov, who assisted in the field work in England and in the Southwest, and contributed insights into the social structures of the communities being studied.

At a number of points, we have indicated our profound indebtedness to Roger Shuy, Walt Wolfram, and William K. Riley of the Detroit study. Our use of their interviews has contributed greatly to the systematic character of our sampling and our grasp of the general processes operating in the Northern City.

Geoffrey Nunberg is responsible for much of the material on the history of English in Ch. 4, 6 and Appendix A. His review of primary sources has been extremely helpful in assessing the generality of our findings. At an earlier stage, we benefited from suggestions of Patricia Wolfe, who in particular called our attention to the Old Prussian and Czech cases. At various points in the discussion we call attention to contributions from a number of scholars who have influenced our thinking and the direction of our work; we are especially indebted to William S.-Y. Wang, C.-J. Bailey, and Peter Trudgill.

The three authors of this report have been responsible for the main body of work at the University of Pennsylvania. Malcah Yaeger has done the major portion of the spectrographic analysis in this phase, and carried out independent analyses of specific acoustic and linguistic problems, particularly in the Outer Banks and Buffalo studies. She has done field work in the Buffalo area; Mrs. Black (Fig. 17) and others are representative of this series.

Richard Steiner has carried out the historical research on other languages reported in the final sections of Chapters 3 and 4 and his insights also figure in the general formulations of Chapter 5. William Labov has been the project director in both phases, carried out most of the field work, and is responsible for the phonological analysis and overall formulation of the report.

Abstract

Sound changes currently taking place in English dialects are studied through tape-recorded interviews with working-class speakers across a range of generations and age groups. Samples are drawn from completed sociolinguistic surveys of New York and Detroit, and exploratory series in a number of other areas in England and America. Impressionistic reports made in earlier periods are used to correlate progressions in age-distribution (apparent time) with changes in real time.

The positions of the vowel nuclei for each speaker are mapped on an F1/F2 plot, locating formant centers by digital interpretation of narrow-band spectrograms. Eighty to a hundred vowel nuclei are used to produce a minimal plot of an individual vowel system. Relations between vowels of different sub-systems are used to establish relative degrees of height of vowels in the process of on-going change.

The raising of tense and ingliding vowels is studied in detail in New York City and the northern cities. The raising of (æh) in New York City shows a number of conditioning factors which are not evident before and after the change. The strongest factor is the presence of a following front nasal: the (æhN) sub-class is lower for the older subjects but becomes the highest for most others. Peripherality, defined as approximation to the outer envelope of the phonological space utilized, is shown as the controlling factor in the rate of vowel raising. At the start of the change, height is defined in terms of F1 only: at a mid-point in the change, it is re-defined as 2(F2) - F1. The initial lower position of nasals is the result of its peripheral position in the first stage of the change.

In the unconditioned raising of (æh) in the Northern cities--Buffalo, Detroit, and Chicago--similar conditioning factors operate (Ch. 3). A chain shift occurs in this area in which (æh) moves to high position and short o moves forward and long open o down and forward. Following stops favor this shift, and the entry of long open o words into the chain is marked by a reversal or re-orientation of /oh/ allophones (Ch. 4).

General principles of chain shifting are set forward on the basis of evidence drawn from New York, Detroit, the Northern cities, London, Norwich,

Philadelphia, the Outer Banks of North Carolina, Atlanta and Central Texas. In chain shifts, tense or long vowels rise; the lax nuclei of upgliding diphthongs fall; and back vowels move to the front. These principles are combined in four basic patterns of chain shifting which can be observed in ongoing changes in completed shifts of the past. In the spectrographic data, it appears that tense vowels rise along a peripheral path, and lax vowels fall along a non-peripheral path. This principle makes possible the re-interpretation of a number of historical cases where merger should have taken place by the usual criteria but did not.

General principles are also set forward for chain shifts between sub-systems.

The results of minimal pair tests and commutation tests which show that vowels have merged may not match the system of distinctions used in actual speech. Five cases are presented in which reports of merger by native speakers of a dialect are shown to be inaccurate in the sense that consistent differences are maintained between vowel nuclei in actual speech. A number of historical problems are reviewed in the light of these findings, and cases of merger with later re-separation are reinterpreted as possible examples of such false reports. The basis of such reports may lie in the relative weakness of perception of the F2 differences which differentiate the peripheral--non-peripheral paths.

CHAPTER 1

BACKGROUND AND STATEMENT OF THE PROBLEMS

1.0. The study of change in progress

This report is a study of sound changes in progress, more specifically of vowel changes, with considerable emphasis on the chain shifting of vowels. It is a technical progress report on NSF Contract 3287 dating from September 1, 1970, but drawing also upon results from research conducted under NSF-1987 in 1969-70. The objectives of this study are to discover the general principles which constrain, govern and promote sound change by the direct observation of change in progress.

We will report a number of vowel changes which we have located and analyzed in English dialects through the spectrographic analysis of tape recorded interviews gathered in the field. Many of the on-going changes reported here have not been observed or reported before; none of those which have been discussed have been seen within the view of phonological space presented in this report. A number of general principles of sound change are presented here for the first time, and a number of widely accepted principles are shown to be incorrect or more limited in application than has been believed in the past.

The general principles we will derive from this study assume greater importance when they are related to changes that have taken place in the past; at the same time our findings tend to illuminate many unresolved problems of historical linguistics. In the course of this research, we have compared our findings with reports of similar vowel shifts in the history of English and other Germanic languages, and gathered data on vowel shifting in Romance, Balto-Slavic, Greek, and a number of cases outside of the Indo-European family. We proceed upon a uniformitarian principle: that the forces which produce sound change today are the same as those which operated to produce the historical record. We have of course looked for limitations of this principle, but on the whole it seems to operate as successfully in linguistics as it has done in geology.

This report focuses primarily on the analysis of current changes; a fuller treatment of historical implications will be given in separate publications. At the end of each chapter we will indicate historical parallels to current sound changes; we will attempt to summarize the unresolved issues of earlier discussions and suggest how our findings may contribute to a resolution of these problems. Two issues in the history of English are treated in greater detail: a discussion of the Great Vowel Shift in the light of our data (in Ch. 4, section 8) and an examination of two reported cases of merger and separation in the seventeenth and eighteenth centuries (Appendix A).

1.1. Scope and general methodology of this study

The tape recordings of English dialects are gathered with equipment which minimizes the problems of competing noise in field situations, and with sociolinguistic techniques which minimize the effects of observation on style shifting. Our most valuable bodies of data are systematic sociolinguistic surveys carried out in earlier studies of New York City (Labov 1966) and Detroit (Shuy, Wolfram and Riley 1967).[1] Beyond this, we have gathered data from many cities in England and America through exploratory studies.[2] Although these studies are not drawn from a random sample, and do not offer as large a body of data from any one locality, they are somewhat more systematic in their techniques of tracing change across generations, superior in sound quality and volume of speech,[3] often closer to the vernacular, and enriched by experimental procedures not utilized in the original sociolinguistic studies.

Among the other urban areas we have explored are the northern tier of cities from Boston to Chicago; Philadelphia; several Southern cities including Atlanta and New Orleans; and urban centers in the Southwest. In the summer of 1971, data was gathered from fifteen inner city areas in England, Scotland and Ireland. We have also explored a number of rural areas in New England, the South and Southwest, and several areas in England. These areas were selected because the on-going changes which were reported or suspected there served to illuminate the general principles of sound change which appeared in our preliminary studies.

In almost every urban area studied we have found clear evidence of sound change in progress. In some of the rural areas the features of interest had already reached their maximum extent in earlier generations and were now receding before the pressure of the standard language. Chapters 3-6 will draw from a wide range of this evidence, concentrating upon those areas where we have the strongest evidence of on-going change, but also utilizing data from dialects where such processes operated in the past but are no longer active.

The recordings we have gathered have been analyzed with the sound spectrograph (Kaye 6061B); the position of relevant vowel nuclei was determined by measuring first and second formant positions at steady states or points of inflection (2.6-8); for some vowels, third formants and end-points of glides were also measured. The vowel pattern of each speaker studied was mapped as a separate system in itself before generalizations were drawn from the relations within that system. A minimum of 80 spectrograms were used to form a general outline of a vowel system; in such an over-all system from three to ten measurements were taken for each phoneme or allophone of particular interest, such as /æ/, that was to be located. Some phonemes were explored in much greater detail, resolved into ten to fifteen sub-classes, and each of these measured through one to five tokens. In the course of this work, we mapped the vowel system of 245 speakers. Approximately 16,000 sections of speech were measured through two to four spectrographic displays.

This study applies the techniques and findings of acoustic phonetics to problems of linguistic theory. In so doing, we make the assertion that data from speech is relevant to linguistic theory, and continue the program of developing an empirical base for such theory in the unreflecting speech of every-day life. We define such a linguistic style or register as the <u>vernacular</u>--the style in which the minimum degree of attention is paid to speech (Labov 1970:46). The present study provides additional evidence that this vernacular is the most systematic form of language, and that more formal styles produce in most speakers irregular and unpredictable distributions, reinforcing the findings of the Lower East Side study in this respect (Labov 1966).

The methods of our study involve the further claim that linguistic theory must take social factors into account for a rational account of language change. Within the theoretical model of a homogeneous speech community there are serious problems of conceptualizing change, and it is not surprising that those who wrote on historical linguistics within this framework rejected on <u>a priori</u> grounds the possibility of studying sound change in progress (Bloomfield 1933:365; Hockett 1958:457; Chomsky 1965:3). When we abandon the identification of structure with homogeneity it is possible to construct a rational model of change and begin to observe it (Weinrich, Herzog and Labov 1968:100-101).

Our present outlook predicts orderly heterogeneity within the community, and we expect to find change in progress located within specific social groups.[4] A great many of the sound changes we have traced are to be found in large cities, where linguistic change proceeds rapidly among working-class speakers in the urban centers.[5] Most of these changes had not been observed before in England or America by dialectologists or linguists resident in those cities, prior to the sociolinguistic studies of the late 1960's. Techniques for working-class speakers and interest in their speech has not been developed in Europe or in America. Dialect geographers are not as a whole concerned with change in progress, since their basic goal has been to trace the oldest regional patterns and relate them to settlement history.[6] This difference in outlook does not prevent us from utilizing and developing the earlier work of the Linguistic Atlas of the Eastern United States (Kurath and McDavid 1961) and the Survey of English Dialects (Orton and Dieth 1970). This data has been all the more valuable to us because dialectologists did not absorb the strictly phonemic orientation of earlier decades in American structuralist linguistics, but preserved a strongly phonetic outlook. This conservatism has been considerably justified in the light of our findings that intuitive judgments of minimal pairs are surprisingly limited as sources of information on the sound system of a language (Ch. 6).

The fact that our study is based on spectrographic analysis also has theoretical implications. It has been necessary to set aside any preconceptions about the relations of impressionistic transcription to spectrographic data. Our use of spectrographs has generally confirmed the accuracy of earlier impressionistic transcriptions, and increased our confidence in earlier observations of chain shifts. But certain limits of such transcription have also become evident. As we will see in Chapter 6, the ear is quite sensitive to first formant position, but it is much less attuned to differences in second or third formant position. Our two-formant plots show systematic differences in F2 position of certain word classes which phoneticians can begin to perceive reliably only after their attention has been directed to them by the visual display. It follows that further use of F3 or other parameters would only increase the relative advantage of instrumental readings.[7] See Chapter 6 for further discussion.

Our systematic use of spectrographic displays to study vowel systems necessarily introduced challenges to the adequacy of current distinctive feature theory as applied to the level of phonetic change that we are studying. The shifts we observe are located in a phonetic space which is more complex than any current feature system and is not in any case a set of independent orthogonal dimensions. Yet the properties of this space offer persuasive explanations for many unsolved theoretical problems. We will be working with the kind of n-ary rules foreseen by Chomsky and Halle (1968:297) at a level of phonetic realization more detailed than their phonological component. We find for example that abstract phonological features such as [+tense] and [-back] are quite appropriate to describe the higher level selectional rule for tensing short a, but not for the raising process which gradually converts low tense vowels into high ones. We will formulate these processes as variable rules (Labov 1969) within a feature system derived from our spectrographic view of phonological space.[8]

1.2 Earlier studies of change in progress.

The most influential and important study of change in progress was carried out by Gauchat (1905) in the Swiss village of Charmey. Gauchat undertook this study to test the accepted idea that such villages had homogeneous dialects; he found instead considerable heterogeneity, locating six variables which showed regular progression across generations. In 1929, Hermann confirmed the fact that at least four of these represented historical changes in real time which had advanced further in the intervening three decades (1929). Sommerfelt (1930) has located change in progress in Welsh, and Kranzmeyer in successive Viennese generations. Quantitative studies of such change, by impressionistic methods, were carried out by Reichstein in Paris (1960), Labov in Martha's Vineyard (1963) and New York City (1966); more recently on-going change has been located by Cook in Salt Lake City (1969), Cedergren in Panamanian Spanish (1970) and Trudgill in Norwich English (1970). In all of these studies except Kranzmeyer, sound change was found to be advancing more rapidly in specific social groups, and spreading outward in a wave-like pattern to neighboring social groups. Bailey's analysis of such wave patterns in the dialects of Northern England (1970) indicates that the change may follow a regular progression through an implicational series of environments without any necessary geographic or social connection, but these are inferences of change drawn from dialect patterns rather than observations of sound change in progress. Our current research finds that on-going changes have a coherent social and geographical base, even when they are proceeding without any overt social recognition. (For further analysis of these studies see Labov 1973b.)

Our approach to the observation of sound change in progress utilizes the differential distribution of features across age levels to infer the presence (or absence) of change. Thus we will be tracing change in apparent time. As all of our studies have pointed out, such inferences are best justified by comparisons with data from earlier points in real time so that we can distinguish age-grading from true change. For that reason, the studies of well-mapped communities like New York City or London are the most promising; but in many other cases we can utilize other indirect evidence to make the inference from apparent time with some justification.

The studies cited above give ample evidence that change can be traced as it occurs even by impressionistic methods. In fact, we find that change is often much more rapid than most historians have realized. A vowel can pass from the most open position to most closed position in less than a century (see 3.2.1.). To trace these changes in their most systematic form, it is necessary to observe them in early stages in their central social location. The instrumental techniques which we are using here make it possible to develop and systematize the type of socially related observations made by Gauchat within the community and in this respect, we must consider this study to be a direct continuation of his work.

1.3. Theoretical issues to be considered.

In the last section we anticipated a question which must still be raised: can sound change be observed? In spite of the many studies cited above some linguists continue to insist that sound change is basically unobservable, and that our reports are records of "dialect mixture" or "the propagation of a change" rather than the change itself (King 1969:119; Postal 1968:284).

The general position that we have taken is that no useful distinction can be made between a change and its propagation (Weinrich, Labov and Herzog 1968) as long as we continue to consider language an instrument of communication. The language does not change if one man invents an odd form or develops an idiosyncrasy, even if people understand and evaluate his behavior; it does change when others adopt his idiosyncrasy and use it as a new social convention for communicating their intent. The presence or absence of dialect mixture is an empirical issue which can be detected in our data; we will encounter cases where speakers have acquired new norms from younger speakers (6.2.) or show two distinct sets of norms in their basic vernacular (4.4.4.).

Assuming that we are capable of observing sound change, there are a number of open theoretical questions to be considered under the general headings of the constraints problem, the transition problem, the embedding problem and the actuation riddle (Weinreich, Labov and Herzog 1968).

1.3.1. The transition problem. In considering how a linguistic system moves from one state to another, we must deal with the traditional problem of the regularity of change. New evidence introduced by Wang and his associates from the history of Chinese dialects has challenged severely the neogrammarian claim that sound change affects phonetic classes rather than words (Wang 1969; Chen and Hsieh 1971; Chen 1971). In their view, word classes are broken up at the beginning of a change and reconstituted (to an extent) at the end of it. We are dealing with a number of changes which show evidence of such lexical diffusion in the recent past (3.2.2., 4.7.1.). Since we are measuring a great many lexical items in the speech of many individuals, we are in a good position to observe the effects of such lexical diffusion if it exists in our data. The study of the raising of short a (Chapter 3) offers the most possibilities on this question. Conversely, we examine the phonetic conditioning of sub-classes in the most detailed sense.

Secondly, we can ask whether such sound changes are gradual or discrete. Linguistic opinion seems to have come full circle in this respect, from a period when all sound change was considered to be gradual (Paul 1889) to a recent view that all change is discrete change in abstract rules (Postal 1968). The defenders of gradualism are still willing to argue the case (e.g., Andersen 1972), and such issues are still being stated in absolute terms. It seems possible to take a calm view of this matter, asking of each change we are studying whether it shows evidence of a gradual movement through phonetic space, or discontinuous positions at low, mid or high. Even the large body of data we have is not enough to resolve this issue decisively, but we hope to throw light on it.

1.3.2. The constraints problem. A theory of sound change which constrains the possibilities and declares that there are some changes which do not occur will obviously explain more than one which allows all possibilities. We are interested in discovering whether there are any uni-directional movements in phonological space, types of chain shifts which cannot occur, or retrograde movements which are ruled out. Chapter 4 and 5 will present several such constraints. We are also interested in discovering what kinds of conditioning exist: to see if grammatical conditioning, uninfluenced by either phonetics or analogy, can be observed at work in our data.

1.3.3. The embedding problem. The first issue to be encountered under this heading is the *locus* of change. At what level of linguistic organization does change take place: in abstract rule systems where all grammatical alternations are taken into account; at a level of contrastive phonemics, where the only significant units are those which keep word classes apart by their phonetic form; or at the concrete level of articulatory phonetic realization? Given a particular level of representation, we must then ask how much influence the other members of the system have upon the movements of a particular vowel. By definition, a chain shift shows such influence; but can we explain other sound changes as well by their embedding in the system?

There is a parallel question in relating change to the normative system on the one hand and the productive system of behavior on the other. Minimal pairs represent one such normative pole: the speakers' perception of same and different. Do changes in such reactions completely determine the rest of the system? What is the relation between intuitive norms and phonetic realization in the language as it is spoken? If we accept some forms of the competence/performance dichotomy, the answer will be that the intuitions of the speaker completely represent the linguistic system. Our data provide additional reason to hold this view suspect beyond the evidence brought forward in previous studies (Labov 1970).

A third aspect of the embedding question concerns the social unit in which the change occurs. Does sound change take place in individuals or in communities? How regular are the processes to be observed from one individual to another? Can we taken any grandfather, father and son, or any older representatives of successive generations, to reveal the change? The over-all review of our data should illuminate this issue.

Answers to all these questions will be needed to determine our approach to the problem of rule-writing. Are the rules which govern or describe sound change discrete shifts in binary features, or continuous functions of the vocal tract? Are they obligatory or optional or variable rules? Do they govern individuals or communities? We will not attempt to give definitive answers for each sound change, but in the course of discussion give examples of rules which indicate the most promising solutions.

1.3.4. <u>The actuation riddle</u>. It is clear enough that all of our explanations of linguistic change are after the fact. The functional principles advanced by Martinet (1955) are given strong support in our studies of chain shifts; but the conditions which lead to chain shifting are often present when no chain shift is to be observed. What are the factors which activate a given change at a given time? Once sound change begins to move, it seems to respond to powerful pressures which we still do not understand. Functional constraints upon these changes are relatively weak. In our studies of the raising of short a, we will observe a number of grammatical and semantic constraints which utilize the distinction between tense and lax a, but the process which led to tensing in the first place seems to be continuing and obliterating the distinction. No matter how much stock we put in the importance of phonemic distinctions, and how often we document the rotations of vowel systems which preserve these distinctions in the fact of sound change, we must still explain the case of Greek which merged seven phonemes into /ι/ over the course of its history.

The converse of the actuation riddle is the problem of drift. Given the fact that we do not understand why a particular change is activated at one period of time, we understand even less why changes continue in the same direction over millenia in one language family, and in another direction in another. We have constrained some of these possibilities, but there are other language-specific directions which remain unexplained, and our contributions here will perhaps only highlight further the mysteries that remain.[9]

CHAPTER 2

METHODS

A wide range of methods has been employed in this study, which utilizes sociolinguistic techniques for gathering data, acoustic instrumentation for measuring it, and linguistic formulations in assessing its theoretical significance. In this chapter we will consider the methods used under the following headings:

1. The selection of speech communities and linguistic features to be studied.
2. The selection of informants within the community.
3. Interviewing.
4. Recording.
5. Sampling word classes, from recorded speech.
6. Making spectrograms.
7. Locating the point in time for measurement.
8. Measuring formant height.
9. Mapping vowel systems.
10. Analyzing sources of variation.
11. Formal notation for phonological rules.

Since our studies are based on the view that the vernacular offers the most systematic record of sound change in progress, sections 1-4 will attempt to provide some indication of the techniques we have used to locate and record the vernacular. The reliability of our techniques of measurement and consideration of sources of error will be analyzed in sections 5-8. The conventions we have used for presenting vowel systems and the theoretical framework for analyzing them are discussed in 9-11.

2.1 The selection of speech communities and linguistic features to be studied

2.1.1. Development of earlier investigations. Our investigations of sound change in progress began with a number of changes which had already been identified in the course of earlier sociolinguistic studies, using impressionistic transcription. The centralization of (ay) and (aw) on Martha's Vineyard had already been examined spectrographically as a means of checking the reliability of the transcription (Labov 1963). The earlier study showed by impressionistic transcription a re-weighting of the phonetic conditioning of the change as it progressed (Labov 1965) and this issue was submitted to spectrographic analysis (Labov 1972). The larger body of materials available through the New York City study had identified nine sound changes in progress in the vernacular vowel system: the raising of (æh) and the parallel raising of (oh); the fronting of (aw) and the backing of (ay); the backing and raising of (ah) and (ahr) and the accompanying raising of (oy); the merger of /ihr/ and /ehr/ and the merger of /uhr/ and /ohr/. Since a large body of tape recordings drawn from a random sample of the population were available, first priority was given to the analysis of the sound changes in the New York City community.

A second major resource was the Detroit study carried out by Shuy, Wolfram and Riley (1967). This is a very large sample of over seven hundred speakers. Only a small number had been analyzed by impressionistic means, and there the main focus was not on sound change or vowel systems. Our preliminary explorations of the northern cities had identified the raising of short a and the fronting of short o as a sound change of major theoretical interest. Fasold (1967) had done preliminary work on this change, though he had not found impressionistic techniques satisfactory. Through the cooperation of Roger Shuy and Walt Wolfram, we were able to utilize the tape recordings collected by the Detroit survey and have drawn on them heavily in this report.

2.1.2. Urban exploration. On the basis of the New York City and Detroit studies, our investigation developed a primary interest in chain shifts in vowel systems. We carried out further interviews in other northern cities to deepen our understanding of the Detroit process: Buffalo, Rochester, Syracuse, Cleveland and Chicago. We also examined some of the neighboring and intermediate rural areas in New York State (Chili, Plattsburgh) to obtain a view of the rural background of these processes, but our major concentration was on urban developments.

The focus on cities rather than rural areas is due to the fact that (1) urban areas are less well known than rural areas, since the major focus of dialectology has been rural; (2) many sound changes are receding or being corrected in rural areas as the standard dialect affects the speech of young people. But in the center of every large city that we have studied, new sound changes are taking place which have not yet risen to social consciousness and are not subject to social correction. The center cities therefore seemed the most important place to draw data in order to develop the theory of chain shifting on the one hand, and mergers on the other.

We therefore carried out exploratory studies in a number of other urban areas beyond the northern cities mentioned above: Boston, Philadelphia, Atlanta, New Orleans, Salt Lake City, Phoenix and Los Angeles. The field work in Salt Lake City followed up a sociolinguistic investigation by Stanley Cook (1969) which focused upon the formation of a new urban dialect as well as the reported reversal of /ɑr/ and /ɔr/ which is a Utah stereotype as in "Put the harse in the born." Field work in England in the summer of 1971 gathered data in fifteen cities: London, Bristol, Cardiff, Birmingham, Liverpool, Carlisle, Lancaster, Glasgow, Edinburgh, Newcastle, Leeds, Manchester, Norwich, Dublin and Limerick. Consultations with dialectologists in Edinburgh and Leeds confirmed the fact that many of our exploratory findings had not been reported before, since British dialectology has not done extensive work in urban areas. In almost every city visited we were able to record phenomena of considerable interest to our general study of sound change, though it would be premature to say that we had actually observed sound change in those areas without the same kind of systematic sampling that was carried out in New York and Detroit.

The one British city that has been investigated systematically is Norwich, where Trudgill recently completed a sociolinguistic survey comparable to the New York and Detroit studies (1971). We were able to obtain spectrographic evidence for several changes in progress that had been identified by Trudgill, and we are currently planning to exchange data and analyses on a much larger scale. In Norwich Trudgill and ourselves have also identified several cases of reported mergers which are in fact not mergers but similar to the asymmetrical approximations we have studied elsewhere (see Chapter 6).

2.1.3. Rural investigations. Exploratory field work in a number of areas had identified other sound changes taking place in the United States, some known to dialectologists and others not described before. The on-going merger of short open o and long open o in cot and caught, Don and dawn, is taking place in a large geographic area, covering half of the area of the United States and rapidly expanding. Studies of the progress of this merger can be carried out in large cities such as Denver, but it is not primarily an urban phenomenon, and is best examined in the rural or small town areas where it is expanding, in New England, Western Pennsylvania, and the West. We made three transits across the hock-hawk line, examining its progress in rural Maine, central Pennsylvania, and the Southwest. Some of the results are reported in Chapter 6.

In general, the study of on-going mergers is best carried out in an area where the investigator can move back and forth geographically and across age groups at the same time, locating the older and younger forms of the change. The merger of fool and full was first identified in Salt Lake City and then found throughout the Southwest. A transit made from Los Angeles to Austin, Texas, in the summer of 1970 was aimed at locating the progress of four mergers: /uw/ and /u/ before -l; /iy/ and /i/ before -l; short open o and long open o before nasals and elsewhere; /or/ and /ɔr/ on the one hand, vs. /ɔr/ and /ɑr/ on the other. The critical areas for each merger are located at different points along the line from Phoenix to Austin: exploratory studies along the major highways are not a substitute for a systematic grid covering the countryside, but in the absence of dialect records, such linear transits can identify the areas where sound change is most actively in progress. The route followed was from Los Angeles, Phoenix, Flagstaff, Gallup, Albuquerque, Socorro, Las Cruces, El Paso, Sierra Blanca, Fort Stockton, Sonora, Junction, Austin.

In the course of our work, it became increasingly clear that important theoretical issues revolved around the changes taking place in Southern vowel systems. To investigate these phenomena we did not concentrate upon urban areas primarily, but rather the regions where isolation and special settlement history had produced extreme divergence. We made several studies of the Outer Banks of North Carolina, where we found that the chain shift termed Pattern 4 in Chapter 4 was most highly developed. In its most extreme form, the Outer Banks dialect converts lax front vowels into tense ones, as well as tense into lax.

These laxed nuclei are backed, while the corresponding back nuclei are fronted, crossing over to a large extent. These back upglides become front upglides often indistinguishable from the other front glides (see e.g. Fig. 41, Nora, Herbert). No more challenging developments could be found for a phonological theory to explain.

Our studies of Philadelphia, central Texas and London led to a focus upon the type of vowel shift which is most closely parallel to the Great Vowel Shift of sixteenth century English. Further exploratory studies were carried out in East Atlanta which are cited at a number of points throughout this volume. This pattern involves the systematic chain shift /iy/→/ey/→/ay/→/oy/→ which embodies two of the three principles of vowel shifting developed in Chapter 4. Pattern 4 also involves the shift of back vowels to the front which involves the third principle but is perhaps the least understood.

Finally, our study of reported mergers in New York, Pennsylvania, Albuquerque and Salt Lake City led to the conclusion that many of the mergers reported in the past may not have been mergers in fact. We therefore specifically investigated the reported merger of loin and line in rural areas of Essex, England. Chapter 6 reports on the results of this investigation (6.5).

The historical implications of our research have become increasingly evident as the investigation progressed. Several of the field projects mentioned above were motivated by historical issues, and an increasing amount of our effort is devoted to examining the implications of the present for explaining the past and the past for explaining the present (see the final sections of each chapter and Appendix A).

The communities selected and the sound changes studied in this report may be grouped under two major headings: (1) the study of vowel rotations and (2) the study of reported mergers. The two investigations complement one another, since a chain shift or rotation is the case where merger does not take place. We have attempted to bring together the most pertinent data which will lead to an understanding of these phenomena, but we are well aware that each of our exploratory studies will realize its full value only if it is followed by a more systematic investigation as in New York, Detroit, Salt Lake City, and Norwich.

2.2. The selection of informants

Previous studies of sound change in progress have confirmed the general principle that the most systematic form of speech is the vernacular--the unreflecting language used in every-day life when the minimum amount of attention is paid to speech. Furthermore it was found that middle-class speakers are most sensitive to correction and reflect a superimposed variety of language learned later in life more than the vernacular. College students and other middle-class speakers have often severely modified their own basic vernacular in inconsistent ways. This is true for sociolinguistic indicators which show no strong stylistic shift as well as markers and stereotypes that are corrected regularly. We therefore find that working-class subjects give us the best view of the vernacular.

Spectrographic examination of the records of the New York City study confirmed this principle. We carried out explorations of the speech of a number of middle-class subjects, but found that irregular correction had removed most of the data on the phonetic conditioning factors which govern the original change.

Most sound changes do not arise at the high or low ends of the social scale. In the New York, Detroit and Norwich studies we find that on-going changes are most prominent in an interior group--upper working-class or lower middle-class. Lower-class speakers are usually more conservative and absorb the full impact of change later than working-class speakers. Our sample of the New York City random sample was based primarily upon working-class speakers, though a few lower-class subjects have been analyzed. In general we have been successful in drawing a sample of subjects of varying ages but similar social and ethnic characteristics. One of the most regular progressions may be seen in a series of working-class Italian women from New York City (see the raising of (æh) from mid to high position in Figs. 6, 7-8, and 10).

In New York we were able to study several families in more than one generation. The Detroit study was particularly rich in this respect; one father-son pair figures strongly in Chapter 3 (Figs. 11-12).

In our exploratory studies of the Southwest, the Outer Banks, England, and other areas, we have adhered to the principle that working-class speakers give us the best view of sound change in progress. We have made some exceptions for certain middle-class females who correct older changes but show very advanced forms in more recent changes (see Sue Palma, Fig. 9).

Techniques for selecting informants in exploratory studies have gradually developed over a number of studies. The most advanced methods were utilized in the English series of 1971. Two basic approaches were followed in order to obtain a clear view of the vernacular across age levels: (1) work with retired and adolescent peer groups, and (2) work with families.[1]

In each city we first located the major football (soccer) fields and working-class areas. This was often done with the help of the city tourist center, where we were able to record a lower middle-class speaker of the local urban dialect to help identify style shifting in later work.

Football fields and bowling greens in England are located in public parks which are most heavily used by retired working-class people and adolescents. We avoided isolated individuals and focused on groups of individuals engaged in some activity. Whenever this rule was not followed, we usually found that the isolated individual was not a full member of the community and showed considerable correction away from the vernacular.[2]

In a group of older men, we focused upon the speaker in the center of social interaction. Men engaged in bowling or other sports were preferred. Isolated individuals with no immediate social connections tended to be depressed and produced little speech.

Among adolescents, we looked for boys playing football, or fishing. Working men at lunch or on vacation were also available. A good informant was defined as someone who talked a great deal, and interacted with others at the same time so that the interviewer was not controlling the interaction. As in any study of groups, it is important to locate the leader and allow him to direct the situation as it develops.

After a small acquaintance with the English situation, it appears that the two polar groups of adolescents were easily identified by their dress. Skinheads and Greasers usually had hostile relations with the police. A negative attitude toward authority is a good indication of a linguistic orientation which will shift least towards the standard language in face-to-face interaction.

The most reliable record of the vernacular is obtained in these group sessions where social interaction controls the production of speech rather than the intervention of the investigator (Labov, Cohen, Robins and Lewis 1968). Youth are less influenced by the standard norm when they are interviewed on their own ground, outside of the home or other adult-dominated situations. Men of working age are also freer away from home where they are under some pressure to exemplify normative patterns for their wives and children.

However, the home is a valuable site for locating several generations within the same family. In recent field work, a family location paradigm was developed which allows us to complete studies across generations in exploratory work.

1. Young children 8-11 are located playing in a street outside of a residential area, and the children are asked to join in a group session.

2. The interviewer approaches the nearest house where a parent of one of the children lives and asks for permission to interview the children. He promises to stop back to let the parent know when he is finished. The interviewer is thus transformed from a suspicious person observed talking to children to a respectable person interested in the parents' own children.

3. After a short group session with the children, the interviewer returns to the house and begins a conversation with the parent (e.g., contrasting older ways with the newer ways of the children). He asks if the parent has time to talk and interviews husband and wife together.

4. If a grandparent lives in the area, arrangements are made for an interview the next day with the help of the parents.

This technique locates families in a given neighborhood and insures at least two generations for comparison of age levels. Furthermore, it provides a base for contacts with an extended family and neighborhood. It gives us a natural route for working with several age levels: in some other approaches, the interviewer's business may be seen as defined as relevant to only one group and not appropriate for all ages. It has the disadvantage that the interviews carried out with husband and wife in the home are controlled by expectations of proper behavior and expression which are reduced in other settings such as pubs.[3] But in working-class families, one member is often relatively free from such constraints, and the interviewing technique reduces style shifting to a minimum.[4]

Family location does insure the profitable use of a limited time spent in a new area. The paradigm was carried out in six neighborhoods in the English study and has since been used elsewhere with good results.

2.3 Interviewing

The basic techniques for interviewing with individuals and groups have been discussed in other reports (Labov 1966; Labov, Cohen and Robins 1965; Labov, Cohen, Robins and Lewis 1968), and some of the general principles involved have been developed elsewhere (Labov 1970). In this section we will discuss only recent developments of technique.

"Interviewing" conveys the notion of an outsider asking questions and the local person responding to them. This is the formulation expected by many informants, who feel that they would not know how to report on themselves, their life styles, and ways of doing things without some guidance from the interviewer in the way of leading questions. (That is, the problem of unstructured description is properly seen as a difficult one). But our individual interviews are constructed to minimize the repressive effects of interrogation.

Any program of field work must consider systematically (a) how the field worker presents himself and how he appears to the subject; (b) the overt purpose of the interview and its over-all focus; (c) the range of topics that are to be covered and their sequential organization (the interview schedule); (d) construction of specific questions and probes; (e) the introduction of formal inquiry concerning language: word lists, minimal pairs, commutation tests, etc.; and (f) provision for further contact with the same individual or members of his group.

(a) In our exploratory studies the interviewer usually presented himself as an outsider. Interest in him and the interview was maximized by allowing this distance to appear as great as possible.[5] That is, the interviewer appears as someone who knows nothing about the area or local customs and can legitimately ask about anything. It is not the case, however, that the flow of speech is proportional to differences in information between speaker and addressee. On the contrary, it seems to be directly proportional to the amount of shared information. Therefore the interviewer quickly modifies his position as an outsider by accumulating as much information as possible on ultra-rich topics (e.g., in working-class England, football; Skinheads; local beer). His questions on these topics demonstrate the kind of knowledge that makes further conversation on fine points natural; otherwise the flow of speech may be impeded by the belief that the outsider can understand only the major facts and differences.

With adults in the family location studies the interviewer must appear as respectable and reliable. The presence of a wife and/or child, though not necessary, guarantees a good moral status for the interviewer. Furthermore, contact between families allows further social intercourse to develop with a more natural social base. The question-and-answer pattern of individual interviews can be overcome more quickly in this setting.

With adolescents outside of the home, the interviewer should appear conversely less respectable, in rural areas coming on as a "country boy," in urban areas as someone who shares hostility towards the established order. The frequent use of taboo words is an important way of defining the situation; reluctance of subjects to use taboo words before a microphone indicates that other forms of style shifting are still strong.

(b) The overt purpose of the interview should never depart from the interviewer's true interests nor be misleading or false. But we do not focus directly upon language. Our overt focus is always upon some topic larger than language which includes it. In the Southwest series and in England, we utilized a focus upon <u>common-sense learning</u>. The main elements of the basic approach may be outlined as

1. Geographic identification of interviewer ("American"; someone who travels about the world, comes from distant places; stranger to this area...).

2. Young people don't do too good in school these days.

3. But when they get out on the job (in the woods, on the ocean, etc.) they do pretty good.

4. They use common-sense learning.

5. Some people say it's disappearing, but we don't think so. We'd like to find out how you learned to do things by yourself when you were coming up.

6. (Opt.) I'm writing a book about common-sense.

This general approach properly covers language and many other topics of interest to us, and produces ready acceptance and interest. Each point in the series usually receives strong agreement from subjects. In our work in England we approached over two hundred persons with only two refusals.[6]

Other approaches utilized in our work share the common property that they cover our interests accurately without emphasizing that the form of language is of particular concern.

(c) The range of topics to be covered has recently been generalized into an over-all schedule, Q-GEN-II. This offers a basis from which specific interview schedules can be drawn, showing the interviewer the most natural route by which he can move from one topic to another, searching out areas of maximum interest for the speaker which elicit a wide range of speech styles. Q-GEN-II is a network of modules, each containing series of specific questions. Some of these modules are highly developed, and the exact wording of the questions worked out over successive sociolinguistic studies. Well-developed questions are short and should take less than five seconds to deliver (preferably one or two). For example, the module on FIGHTS contains the following sequence:

1. Why do fights start around here?

2. Is there such a thing as a fair fight?

3. If someone wanted to give you a fair fight, what would that mean?

4. What would someone say if he had enough and wanted to stop?

5. If he said (Q.4) , could you walk away without watching your back?

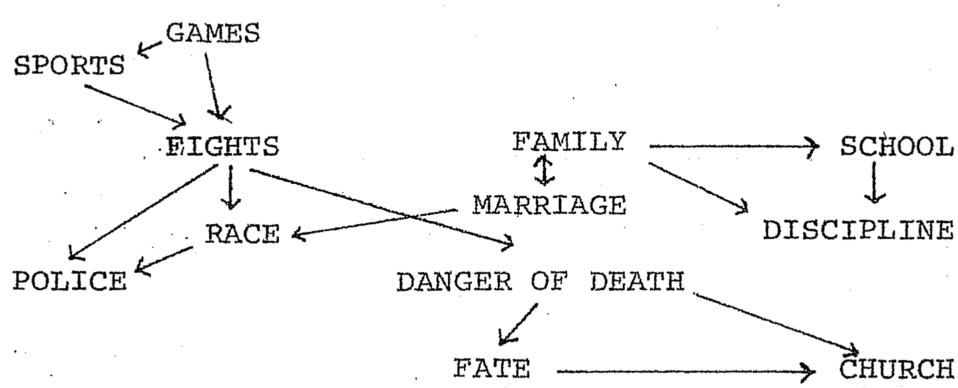
6. Did you ever get in a fight with someone bigger than you? How did you get into it?

7. What was the best (worst for middle-class subjects) fight you ever saw?

8. Was there one fight that you'd never forget?

The first five questions are designed to give structural information important for an understanding of the community and its relation to vernacular culture. The last three are designed to elicit narratives. Question 6 is phrased to allow anyone to give an account of any fight, whether he won or lost, without damaging his presentation of himself.

The sub-section of the Q-GEN-II network which includes the FIGHTS section takes this form:



The paths that can be followed by the interviewer are often bi-directional, though in some cases they are not. Entrance into the network varies with the age and social status of the subject.

(e) Formal inquiry into language can be introduced on the basis of the initial framework or in relation to the act of recording. Since colloquial language is the paradigmatic example of common-sense learning, the overt discussion of language fits naturally into this framework. But since it is also true that we often misunderstand speakers when we play back their tapes, it is always relevant to have them read lists of words or do commutation tests at the end of the interview. Subjects in every area show strong interest in linguistic questions when they have an appropriate framework in which they can discuss them.

Commutation tests are carried out as follows. One member of a pair reads a random list which alternates the two forms in question, and the second member tries to identify the word by spelling or meaning. This order is reversed for a second list. The interviewer then may also play a role himself which gives additional data of considerable value (see Chapter 6).

2.4 Recording

Most of the recordings utilized in this study were made with a Nagra full-track tape recorder at 3 3/4 inches per second on 1 mil mylar. For earlier studies, a Nagra III was utilized, with a mixer for some group sessions. A Nagra IV was used in more recent interviews, with one, two or three microphones feeding into the same track, for group sessions, in the field. Lavaliere microphones were used except in some indoor sessions: the Sennheiser MD-217 has replaced the RCA BK-6B or BK-12A as the most reliable unit, since it minimizes noise and clothing movement; good results have also been obtained with the AKG 110. The best recordings are obtained with the condenser microphones: the omnidirectional Sennheiser 104 and cardiod 404. But since these condenser microphones are sensitive to wind noise, even with a wind screen, they have been used mostly in indoor situations where they could be located close to the speaker's mouth without being directly in his line of vision. The two basic principles of recording in the field which we have followed are to minimize mouth-to-microphone distance and to remove the microphone from the main line of sight, so that eye contact with the subject can be maintained.

In group sessions, feeding several signals into one track has the serious disadvantage that it may then be difficult to tell who is speaking, even when voice qualities appear at first to be quite different. Stereo recording is the natural answer to this problem, but until the Nagra stereo equipment is available, a single microphone for group sessions is sometimes preferred. Spectrographs made from the speaker further from the microphone are of course not as good, but it is essential for this study to identify each individual accurately.

We have also utilized cassette recorders for some work. The Sony 120 has given reasonably good results, using the built-in condenser microphone or the ECM-16 Lavaliere microphone. Spectrographs made from cassette recordings are inferior to full-track recordings at 3 3/4", and show some distortion of the harmonics, but they can yield a full range of frequencies and can be used for measuring vowel height when necessary.

2.5 Sampling word classes from recorded speech

The first step in approaching a given dialect or sound change is to establish the relevant word classes. The problems and procedures are exemplified in the discussion of (æh) in Chapter 3. In new areas such as Norwich a search of the earlier dialect literature is essential to identify such classes as /ɔw/ in <u>tow</u> and <u>roll</u> vs. /ow/ in <u>toe</u> and <u>role</u>. The notation that we use to identify such classes is essentially a broad phonetic notation derived from the autonomous phonemic level of Trager and Smith 1957. These sub-classes show generally the point of departure of all the major sound changes we encounter. Thus /iy/ represents the class of <u>beet</u>, <u>be</u>, <u>beat</u>, etc., with M. E. long ē and long ɛ̄ which has been diphthongized in final position for most American and English dialects, and /ay/ represents the class of M. E. long ī which has been diphthongized in all positions and developed a mid or low nucleus.

We also represent conditioned allophones by adding the conditioning factor (usually the following consonant) to the notation: thus /æhN/ represents the class of long and ingliding short <u>a</u> words before nasals: <u>man</u>, <u>stand</u>, etc.

The number of vowels first selected for measurement in each class varies from three to ten, depending on the interest of that class for the sound change to be studied: either its involvement in the change, or its relation as a neighboring or limiting element to vowels involved in it.

When a series of sub-classes has been mapped out in one dialect (such as (æh) in New York City) it may be carried on to other dialects even where such sub-classes have not been considered before (such as /æh/ in Atlanta). If exploratory operations show no significant separation of the sub-classes, they are then collapsed. In the course of our studies, we have continued to discover new environments of interest for the changes examined most carefully. In many cases it has then been necessary to restudy a number of speakers, taking a much larger number of cases. For the raising of short (æh) we have examined all the relevant words for some speakers, including reduced and polysyllabic forms (see Fig. 3-12).

The selection of the words to be measured is deeply involved with the problem of reducing and accounting for variation in the distribution of vowel nuclei, discussed in 2.10. Our basic sample is from fully stressed lexical monophthongs (not weak words or function words). With subjects who show evidence of style shifting, we begin our analysis a fixed distance into the interview (approximately five minutes), avoiding the more formal portion at the beginning. From that point on all fully stressed monophthongs are selected in a given word class until we reach the number specified. Words with extra-heavy stress are marked. In the absence of stressed monophthongs, polysyllabic words with preceding or following syllables are examined. In some special studies, the distribution of these types have been examined as a whole.

All vowels before final and pre-consonantal /r/ automatically form separate word classes in our accounting. Vowels before final <u>-l</u> are studied along with a given class, but they are not taken as representative, since they will normally be lower and backer than other members.

Words with <u>l-</u> or <u>r-</u> preceding the vowel are considered in the same category as words with other initials except for certain classes in the course of large-scale sound change such as (æh). But words beginning with clusters of obstruent plus liquid are always considered special sub-classes and not taken as representative of the major class.

In addition to these major considerations, we find a number of minor factors which move elements of a word class away from the normal distribution. Preceding nasals have a pronounced effect in some cases similar to final nasals; final consonant clusters may also be considered. These and other features form a continuum between the major conditioning factors which automatically establish separate sub-classes and minor factors whose effects only become detectable when a linguistic variable is further extended in phonological space. The relative effects of different final voiceless stops on vowel position are considered in some detail in Chapter 3: a typical case of fine conditioning which becomes important in the midst of a change.

2.5.1. Stylistic conditioning. One of the most crucial questions to be faced in stylistic analysis is whether or not one can supplement an interview with words taken from formal elicitation: reading passages, word lists, minimal pairs. Throughout this report, it will be apparent that our answer must be negative. Given the importance of certain critical environments, we have resorted a number of times to reading lists where these forms could be well represented. But in each case we find radical differences between the over-all pattern of reading and the pattern of connected speech which makes it impossible to interpret the significance of isolated words which do not occur in speech.

There are two opposing shifts which we observe when a subject begins to read. The type we are most familiar with is correction: faced with a stigmatized feature in his own vernacular, the speaker corrects his speech to the socially approved form. Since overt social stigma is applied only in the late stages of a change (Labov 1966: Ch.10) there is usually a sizeable phonetic distance involved and the correction is quite clear. Fig. 3-3a shows the (æh) pattern in connected speech of a young working-class man in New York City. Fig. 3-3b shows his (æh) in a reading passage, and 3-3c the pattern of a word list. It is obvious that the data mostly disappears in formal style.

There are of course some speakers who do not correct their speech even in reading word lists--at least as far as the gross shifts are concerned. We are always interested in speakers who preserve vernacular style in reading, in the hope that they will be able to fill in the fine details which are missing in our data. For the study of an abstract selectional rule this strategy may have some advantages. In studying fine-grained phonetic differentiation it does not work as well, because such speakers seem to shift past the vernacular in reading, aiming at a more advanced norm. Fig. 3-4a shows the (æh) pattern in natural speech of a middle-aged New York woman, and 3-4b shows her reading pattern. We can derive a great deal of information from 3-4a, but from 3-4b we only learn that the speaker has adopted the norm of younger speakers and is resisting the process of correction.

When the linguistic variable is not subject to any overt social correction, it might be expected that reading passages would then match the pronunciation of clearly pronounced items in natural speech. But in such cases the reading pronunciations are also shifted further in the direction of the change. Fig. 3-19 and Fig. 15 show this shift between reading and speech for the (æh) pattern of a young girl from Detroit. Fig. 3-18 shows the (æh) reading pattern for a young girl from Chicago. This may be compared with base Fig. 23, which shows connected speech for the same subject. The reading forms show a tighter concentration, preserving some of the conditioning factors for (æh) but not all. For example, the peripheral position of (æhN) is maintained but not the low position of (æhf). (See Chapter 3). Thus we can use the evidence of a reading pattern to confirm relations we find elsewhere but not to disconfirm it or to make new discoveries.

There remains the question of stylistic differentiation within spontaneous speech. In the New York City study (Labov 1966) casual speech (Style A) was differentiated from careful speech (Style B); it is the sound pattern of this casual speech or vernacular that is our target in this study. At the beginning of our spectrographic work we analyzed only passages of casual speech, but in face-to-face interviews these did not give enough data to outline the sound system. We therefore began to examine the differences between Styles A and B. We found that B differed from A for most speakers in the frequency of grossly corrected forms, but not in the placement of uncorrected forms. This is a question which requires continual re-examination; in the light of our current data we take the main body of connected speech as a basis for sampling: we exclude data from formal discussion of language itself and from certain portions of the interview which are plainly more formal than the rest.

In our final analysis of the sound system of a given speaker, we sometimes find evidence of two distinct norms: one in the direction of the advancing vernacular, and the other corrected towards the standard language. This is evident in Fig. 3-4a where a single corrected ask is seen. It also appears in Fig. 3-3a, where one pronunciation of hand is lowered almost to the lax position, while the other is the most advanced vowel in the pattern. In Southern dialects we often find such evidence of correction. The Gratton family (Figs. 46-49) offers a good illustration. The parents show several distinct norms (Figs. 46-7) and the two daughters (Figs. 48-9) give even clearer evidence of a dual set of norms in the high vowels. More detailed study may eventually show that these form a continuous distribution, but in the case of /uw/ we see a discrete shift between high back and high front. The same kind of double norm for /uw/ can be seen in many speakers in Norwich (Figs. 33-4, 36).

2.6 Making spectrograms

Spectrograms analyzed in this report were all made on a Kay Elemetric Sonograph Model 6061B, with high shaping and linear display. Mark level and automatic gain control are set at levels sufficient to show all harmonics in a resonant vowel, but with no more than one or two primary (darkest) harmonics for a single formant.

The signal is normally fed from a Nagra IIIB full track tape recorder or a Tandberg 1521. Comparisons of the spectrograms made from these two inputs show no significant difference. None of the materials reported here were analyzed from cassette tape recordings, but preliminary trials show that this can be done.

Narrow-band spectrograms are made of the word and its immediate environment from 0 to 4000 Hz, with the base line identified in a mirror-image pattern. A broad-band spectrogram from approximately 3500 to 0 Hz is then made in an inverse display on the upper part of the spectrogram.

An alternative display which we have utilized recently uses a 33 per cent expansion of the narrow-band spectrogram. The broad band spectrogram is then made in unexpanded form above on the upper half. The frequency range of the narrow-band is reduced proportionately, but as long as enough data remains to give us a clear view of the third formant, this expansion results in a gain in accuracy of measurement.

In sections 2.7-8 we give the procedures we use for measuring spectrograms in outline form.

2.7 Selecting temporal location for measurement

The point for measuring the vowel nucleus is selected by observing the contours of the formant on narrow band and broad band spectrograms. Broad band spectra are utilized for greater clarity in locating relative maxima or minima.

2.7.1. The vowel is then measured at the point of inflection--the local maximum--of the first formant (see Fig. 2-1).

2.7.1.1. If the first formant shows an extended steady state, the point of inflection of the second formant (local maximum or minimum) is used to specify the point for measurement more narrowly (Fig. 2-2).

2.7.2.2. If the second formant does not show a point of inflection, the center of the steady state of the first formant is chosen (Fig. 2-3).

In any case, the vowel is measured at a point at least 50 msec from the beginning of the syllable.

2.8 Measuring formant height

2.8.0. Some spectrograms may be discarded if they appear difficult to measure because of noise interfering with the formant structure, lack of clarity of the formant, or extremely high pitch which offers too few harmonics for measurement.

2.8.1. All measurements are made on the narrow band spectrogram. Some previous studies (Ladefoged 1967) have favored measuring height on broad band spectrograms, but our own studies indicate that if the procedure outlined here is followed, measurements of narrow bands are more accurate on F1. Table 2-1 shows reliability tests which show that errors in our measurements range from ±25 Hz to ±40 Hz. Test I shows that broad band measurements registered almost twice as much variation as narrow band measurements on F1.

The formant is identified as a pattern of darker harmonics surrounded by lighter ones. Within the formant, primary harmonics (the darkest) and secondary harmonics (lighter, but darker than the background harmonics in between formants) are identified.

2.8.2. Basic location. The basic location of the formant center is determined as follows:

3 primaries	center of the middle primary
2 primaries	point midway between
1 primary	center

2.8.2.1. Adjusted location. If a secondary harmonic on one side of the primaries is distinctly darker than the secondary on the other side, the center of the formant is moved in the direction of the darker secondary by one quarter of the distance between formants.

2.8.2.2. Re-assignment of primary and secondary status. Part of the energy represented in a given harmonic may come from other sources besides the vowel formant being measured:

2.8.2.2.1. The first formant normally overlaps the voicing bar for high vowels. The higher mid vowels may also border on the harmonics which reflect glottal energy directly. For some speakers, the energy from voicing is concentrated in the first harmonic rather than the fundamental. This can be seen by examining low vowels, in which the first formant is well above the voicing bar.

2.8.2.2.2. When two formants are close together, a secondary harmonic for one is also likely to be a secondary for the other, and thus derive energy from both formants.

2.8.2.3. If energy for a given harmonic is contributed from another source besides the formant being measured, the harmonic is reassigned as follows:

→ primary harmonics are considered secondaries
→ if a secondary is darker than its opposing secondary (on the other side of the primary), this difference is discounted.

2.8.3. The height of the formant from the center of the base line to the center of the formant is measured in 40ths of an inch, to the nearest half. On the expanded spectrogram, 30ths of an inch are used.

2.9 Mapping vowel systems

This report includes a large number of diagrams which display relations between vowel nuclei and glides by plotting F1 against F2 on linear scales. We have considered alternative displays of this data at several point,, including linear-logarithmic plots, but none of the problems considered in this volume have been further illuminated by the other approaches.

The base diagrams for this study are given at the end of the text numbered without chapter headings as Figure 1, Figure 2, etc. Diagrams which analyze particular aspects of the system are given in each chapter, labelled Fig. 3-1, 3-2, etc. Both base diagrams and special diagrams utilize a scale in which F1 = 2F2. This display gives proportions which closely resemble the distributions we have been accustomed to in impressionistic transcription oriented to cardinal vowels. The dimension of height in the front vowels is then seen as a progression of vowels diagonally upward, that is, H = F2 - 2F1.

Our study proceeds from the results of experiments which show that F1/F2 stimuli produce satisfactory identifications of cardinal vowels (Cooper, Liberman & Borst 1951; Cooper, De Lattre, Liberman, Borst & Gerstman 1952) of English vowels (Peterson & Barney 1952) and of vowel systems in general (Fant 1958: 296-7). In our own studies of connected English speech development and change in vowel systems by using the maxima or minima of the first two formant positions of the nucleus, it follows that any contributions from F3, formant amplitudes, etc., could not make the vowels we are studying less distinct, but only more so. Some of our major findings (Chapter 6) involve F2 differences between vowels which are not predicted by traditional principles since native speakers report the vowels as "the same." Additional measurements at this point could not reasonably alter these findings but could only substantiate them. It has also been noted that duration can play a significant role in the perception of vowel color (Peterson & Lehiste 1960; Lindblom 1963). Although this issue is minimized in our present studies by the procedure of focusing on fully stressed vowels in monosyllables (p. 25), we plan to explore the issue in further research, especially in relation to the overlap of short vowels in F1/F2 plots discussed at various points in this report.

TABLE 2-1

RELIABILITY TESTS

All tests were conducted by specifying the words to be measured, but not the horizontal locus of measurement (point in time) which was included in the test.

Figures are given below for mean absolute differences between measurers in fortieths of an inch [1/40].

Differences of more than 150 Hz or 3/40" are normally due to wrong identification of formants; since such errors are normally corrected by their aberrant distribution on the vowel chart, the second "corrected" figure shows the mean absolute differences between measurers without such gross errors.

	F_1		F_2	
	Gross	Corrected	Gross	Corrected
I. W. Labov vs. B. Wald, 8/15/69; 25 vowels of Arlene Radziminsky				
Narrow band:	.81	.74	1.68	.96
Broad band:	1.61	1.33	1.36	-
II. V. Hashii vs. B. Wald, 5/15/70: 42 vowels of Ray Cutts, Essex, England (poor recording)	.63	-	1.20	.61
III. V. Hashii 4/15/70 vs. V. Hashii 5/15/70: same vowels as II.	.70	-	.76	.50
IV. V. Hashii vs. W. Labov, 6/1/70: 20 vowels of Allen Graham, Sheffield Texas (clear formants)	.67	.52	.81	.61

However, there have been a number of studies which suggest that F3 plays a major part in the identification of the front vowels, and that a weighted average of F2 and F3 may correspond better to acoustic impressions received by the listener than F2 alone (Lindblom 1968). Such considerations become crucial when we encounter cases of overlap in F1/F2 plots of vowels which seem to be perceptually different. In several such cases we did not find any consistent differences in duration, contour, etc., which would distinguish the vowels. Overlap of this kind occurred with some cases of fronted /uw/ vs. /iy/, where the glide of /uw/ was fronted as well as the nucleus; and with some cases of lowered /e/ which overlapped with fronted /a/ from short o (Fig. 23).

The case of the rounded vowels holds considerable interest because the F1/F2 plot does not give us a satisfactory representation of the effect of rounding. It is usually true that rounded vowels have lower F2 positions than corresponding unrounded ones; but this does not explain how unrounded and backed /iy/ is to be distinguished from rounded and fronted /uw/. In one case we studied in detail weighting of F2 by F3 did not further separate the rounded fronted /uw/ from the unrounded /iy/, both front upgliding diphthongs. So far, we have not succeeded in increasing the differentiation of the nuclei by weighting with F3.

In the base figures, the position of a word class is usually shown by an ellipse. This is the outer envelope of the vowels which we have plotted, and its size is a function of the number of vowels measured. Its shape and relative position seem to be relatively constant. The shape of the ellipse may be in part a function of allophones with slightly different distributions which were included in the class and mapped in that particular sample. A change in the definition of the class, splitting away certain sub-classes, will then produce a radical change in the shape of the ellipse. But the orientation of the ellipse is often significant in that it shows the direction of movement of a sound change in progress. Stable phonemes tend to cluster in ellipses no more eccentric than 40° while sound changes in motion show more elongated distributions. Fig. 50, for example, shows a Central Texas vowel system which is developing a chain shift /iy/→/ey/→/ay/→ but /ay/ is moved out of the way by being monophthongized and the position of its nucleus is stable. We see that /iy/ and /ey/ show elongated distributions in the direction of the shift, but /ay^v/ remains more tightly clustered in a low central position. On the other hand, /ay/ does not monophthongize in the Outer Banks dialect but moves strongly up to the back. Fig. 40 shows the elongation of the /ay/

distribution which indicates the variable character of this vowel. One would not want to lean too strongly upon the impressions created by the shapes of these ellipses, however, until a more rigorous treatment of the distributions can be provided.

In many of the base figures we have not drawn ellipses around the vowel classes which were in most active motion. Instead, each individual vowel is plotted with the following environment (and where relevant) the preceding ones as well. The reader will then be able to confirm the statements made in the text about fine-grained phonetic conditioning better than by examining the distributions directly (see 2.10 below). As a general convention, we have indicated the class of weak words by upward triangles or diagonally oriented squares in contrast to full lexical items which are shown by triangles with downward apexes and horizontally oriented squares.

2.10 Analyzing sources of variation

The considerations raised in 2.5 on selection of word classes interact with the methods discussed here for analyzing sources of variation. The end result of such an analysis may be the decision to create a new sub-class or the conclusion that a given vowel shows inherent variation along a certain dimension.

The basic limitation of our method is that we cannot replicate instances of a given word class indefinitely unless we have permanent access to the subject. The recording of one or two hours of speech usually represents a fixed body of data, and it may be that all the examples of (oht) in actual speech are brought, so that there is no direct contrast with walk or talk. We cannot insure the occurrence of bought from a word list for the reasons advanced in 2.5.1. We therefore look for contrasts within the lexical items that we have. If the relationships between -t, -p, and -k as conditioning factors are linguistically significant, they should recur in many speakers with only a few exceptions. Tables 3-3 through 3-8 show that the regularity of these relations can be observed by assembling a number of speakers from the community, and then comparing results from a number of different communities.

As usual in linguistic analysis, we are concerned with relations between elements rather than absolute positions. Thus it is not significant that allophones of short o before final -t should be in mid or low position. But if the -t allophones should consistently be higher than the -p or -k allophones we have a regularity of considerable interest. If in the course of sound change this relationship is reversed (Ch. 4) we are close to the mechanism of the sound change involved. Thus higher relations are the foundations of the principles developed here.

One way of checking our success in accounting for variation is to take a particular phoneme involved in change and examine all of the vowels in it to see how much of the distribution is explained by the principles already developed. Fig. 2-4 shows the (æh) pattern of Bea Black of Buffalo, a detailed version of Fig. 17. We have selected this example because it shows all short a classes in the course of change.

Our examination of this pattern will proceed from the most peripheral to the least peripheral. Each vowel is numbered and also shows the preceding and following environment as well as any unusual stress pattern.

First we may examine the allophones of (æh) with following nasals: 1,2,3,10. These are all on the most peripheral track, as predicted by 3.3.1.1., and the velar nasal is less peripheral (3.3.1.2.) as we find in general. (It is also close to the position of words which differ only by absence of the nasal: cf. 11 (bad) vs. 10 (banged)). The relative height of the nasals is not predictable except by stress, but in the course of change they are typically strung out along this track, advancing to highest position, i.e. towards /iy/.

The (æh) allophones before voiceless fricatives are 4, 5, 6, 8, 12, 15, 18. All but 15 and 18 are in upper mid position ranging from most peripheral to least peripheral. They are relatively low, as we predict for voiceless fricatives in Buffalo (3.3.1.6). No. 5 is closest to the nasals, as the initial nasal would predict (3.3.1.1). The final -f in 6 is also found in low, relatively peripheral position (3.3.1.6). We would expect to find 8 (asked) as less peripheral than mass with a single consonant in any case (3.2.2.4). No. 12 is predictably back non-peripheral with initial gl- (3.3.1.3). Finally, we find fashioned in the least peripheral position but relatively high. The following syllable conditions its non-peripheral position (3.2.2.4), and it is typically high in Buffalo (3.3.1.4). This leaves 15 and 18. No. 15 is at the same F1 position as the other last, but is at the other extreme of peripherality. This difference in the effect of l- is not accounted for. But the effect of initial l- is quite variable, compared to kl- clusters, for reasons still unknown. No. 18, calf, is not as common a word as half. We have observed it in low back position elsewhere, and it is possible that it is a lexical exception to the general positioning of (æhf) words (3.3.1.6).

Nos. 7, 9, 13, 14, 16, 17 and 20 show (æh) before voiceless stops. They are all in relatively non-peripheral position and follow the predicted progression of height, with palatals highest (7), alveolars next (9; 13), then labials (16) and velars (14; 17, 20) with some variation but the velars usually lowest (3.3.1.5). Finally we observe that 20, black, is the lowest of all, and least peripheral, combining the effect of the initial cluster (3.3.1.3) and the final -k (3.3.1.5). It typically overlaps the most advanced of the short o words, not (3.3.1.7).

The only word we have not discussed is 11(bad), which is the only (æh) before voiced stops, and is somewhat more peripheral than the voiceless stops, as we would expect (3.3.1.5) and at about the same level of height.

We find in this example that the principles we have discovered in this investigation account for the great bulk of individual variation in the (æh) words. A few items remain unaccounted for, but most are following paths which are determined by the nature of their phonetic environments. This is characteristic of sound change in progress. When the change comes to an end, we will not expect comparable success in accounting for individual fluctuations in allophonic position.

2.11 Formal notation for phonological rules

Throughout this study we will formalize the regularities discovered in spectrographic analysis as phonological rules. Since we will be dealing with inherent variation and varying degrees of continuity in the course of change, it will be necessary to write variable rules which can constrain free variation. The formal notation developed in Labov 1970 will be summarized here.

Variable rules are indicated by the use of angled brackets around the element to the right of the arrow. Thus (1) is a categorical rule and (1') a variable rule. The use of angled brackets indicates that relations of more or less will be relevant in linguistic description.

(1) $X \rightarrow Y \;/\; \_\_\_\_ \; Z$

(1') $X \rightarrow \langle Y \rangle \;/\; \_\_\_\_ \; Z$

The environment Z in (1) is a minimal condition for the rule: its presence is required if the rule is to operate at all. But if the presence of Z *favors* the rule--if the rule applies more often when Z is present than when Z is absent--we write

(2) $X \rightarrow \langle Y \rangle \;/\; \_\_\_\_ \; \langle Z \rangle$

More than one variable constraint in the same segment is indicated as in (3); their relative weight is shown by vertical ordering.

(3) $X \rightarrow \langle Y \rangle \;/\; \_\_\_\_ \left\langle \begin{matrix} V \\ W \\ Z \end{matrix} \right\rangle$

If no ordering is to be indicated, braces may be used within angled brackets:

(4) $X \rightarrow \langle Y \rangle \;/\; \_\_\_\_ \; \left\langle \begin{Bmatrix} V \\ W \\ Z \end{Bmatrix} \right\rangle$

If a rule always applies in a given environment, but remains variable in others, we use an * notation to show the invariance condition:

(5) $X \rightarrow \langle Y \rangle \;/\; \_\_\_\_ \left\langle \begin{matrix} {}^{*}V \\ W \\ Z \end{matrix} \right\rangle$

A linear variant of the vertical ordering in (4) and (5) will appear as <V<W<Z>. A particular constraint W may favor a rule only in the case that another constraint V is present, in which case we would write <V<W>>.

Rules (1-5) are written without regard to the feature system employed, X, Y, Z may be segments, binary features, or continuous dimensions in phonological space. If we want to indicate that a mid vowel becomes high variably we can write

(6) $[-\text{low}] \rightarrow \langle +\text{high} \rangle / \ldots$

This means that there is a certain probability of the mid vowels being high; otherwise they remain mid. But if the relative position of the vowels along a continuous dimension of height can be predicted, then we would write

(7) $[-\text{low}] \rightarrow \langle y\text{high} \rangle / \ldots..$

The notation $\langle y\text{high} \rangle$ must necessarily have a maximum value; its normal limit will be cardinal [i]. In the linear notation to be developed in Chapter 4, this is [3high]. To register finer degrees of raising and lowering, or to express the gradual nature of a change, the difference between [2high] and [3high] can be subdivided. The notation of [0high...3high] developed in Ch. 4 is neutral on this issue. However, we can assign limits to a rule of this sort to express the maximum distance that the vowel can be raised (or in the case of completed changes, the distance the vowel actually was raised). Thus to (7) we can append the condition: $y<4$, where [4high] is the semivowel [j].

A rule such as (7) will merge all front or back vowels into one high vowel if it continues to operate. Such rules have operated over long periods of time with exactly that effect: see the case of Greek or Akha in Ch. 4.8.5. Since chain shifts preserve distinctions, they obviously cannot be expressed in the form (7). The fact that chain shifts preserve the relative positions for all vowels involved is indicated by writing a variable feature on both sides of the arrow.

(8) $[y\text{high}] \rightarrow \langle y+x \text{ high} \rangle / \ldots.$

Condition: $y+x < 4$

Rule (8) states that whatever degree of height a vowel has is increased by a variable amount. This amount will be the same for each [yhigh] vowel. Thus if two vowels enter the sound change at [0high] and [1high] respectively they will not be merged by rule (8) but preserve their relative distances of [1high]. Thus at any given time, _x_ is constant for all values. In this notation, _y_ is a variable only in the sense that it can represent various categorical units--which may over the course of time shift their absolute but not relative positions. The quantity _x_ is a function of time (or age), and sometimes of style, social class, ethnic group, etc. In this report we will be dealing with relatively homogeneous groups of working class speakers, and _x_ will mainly be a function of age and style.

The condition on (8) limits the total value of the quantity _y+x_. For some given low value of _y_, such as [0high], _x_ may be limited to 1 unit because there exists [1high] and a [2high] vowel in the series. The condition is therefore to be read that for any y, $y+x < 4$.

We will also encounter chain shifts which operate in two directions, depending upon some controlling feature. Thus we may have

$$\text{(9)}\quad [y\text{high}] \rightarrow \langle y+\alpha\,\text{high}\rangle \;/\; \ldots \underset{\alpha\,\text{feature}_i}{\underline{\qquad\quad}} \ldots$$

$$0 < y+x < 4$$

Here we will need two separate limits since the rule operates in both directions. The condition is applied separately for the two values of α.

It is usually convenient to refer to a linguistic variable rather than the output of a variable rule, and for this purpose we will continue to use the parentheses notation. The phoneme /aw/ is a category defined as distinct from all other categories in the vowel system. It is normally assigned a realization in the phonetic output in terms of distinctive features. The variable (aw) may range over a much wider area in the speech of one person or the community, possibly overlapping other categories. It is defined as a group of sounds which vary together, jointly subject to the same stylistic, social, and linguistic constraints. In our discussion we will occasionally alternate these notations, using /aw/ to refer to the phoneme in a relatively stable position, and (aw) when we are focusing on the variability of (aw) in the course of change. Variables are not necessarily discrete from all other categories in their full range; identity of the elements composing this class is established by the range of variation and co-variation. In this respect, variables are similar to "underlying forms" or morphophonemes which may preserve their identity in the light of grammatical alternations. The identity of the variable is demonstrated by empirical observations of its behavior in speech; the identity of an underlying form by the construction of the simplest grammar which allows us to derive various surface forms by rule from a single dictionary entry.

The parallel behavior of members of the variable class is relative. There are cases where sub-classes of (aw) are clearly divided and go separate ways, at least for a time. They may be identified for example as (aw°) and (aw^{V}) for vowels before voiceless and voiced consonants respectively. Sometimes the two allophones are separated into two discrete categories, as in New York City, where /æ/ plainly does not co-vary with (æh); this situation justifies setting up an /æh/ category in the surface realization. Whether or not the unpredictable features of the tensing rule justify setting up different underlying forms for /æ/ and /æh/ in <u>average</u> vs. <u>avenue</u> is another issue, which is not easily resolved.

CHAPTER 3

THE RAISING OF TENSE INGLIDING VOWELS

This chapter will deal with the tensing and raising of low and mid vowels, with special attention to the ongoing raising of short _a_ in _bat_, _bad_, _ask_, _dance_. This is a process of some magnitude, carrying low [æ·] to [ĩ·ə] and, in more general form, [ɔ·] to [u·ə] as well. This sound change raises a number of important phonological issues. We will encounter first problems of identifying relatively homogeneous sub-classes of words, assessing the effect of stress, grammatical conditioning, formality of style, following syllables, and immediate segmental environment. We will obtain a close view of fine phonetic conditioning, especially as it develops in the course of change. The generality of these conditioning factors will then become a question: while some are particular to a given dialect or stage of evolution, others seem to have general force beyond any one dialect or language. In terms of rule-writing, the reweighting of constraints will appear as an important mechanism of change. The more general principles of vowel shifting in the next chapter will be foreshadowed in the _peripheral_ feature of this raising process and its directionality. Finally, we will be able to search for the existence of lexical diffusion in the detailed data on the raising of short _a_.

3.1. The class of tense ingliding vowels and its defining features.

In order to identify the word classes involved in these processes and present the data, we must first explicate our use of the feature [+tense] and its lower level realization as [+peripheral].

The feature [+tense] is used here as a classificatory feature in the abstract phonological rule which selects certain short or lax vowels and differentiates them from others by a variety of phonetic features. No single feature necessarily defines tensity: for our purposes, it is not necessary to decide the status of pharyngeal width, tongue shape, muscular development, etc. In our current academic studies, [+tense] vowels appear regularly with extreme formant positions. We will first identify a front vowel as _peripheral_ if its nucleus shows high F2 values relative to neighboring front vowels, and back vowels as peripheral if they show low F2 relative to neighboring back vowels. We may refer to word classes, allophones, or individual vowels as peripheral relative to other such classes, allophones or vowels. There may or may not be autonomous phonemes which contrast by this feature, but in all the English vowel systems we have studied there are two sets of front and back nuclei with relatively peripheral and less peripheral formant positions.

Thus in Philadelphia we find tense bad, bass, ban opposed to lax sad, bash, bang. At a lower level of representation, peripheral bad, bass, ban will be opposed to short and non-peripheral bed, bess, Ben. Similarly tense cough and dawn will be opposed to lax rob and Don, and peripheral cough and dawn will be opposed to non-peripheral cuff and dun after a number of other phonological rules have applied. This chapter will be concerned with the raising, fronting and backing which brings about this further differentiation of tense and lax pairs, and in some cases restructures the basic oppositions entirely.

Peripherality will then play a major role in this investigation as a classifying feature at several levels of specificity. The feature [+peripheral] has been used to distinguish front and back from central vowels (Stockwell 1966). We will use the classifying feature in a different way, distinguishing [±peripheral] vowels among front and back, high and low vowels. At this level of representation, schwa and other mid-central vowels are defined as [+central] in opposition to all others.[2] But as we shall see in this chapter, degrees of peripherality play a major part in sound change: the upward movement of the tense and ingliding vowels is sensitive to the relative peripherality of the nucleus as it is conditioned by various segmental environments. We might easily distinguish at least three degrees of peripherality among the [+peripheral] front vowels, but digitalization would be quite arbitrary, and instead we will present tables with quantitative values reflecting this continuum.[3]

The simplest way to translate the degrees of peripherality into quantitative form would be to use F2 values for the front and back vowels and F1 values for high and low vowels. But there is no such simple relationship, since phonological space is curved within the two-formant space. If we define peripherality as approximation to the outside of such a space, it will be necessary to define for each speaker the shape of the phonological space used before we can express peripherality for him in terms of F1 and F2. In the majority of cases we can show peripherality for front vowels as an index with weighted values of F1 and F2, since vowel height in the front follows a forty-five degree angle in the linear two-formant display with F1 showing twice the spacing of F2.

The utility of the [peripheral] feature must not obscure the fact that the higher level feature of tensity will still be required, and the problem of showing how this feature is realized phonetically has not yet been fully resolved.[4]

The phonetic class of tense-ingliding vowels is opposed as a whole in current English to the phonetic class of upgliding vowels, and there is no overlap between them. However, the tense and ingliding vowels alternate regularly with long monophthongs in low position (and to a certain extent in mid position) while the upgliding diphthongs alternate with long monophthongs in high position.[5] The ingliding element may not be prominent or may be completely absent in low position, but it assumes much greater prominence when the nucleus rises to mid position and is even more distinctive with a high nucleus. In classificatory terms, there is then a clear opposition between a [+tense] nucleus and a [-tense] glide. In the slowest, most emphatic forms, the glide is generally directed towards a position below and slightly back of center [ə], in the area where [ʌ] nuclei are usually found in American English, but in more rapid speech the end-point and direction of the glide may be considerably higher. Our discussions and measurements will be concerned with the nucleus; we will for the moment take the glide as determined by these and other environmental factors.

In historical records, the tense and ingliding vowels may appear graphically as *ie*, *ia*, *uo* and *ua*. As we will see below, these forms are normally found as reflexes of long vowels or after a process of lengthening of short mid vowels. They may of course refer to rising diphthongs as well as the falling diphthongs which are the main focus here (3.8).

To indicate the class of tense and ingliding vowels in English we will use the notation *Vh*, abbreviating the features

$$\begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{tens} \\ \cdot \\ \cdot \\ \cdot \end{bmatrix} \quad \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{tens} \\ +\text{cen} \\ \cdot \\ \cdot \end{bmatrix}$$

A few words in this general class have the lax glide derived by vowel reduction from underlying forms with unstressed *a*: *idea*, *theater*, *yeah*, *baa*, *whoa*, *skua*--that is, an original *Va* class. But most of these forms are generated by a phonological rule which selects certain lax vowels to become tense and then raised by a later rule. Low vowels may be selected, as short *a* or short open *o* in *bad* and *lost*, or mid and high vowels as in *bit* and *bet* in the Outer Banks (see 4.5.3 below).

Such tense low vowels occasionally show slight inglides; but as a rule, we do not have a distinct inglide until the vowel is raised to mid position. A dissimilating rule then operates to produce a [-tense] glide after the tense vowel:

$$(1)\quad \emptyset \rightarrow \begin{bmatrix}\text{-voc}\\ \text{-cons}\\ \text{-tense}\end{bmatrix} \;/\; \begin{bmatrix}\text{+voc}\\ \text{-cons}\\ \text{+tense}\\ \text{-low}\end{bmatrix} \;\_\_\_\_\_$$

This [-tense] glide is automatically [+central] by a redundancy rule ($1_\circ$):

$$(1_\circ)\quad [\text{-tense}] \rightarrow [\text{+cen}] \;/\; \begin{bmatrix}\overline{\text{-voc}}\\ \text{-cons}\end{bmatrix}$$

The prominence of the glide naturally increases as the vowel rises further and the distance of the nucleus from the target of the glide increases, just as in the case of the upgliding vowels. There may in addition be a later monophthongization rule which averages the position of the nucleus and glide, yielding a long tense centralized vowel, but we will not consider this process further in this report.

The symbol Vh may also be used for vowels preceding /r/ in where, bared, etc., in r-less dialects.[6] They are produced by a vocalization rule in r-less dialects. The form of this rule for the white New York City vernacular is shown in (2).

$$(2)\quad [\text{+cen}] \rightarrow \langle\text{-cons}\rangle \;/\; [\text{-cons}] \;\_\_\_\_\_\; \begin{matrix}{}^{*}\left\langle\begin{Bmatrix}C\\ \emptyset\end{Bmatrix}\right\rangle\\ \langle\#\#V\rangle\end{matrix}$$

The r-vocalization rule is obligatory in its basic components--when /r/ occurs before a consonant or pause--but variable if the next word starts with a vowel. Thus /r/ is vocalized in four, fourth, and four o'clock, but not in pouring or borrow. Since the Vh from rule (2) along with original Vh words from Va may fall together with Vh from rule (1) there must be an additional tensing rule operating:[8]

$$(3)\quad \begin{bmatrix}\text{+voc}\\ \text{-cons}\end{bmatrix} \rightarrow [\text{+tense}] \;/\; \_\_\_\_\_ \begin{bmatrix}\text{-voc}\\ \text{-cons}\\ \text{-tense}\end{bmatrix}$$

It would then be a natural economy to utilize (3) for the tensing of all Vh sequences. Rule (1) would then supply an abstract inglide after certain selected low vowels and rule (2) would convert a central consonant to an inglide. Rule (3) would then tense all three classes giving a single $\bar{\text{V}}$h class.

This economy depends upon the complete coalescence of the three classes in actual phonetic fact. In our earlier New York City investigations (Labov 1966) this merger was supported by reports of "same" and "different" from native speakers and by our impressionistic transcriptions. But the spectrographic evidence discussed in Chapter 6 forces us to question the intuitive judgments of native speakers and re-examine our impressions. The economy of utilizing (3) for tensing all sub-classes thus becomes problematical.

The inglide generated by (1) is an automatic accompaniment of tensing and raising for all the rules considered in this chapter. It will not be shown in rules (1)-(15) here; the segment following the tense vowels will be the following consonant. When the rules are formally re-stated and re-ordered in Chapter 4, the glides produced by (1) will be included in the rule statement.

A further simplification of the rule statement in this chapter will be to omit the specification [-back]. It will appear that some of the rule specifications for raising and tensing of front vowels apply to back vowels as well, but current investigations do not show the full extent of front-back differences and similarities. The more detailed statement of Chapter 4 will differentiate front and back vowels.

Since the Vh words resulting from rule (2) follow their separate histories in many dialects, we will refer to this word class as Vhr. In general, our notation will preserve the identity of most underlying forms, despite possible merger at the level of autonomous phonemics, although the phonetic position indicated by our notation is not far from that level. We are in effect identifying word classes by their broad phonetic position in conservative American and Southern British dialects. Thus the Vh symbols that we will use represent:

ih	idea, theater
ihr	beer, beard, etc.
eh	yeah
ehr	bear, bared, etc.
æh	bad, ask, dance, etc., depending on what the raising rule (1) applies to.[9]
ahr	cart, card, car, etc.
ah	pa, palm, pajama, llama, etc.; including "broad a words" where the class exists: laugh, bath, ask, past, dance, aunt, etc.
ɔhr	short open o words before final and pre-consonantal /r/: horse, for, morning, storm, etc.
oh	long open o words: caught, all, off, lost, etc., depending on how many short open o words were lengthened by an earlier tensing rule.
ohr	closed o words before final and pre-consonantal /r/: hoarse, four, mourning, pork, etc.
uhr	lure, moor, etc.

The rest of the symbols follow well-accepted conventions:

i	bit, bid
e	bet, bed
æ	bat, bad (except where tensed)
o	cot, cod
ʌ	cut, cud
u	put, good
iy	beat, bead, be
ey	bait, bayed, bay
ay	bite, bide, buy
oy	quoit, Lloyd, boy
uw	boot, mood, boo
ow	boat, road, row
aw	bout, loud, bough

The symbol a is normally used in referring to the underlying class of short a words. In Scotland and northern England, the same symbol /a/ is reserved for short a, which has not been fronted at all to [æ]. In most of the United States and parts of England, /o/ is unrounded to [a] and may merge with /ah/. It may then split into two allophones, "a" before voiceless consonants and the rest "ah". We use "a" and "ah" in New York City for this unit and elsewhere refer to the short o class as /o/ or (o).

Certain special additional symbols will be needed in our discussion for word classes that are not generally distinct. In some dialects there is a /ʉw/ class contrasting with /uw/ as in *dew* vs. *do*. The /ɔw/ symbol is available in Norwich to distinguish *road* and *roll* from *rode* and *pole* as /ɔw/ vs. /ow/.

We will continue to use the slash notation to indicate broad phonetic categories without suggesting that these represent ultimate units of contrast or minimally significant units. Parentheses will be used to indicate linguistic variables where the internal structure of variation is our primary concern. Thus /æh/ indicates the categorical class of /æ/ words subject to the tensing rule; (æh) indicates the variable which is raised progressively from [æ] to [iᵊ], progressively matching the vowel height of /eh/ and /ih/.[10]

3.2. The raising of (æh) in New York City.

The raising of the nucleus of *bad*, *ask*, *dance*, etc., was one of the main variables studied in the sociolinguistic survey of New York City (1966). Records of this process go back to 1896, when E. S. Babbitt first noted the raising to mid position:

> Among the older New Yorkers this very high vowel is used in all the set of words pronounced in New England with the broad vowel (*ask*, *half*, *pass*, etc.) and is really higher in these words than in *man*, *cab*, etc. But this distinction is now lost and the general vowel has quite overtaken the special one (*hend*, hand, *keb*, cab, *dens*, dance, *helf past* [sic] *half past*) (1896).

The records of the Linguistic Atlas show only a raised [æ^] for this class, but Hubbell (1950) confirmed that the vowel had reached full mid value. Labov 1966 showed that the vowel was generally at mid value for most New Yorkers but had risen to high for many young people, along with /ehr/, so that there was only one front ingliding vowel.

The raising of short *a* in New York is a continuation of a much more general tendency in English, which we can trace back as far as the history of the language permits. The Anglo-Frisian brightening involved the raising of long ā to ǣ before the Anglo-Saxon invasion of England. In Early Middle English, short *a* was lengthened in open syllables, and this new long ā in *name*, *grave*, etc., shifted to [æ:] and then to [ɛ:] and finally [e:]. The latest raising of lengthened short *a* is then at least the third in a series extending over fifteen hundred years.

The first ten of our general vowel diagrams show four male and six female New Yorkers. The upward progression of short *a* can be followed clearly in these charts as it moves from low to mid to high position. Since the height of the upgliding /iy/ and /ey/ vowels is stable in New York City, the progress of the (æh) class can be measured by comparison with these as well as /ihr/ and /ehr/. But before we can examine these findings, it will be necessary to consider the higher level selectional rule which establishes the (æh) class and then review previous findings on the raising rule.[11]

3.2.1. The tensing rule. The raising of short a follows a complex sectional rule which tenses certain members of the short /æ/ class. This is the most complex conditioning rule that we know of; it is itself the subject of several other investigations we are now carrying out. The New York City rule was first discussed by Trager in a series of articles (1930, 1934, 1940) and most recently examined by Cohen (1970). The complex rule exists in a series of closely related forms throughout the Middle Atlantic States and in somewhat different form throughout the South. Moving from New York City to Philadelphia and Baltimore, the rule affects fewer and fewer classes; moving northeast to New England it is sharply simplified; we find that in New Haven, for example, all vowels before nasal consonants and only those are tensed and raised. But moving northwest out of the Hudson Valley, we enter an area where the rule is simplified in the other direction, affecting all /æ/ words without exception. In this section we will consider only the New York City form of the rule.

In New York, tensing affects /æ/ before front nasals and all voiceless fricatives and voiced stops, if the next segment is an obstruent of → or # boundary and if the word is not [+weak] (henceforth [+W])--i.e., a function word with only one vowel which can be reduced to schwa. Without taking variability or lexical exceptions into account, the following rule shows the main outline of the tensing rule in New York City:

$$(4) \quad [+\text{low}] \rightarrow [+\text{tense}] \ / \ \begin{bmatrix} \overline{} \\ -\text{back} \\ -\text{W} \end{bmatrix} \left\{ \begin{array}{c} \begin{bmatrix} +\text{nas} \\ +\text{ant} \end{bmatrix} \\ \begin{bmatrix} \alpha\,\text{cont} \\ \alpha\,\text{tense} \end{bmatrix} \end{array} \right\} \left\{ \begin{array}{c} \# \\ [-\text{son}] \end{array} \right\}$$

This rule exhibits certain economies such as the use of alpha convention, which appear at first glance to show the effects of rule simplification operating in the course of linguistic change. The basic rule (4) would produce the following oppositions as it stands above:

lax	tense	lax	tense
cap	cab	had	bad
bat	bad	can (Aux)	can (Vb, N)
back	bag	wagon	waggin'
bang	ban	dagger	dragger

lax	tense	lax	tense
hammer	ham	cabbie	cab
badger	badge		
jazz	pass		

But the rule also contains many fine points, lexical exceptions, and variable sub-classes which show that it is moving away from the simplicity of (4). We might add a number of notes about sub-classes. [Throughout this discussion and the balance of this report we will abbreviate references to "the class of words with /æ/ before sequence X" as "sequence X"; thus "voiced fricatives are variable" means 'the class of words with /æ/ before voiced fricatives is variable'].

a. Voiced fricatives are lexically variable and unpredictable for any given speaker; razz, jazz and raspberry are unpredictable.

b. For some speakers, weak words with nasals are raised.

c. For some speakers, the rule applies in polysyllabic forms with the nasal followed by a glide.

d. In polysyllables, /ʃ/ followed by + or even directly by a vowel is beginning to be tense in many cases: fashion, national, passionate, etc. The same is true for some /s/: fascinate, etc.

e. Avenue is tense, for all speakers, an addition to the rule which yields lax average, savage, etc.

f. Wagon, magic and imagine are tense for many speakers, as additions to the rule which yields lax stagger, agile, badger, baggage, etc.

g. Diminutive suffixes are treated variably, so that for some speakers cabbie, Abbie and lassie are lax, for others tense. The same is true for many derivational suffixes, which are treated by some speakers as if they were preceded by a # boundary.

h. A few speakers raise velar nasals, or at least raise them partially, so it is not clear what the class of bang is.

i. A very few speakers show lax ran, swam, began as opposed to fan, tan, etc., i.e., irregular verbs with nasals are not tensed (i.e., the basic

Philadelphia rule).

j. Many learned words, acquired late in life, are excepted, e.g. lad.

k. Abbreviations may or may not retain the vowel of the full form: e.g., math.

Most of these cases are additions to the rule rather than exceptions: only i. and j. actually show restraints on the rule. The particular form of these exceptions and additions will assume considerable importance when we consider whether or not the same categories operate in the raising rule-- whether or not raising is responding to a continuation of the forces that produced tensing. There are three major tendencies to be observed here: (1) the advanced position of nasals, (2) the advance of certain polysyllables especially before continuants, and (3) the variable treatment (or analysis) of grammatical boundaries.

Rule (4) is obviously ordered after the vowel shift has moved the original tense low vowels to mid position and probably after they are diphthongized. Its order with relation to r-vocalization and other tensing rules is discussed above. It must precede the flap-formation and voicing of intervocalic -t-, since the rule never applies to fatter even when it rhymes with madder.

We must obviously understand the subtle details of the tensing rule if we are to make correct observations of the raising rule which depends upon it. In our basic analysis we concentrate however upon stressed monosyllables, noting weak words separately. Thus the most frequent lexical tokens that we measure as subject to (4) are:

N nasals	F voiceless fricatives			D voiced stops		
	f	θ	s	b	d	g
man	half	bath	pass	cab	bad	bag
hand	laugh		past	grab	dad	tag
stand			ask		mad	
can't			gas			
chance			class			
ham			glass			
			fast			

Monosyllables with /ʃ/ are relatively rare in ordinary conversation: cash, dash, and trash are found occasionally. We will refer back to this distribution at a number of points, and use the cover symbols N F and D as noted above. If /ʃ/ is included in F, we will add the diacritic $\check{F}$.

The extreme lexical correction of the tensing raising rule in New York City has been documented in Labov 1966. Lower middle class speakers show the heaviest correction and are more consistent in reading low (æh) as low /æ/ than others. Some lower class speakers, on the other hand, will show that they have acquired a higher norm from younger speakers without regard to its low social status. But in New York City, most working-class speakers are deeply concerned with this social variable, and make strenuous efforts to correct it in reading. (See Fig. 3-3a vs. 3-3b). There are only a very few speakers who will read a list of words with bat, bad, etc., without correcting some words which are always tense in the vernacular.

If word lists could be used to give us an accurate picture of the data, then we could greatly enrich the lexical items shown above and could finish a study of the tensing and raising of short /a/ in a much shorter time. We have such lists available. But the formal correction of this variable makes them useless for a view of the tensing rule, and as we will see, a reading list also gives us a poor view of the raising rule.

Correction of the raising rule does not always affect the tensing rule. Typically, women will lower tense vowels drastically without affec ting their peripheral character, shifting F1 but not F2. This correction is strongest in reading and formal style, but occasional instances will be found in the careful conversation of the interview or even in casual speech. Figure 9 is the vowel system of Sue Palma, from the Lower East Side survey, based on both Styles A (casual speech) and B (careful speech).[12] The fast in the lower left is obviously corrected when we compare its F1 to the fast in the main body of (æh) words,almost 200 Hz higher. Note that this corrected fast has distinctly higher F2 than the lax /æ/ forms to the right. Similar corrections can be observed in the detailed (æh) displays of Figs. 3-1 to 3-6. Fig. 3-4 shows the (æh) system of Lucy Ricata; here there is an obvious correction of ask, aiming at a different norm than the main group of vernacular forms. One ask is at an F1 of 400 Hz, the highest (æh) level for this speaker; a second is at 550 Hz; and the third is lowered to 820 Hz, at the level of lax /æ/ but still quite peripheral with respect to happen and wax.

The vowel systems of men do not show such sharp differences in peripherality, but we can observe the same kind of correction of the raising rule without affecting the tensing rule. Fig. 3-2 shows the vowel system of Jacob Schuster from connected speech (Styles A and B) with two corrected nasals: pants and hands. These are still relatively peripheral, with only ~~the third~~ item less peripheral than lax that and well to the front of happen and back.

In the light of Figs. 3-2 and 3-4, we might argue that it is still possible to analyze the lexical distribution of the tensing rule by listening to degrees of peripherality. Unfortunately, the ear is not sensitive to F2 differences of this kind (a major factor in the discussion of Chapter 4). Furthermore, there are some speakers whose corrections become indistinguishable from original lax vowels--at least on an F1/F2 plot. Fig. 3-3a shows the (æh) system in connected speech for Leon Alinsky. His (æh) is quite distinct from /æ/ except for one item in the middle: a corrected _hand_. This contrasts sharply with the other two tokens of _hand_ which are in the upper left, high peripheral position as we would expect. In reading style, shown in Fig. 3-3b, Alinsky shows a regular shift of (æh) downward towards the lax vowels, so that it is no longer clear if the weak word _can_ and _jazz_ are lax or tense. In the most formal style--word lists shown in Fig. 3-3c--Alinsky shows a much tighter conjunction of corrected (æh) words and original lax words. Only _pad_, _bad_ and _bag_ are uncorrected, and we find that _pass_, _badge_, _ask_, _bath_, _half_, _cash_ are tightly intermixed with _bat_, _has_, etc. It is still possible to account generally for the distribution of most items in the lower set (see below) but it is not possible to identify the set of lax vs. tense vowels. Figures 3-1 through 3-3 give a clear view of the process of correction as the sociolinguistic variable (æh) becomes increasingly subject to social correction for younger speakers, and as the formality of the eliciting situation increases. This makes it evident why we must concentrate upon those speakers and contexts which show the least effect of formal correction (2.3).

3.2.2. _The raising rule_. The gradual raising through age levels of short _a_ was reported in Labov 1966 through the impressionistic rating of the height of the variable (æh) on a four-point scale of height ranging from [æ·] to [ɪ·ə].[12a]

1	[i·ə,ɪ·ə]	Level with the vowel of NYC _beer_, _beard_
2	[e·ə,ɛ·ə]	NYC _bear_, _bared_
3	[æ^·]	
4	[æ·]	NYC _bat_, _batch_

The index used to record the average height of a group of vowels was the mean value of the variants times 10. An (æh) value of 10 means that the speaker used only high vowels for _bad_, _ask_, _dance_, etc.; (æh)-40 indicates that he used only low vowels--that is, was completely corrected or was never affected by the change. The over-all progression in the values of the variable for 63 New York subjects is shown in Table 3-1.

TABLE 3-1

AVERAGE (æh) INDEXES BY SOCIAL CLASS AND AGE IN CASUAL STYLE IN NEW YORK CITY (from Labov 1966:356)

	Social Class			
Age	Lower Class	Working Class	Lower Middle Class	Upper Middle Class
20-39	24	24	22	35
40-	27	26	25	31

N:

2	11	5	4
17	8	10	6

These average values show only slight movement across age levels for the lowest three classes, and a reversal on the part of the highest social class.[13] The raising of (æh) is a long-established process in New York City which has already affected most older speakers, as Table 3-1 shows. Among lower class speakers who lag behind the others, the on-going development was seen more clearly. For lower class subjects, we have

	Age	(æh)
(æh)-20	8-19	20
(æh)-24	20-39	24
(æh)-26	40-49	26
(æh)-28	50-	28

There is clear differentiation among ethnic groups in New York City as far as (æh) is concerned. Speakers with Italian backgrounds have higher (æh) than Jews. Italians averaged close to (æh)-20 for all age groups, while the Jewish group lagged behind.

We can see this when we combine values for all Jewish speakers in the three lower social groups:

Age	(æh)
8-19	22
20-39	23
40-49	27
50-	29

The average values for Italian adults were all higher than these, about (eh-20) in the 1966 survey. But when we examined younger children it was evident that the change was going on to higher levels among Italians. The value of (æh)-20 means that the variable is essentially a mid vowel, and there are a great many speakers under 21 years old with average values at that point. Four younger speakers, age 8 to 15, had values considerably higher, and three were from working-class Italian families (Labov 1966:363). The over-all view of the raising of (æh) then shows a movement in the current population from essentially low vowels, allophones of /æ/, to a norm at the mid level and some movement ahead to high vowels.

In all the New York City sound changes, we found that women are considerably more advanced than men. The distribution among men vs. women is shown in Table 3-2.

TABLE 3-2

DISTRIBUTION OF (æh) VALUES BY SEX FOR NEW YORK CITY IN CASUAL STYLE (Labov 1966:313)

	Number of Speakers			
	Style A Casual Speech		Style B Careful Speech	
(eh) values	Men	Women	Men	Women
10-13	-	1	-	-
14-18	1	4	-	2
19-21	3	10	3	9
22-26	4	6	7	9
27-32	3	4	11	12
33-39	4	4	3	5
40-42	1	2	-	6

It is now a general principle that women in the United States and England correct more than men in formal styles in response to social pressures (Labov 1966; Shuy, Wolfram & Riley 1967; Wolfram 1969), but it is also true that for all the sound changes we will consider within the United States, women are more advanced than men.[13a] This observation follows the findings of Gauchat in Charmey (1905) who found that for each sound change women were further advanced than men by as much as a full generation. We must bear this fact in mind in our selection of speakers to be analyzed. A comparison by generations within the same family must be within the same sex, or allowance must be made for the conservatism of the males; where we have a larger series of speakers drawn from a random sample, we will show separate progressions of men and women.

To approach the spectrographic study of the New York City vowel system, we drew from the basic sample of 63 adult New Yorkers a sequence of male and female working class speakers. The speech of ten males was examined, along with two male children of these families, so that we have a sequence of twelve speakers ranging from 73 to 13 years old. Eight adult female speakers were examined, and two children of informants. Several older women in our sample did not speak much or showed signs of foreign influence. We therefore augmented our sample with a new series of "older New Yorkers" at a day center in upper Manhattan.[14] From this series of eight interviews, we selected two older women for our series, yielding twelve females from age 73 to 15.

The class background of these informants is largely working class, with some lower-class speakers. The children tend to show strong upward mobility, and their language reflects this fact.[15]

Figures 1-10 shows the vowel systems of four men and six women drawn from this series. One can easily follow the upward progression of (æh) in this series. The oldest speakers in each series are of Norwegian and English background respectively. The three younger males are Jewish, and the five females are Italian, so that the conservative nature of the male pattern and the advanced style of the female is accentuated. For most of these subjects, the (æh) pattern has been studied in much greater detail and their (æh) patterns are presented in Figures 3-1 through 3-6.

A direct quantification of this progression is not possible, since the F1/F2 values for each speaker can have significance only in relation to their vowel system. Our approach then will be to set up a scale of degrees of height parallel to the Lower East Side scale and count the number of vowels at each level (Labov 1972). The conventional division into upper and lower high, mid and low vowels is quite convenient here, since each of the three levels can usually be divided into two halves with reference to other stable vowels. We can divide the high vowels into upper high and lower high according to the distribution of /iy/ and /ihr/. The mid vowels can also be divided into an upper and lower range, though here it is not unusual to find /ey/ and /ehr/ reversing positions (see below). In the early stages of the New York City system, (æh) itself defines upper low, since it occupies a space above /æ/ but below /ehr/. In the later stages, it becomes increasingly arbitrary to maintain these distinctions, because /ehr/ rises along with (æh) and they both overlap /ihr/, leaving a very large gap between high and low vowels.

In Figures 1-10 we have not generally indicated these divisions, as it will become clear that they have no systematic theoretical status and may actually obscure the pattern. The work of drawing such divisions makes it increasingly clear, however, that vowel height in the front is usually a weighted index of F1 and F2 combined: as our F1/F2 plots are scaled, we find that the front vowels are normally arranged along a 45° angle from low to high. The significance and limitations of this definition of height will be discussed below.

Table 3-3 shows the results of a gross assignment, throwing together all (æh) vowels in connected speech regardless of segmental environment or obvious corrections. The mean values are quite parallel to the distributions of Table 3-2. The men show a concentration around (æh)-33-39, and around (æh)-27. Women show a few at the lower values, but the heaviest concentration is around (æh)-20. Since our spectrographic series is drawn from Styles A and B, it is natural that the distribution of Table 3-3 should be intermediate between them.

However, the mean values for the males do not show any clear upward progression with age. For the females, we see a much clearer pattern, beginning with 4.2 and generally moving to 2.0, but there are many irregularities in both series. These are the result of a number of factors which obscure the record of upward movement of (æh). There are three shifts in over-all distribution:

(1) Correction of advanced (æh) downward. This is obvious in the case of Schuster (Figure 2 and 3-2), Alinsky (Figure 3 and 3-3), Ricata (Figure 3-4), when we examine the obvious shift of a few items to radically different norms. But it is not so obvious in the six-level scale of height of Table 3-3, because the levels expand to fill the gaps.

(2) Over-all correction. Some of the younger speakers are classic cases of over-all correction. For example, young 15 year-old Corinne Milner shows this and, to a lesser extent, 13 year-old Joel Sotnick does too. Sue Palma, 37, shows a smiliar downward shift in Fig. 9; as we will see, she is an extremely advanced speaker on other more recent variables which have not received overt social stigma. Among the men, Albert Onders is relatively advanced, but Abraham Greenword is much more conservative than his age mates. The lower-class Onders shows no orientation toward higher reference groups, but Greenword is a cab driver who is continually trying out complex language in imitation of the business

TABLE 3-3

DISTRIBUTION OF (æh) FOR 24 NEW YORK SPEAKERS

			High		Mid		Low			
			U	L	U	L	U	L		Un-Corrected
	Age	Class	1	2	3	4	5	6	Mean	Mean
Men										
Andersen	73	3		1	4	9	6	2	4.2	
Clancy	72	2		3	1	6	2		3.4	3.8
Sotnick	60	2			1	7			3.8	
Vanek	60	0		1	2	5	1		3.5	
Schuster	60	WC 4			2	5	4		4.1	3.7
Onders	55	LC 2		2	10					
Greenword	46	WC 3			5	7	3		3.8	
Alinsky	31	WC 4		2	7	7	1		3.7	3.3
Le Nez	30	LC 0		2	5	2	2		3.7	3.3
Wollner	23	WC 5		5	2	2			2.7	
Sotnick	13	WC 5	1	2	1	4			3.3	3.0
Women										
Morgan	65	WC "5"			2	10	5		4.2	
Rafferty	63	WC "4"	2	4	5	6			4.2	
Nasca	59	WC 3		4	1	3			2.8	
Ricata	57	WC 6	2	5	11		1		2.7	2.5
Fuchs	46	LC 2		5	3				2.4	
Lenk	41	WC 6		2	9				2.8	
Calissi	42	WC 3	4	10	5				2.1	
Palma	37	WC 3			1	5	1		4.0	3.9
Bendato	31	WC 3	1	8	1	1			1.9	
Canzone	23	WC 3	3	6	2				1.9	
Milner	15	LMC 6				1	5	2	5.2	

Mode is underlined. Uncorrected mean shows mean with obviously corrected forms (see text) eliminated. U = upper L = lower
Age as of 1963.

SEC: See Labov 1966 for index ranging from 0 to 9, roughly labelled as

0-1	Lower class
2-5	Working class
6-8	Lower Middle Class
9	Upper Middle Class

Ratings in " " supplied informally from more limited information.

men who are his fellow officers in the American Legion.

(3) Borrowing of newer norms. The claim of Bloomfield (1933:361) that irregularities in sound change are often borrowings and re-borrowings between generations finds some support in the patterns of Anderson and Clancy. Figures 1 and 3-1 show that Chris Anderson has two distinct (æhN) norms: one peripheral and low, the other less peripheral and high. His low norm is identical with Clancy's low norm (Table 3-3) and Margaret Morgan's. These older speakers do not show the correction in formal style that marks the younger ones, and we put forward the hypothesis that the higher (æh) cluster is indeed a dialect borrowing.

Even with these three disturbing factors, we note a regular progression upward if we disregard the average and consider modal values. These begin with 4 (lower mid) with the men and stay at 4 (except for Onders) until we reach the early thirties and twenties. Only with the youngest adults do we find modes at 2. With the women, the shift upward is faster. Morgan starts with a mode at 4; this shifts irregularly to 2 and 3 for women in their forties. Thus women are in advance of men by two decades. The further shift towards a mode 1, upper high, is shown by Calissi and Canzone, prefiguring the end point of the process.

To review this over-all finding on the raising of (æh), we can note the following features:

a. There seems to be a regular progression across generations, and a suggestion of discrete generational stages, e.g. in the break between the oldest group (Anderson, Clancy, Morgan) and the others.

b. This older generation plainly had one continuous vowel range for /æ/, with (æh) as a slightly higher allophonic variant. There is already some overlapping into the mid range, going from [æ] to [æ^] to [ɛ·ə], with no breaks in distribution. Margaret Morgan, being more advanced, shows the beginning of this break (Figure 5).

c. A distinct gap between /æ/ and (æh) begins to appear with those in their sixties. With women, the mid-range becomes entirely emptied of tense ingliding vowels.

d. With younger speakers, the (æh) variable begins to overlap (ihr), and /ehr/ is gradually drawn upward as well.

This last consideration leads us to review the position of /ehr/ relative to /ihr/. With Margaret Morgan (Figure 5) the two are widely separate. In Alice Rafferty's pattern (not shown here), we see the beginning of an approximation, with an overlap of (ehr) and here. For Nasca, /ehr/ is more peripheral than /ihr/ but lower (Fig. 6). Ricata (Fig. 3-4b) has both peripheral and non-peripheral /ehr/, and some overlap with two mid /ihr/ words. Lapper and Fuchs also have a marginal overlap, but with Calissi (Fig. 7) /ehr/ is now at the height of /ihr/ and more than half of the items overlap. Bendato shows exactly the same situation (Fig. 8) though the carefully corrected Palma does not (Fig. 9). Canzone (Fig. 10) has the same merger as Calissi. Thus we see that the on-going merger of /ehr/ and /ihr/ accompanies the rise of (æh). But there is no direct evidence that (ehr) and (æh) merge and become the same unit. Rather they seem to be making their independent ways to the top of the vowel system. We will return to the on-going merger of /ehr/ and /ihr/ in Chapter 6.

The raising of (æh) may be expressed as a sequence of rules within a binary framework. First rule (5) would raise front tense low vowels to mid, and then rule (6) would raise tense mid vowels to high

$$(5) \quad [+\text{tense}] \rightarrow [-\text{low}] \; / \; \frac{\quad\quad}{[-\text{back}]}$$

$$(6) \quad [+\text{tense}] \rightarrow [+\text{high}] \; / \; \frac{\quad\quad}{[-\text{back}]}$$

presuming that the only tense vowels in the front system were the ingliding ones. For many middle-aged male speakers, (5) may be reasonably adequate, brushing aside a certain amount of variation. In Table 3-3 Sotnick and Vanek are essentially confined to mid vowels, and Greenword and Schuster have a few lower forms at level 5 which can reasonably be reassigned to the mid level. Among the women, a similar case might be made for Morgan. In other words, there is no solid basis in this data for positing a gradual shift between low and mid which would require a variable rule. But this is not the case for the raising to high position, which shows all the signs of a gradual process. Figures 6, 7, 8, and 10 document this process. In Figure 6, Nasca shows the beginning of an overlap of (æh) from mid into the high range in that her (æhN) weak words are as high as (ihr). In Figure 7, Calissi shows that (æh) has risen largely into the high range, but still extends into mid more than /ehr/. In Figures 8 and 10 one can see the end result of this process, where (æh) becomes essentially a high vowel. There are many vowel systems which show the intermediate range: see Figure 3-4a for Ricata's spread across high and mid.

We would therefore need a variable rule to replace (6):

$$(6') \quad [+\text{tense}] \rightarrow \langle+\text{high}\rangle \; / \; \frac{\quad\quad}{[-\text{back}]}$$

This rule is subject to many additional constraints as we will see in the next section.

3.2.2a The phonetic conditioning of (æh). The (æh) variable is defined as subject to phonetic conditioning by the tensing rule. Some of these selectional principles are predictable by general principles: for example, that final -l would restrain the rule. But as we began to study the raising of (æh) we encountered a number of strong conditioning factors which we had not anticipated through past experience or general phonetic principles. [In referring to phonetic sub-classes we will use either general cover symbols or specific consonants; N will be understood as equivalent to (æhN), f as (æhf), etc.]

3.2.2.1. The effect of nasals. The most striking fact is that nasals are more peripheral than other consonants: that is, the nuclei of (æh) vowels before front nasals (æhN) assume more extreme front positions than other (æh) nuclei. The pattern is clear in the great majority of our vowel systems (see Table 3-5, p. 63, and 3-7, p. 75).

There are two possible ways in which we might characterize peripherality of the front vowels: as simply F2 in (7a), or as a weighted measure of F1 and F2 in (7b) for front vowels:

(7a) x peri = F2

(7b) x peri = 2F2 + F1

The peripherality of (7b) is at right angles to the dimension of vowel height discussed above. The linear property of (7b) is obviously an approximation, but appears to hold quite well for our study of (æh) in general. The relative peripherality of vowels would then be checked by moving at a 45° angle from lower left to upper right, or by applying the formula (7b). Peripherality for the front vowels will then be expressed by a numerical scale of Herz values which has no absolute significance but orders vowels relative to each other. Thus the peripherality of the two can't nuclei at the lower left of Fig. 3-1 are 4450 and 4375 Hz respectively--they both lie along the perimeter of Anderson's space. Peripherality for the highest vowel is only 3800.

Which of these two views is correct? One way to proceed is to see which gives the greatest coherence of phonetic sub-classes like (æhN). Table 3-4 compares the results of ordering the peripherality of vowels by (7a) vs. (7b). As applied to the vowel systems of Anderson (Fig. 3-1) and Schuster (Fig. 3-2), the second method gives greater clustering and reveals the pattern most clearly: that (æhN) is most peripheral. This is our general finding: that for all speakers, peripherality is best defined as approximation to the outer envelope of the vowel system along a dimension at right angles to that perimeter. There will occasionally be cases where (æhN) is relatively most

TABLE 3-4

CLUSTERING OF (æh) BEFORE NASALS BY TWO DEFINITIONS OF PERIPHERALITY AND RAISING

		Ordering of (æhN) allophones
Margaret Morgan: 7 (æhN) out of 17 (æh)		
(7a)	peri = F2	1, (2), (4), 5, 6, 7, 9
(7b)	peri = 2F2 + F1	1, 2, 3, 4, (7), 8, (9)
(9a)	high = F1	(3), (6), 9, 11, 13, 15, 16
(9b)	high = 2F2 - F1	(3), (4), 6, 7, 10, 11, 14
Jacob Schuster: 7 (æhN) out of 24 (æh)		
(7a)	peri = F2	1, 2, 3, 4, 5, 13, (18)
(7b)	peri = 2F2 + F1	1, 2, 3, 6, 9, 10, (11)
(9a)	high = F1	2, 5, 11, 12, 14, 16, (22)
(9b)	high = 2F2 - F1	1, 2, 3, 4, 6, 12, 15, (22)

( ) = nasal preceding: the last item for Schuster is manners, which is usually considered /æ/.

peripheral: that is, there may be other more peripheral vowels located higher or lower along the front series, but none in the (æhN) area.

The ellipses drawn on Figures 1-10 will therefore indicate more clearly than a table whether (æhN) was the most peripheral sub-class and whether (æh) was a peripheral front vowel.[15a]

The first two columns of Table 3-5 show the (æh) sub-class for each speaker which is clearly most peripheral, and (where relevant) least peripheral. Column 1 shows N for all but three speakers: Sotnick, Nasca and Calissi. Sotnick and Nasca show a less peripheral N; Calissi shows no clear differentiation of peripherality for any sub-classes. It is interesting to note that two speakers near the beginning of the series are exceptions and one speaker at the end point of the raising of (æh).

Nasca and Sotnick talked less than any other subjects, and are both about 60 years old.[16] They agree with Anderson, our most conservative speaker, in showing a group of non-peripheral (æhN). Anderson has two separate norms for (æhN); one is peripheral and the other not. N_2 is high and centralized; N_1 is low and peripheral. Anderson's N_2 may represent borrowing of a recent pronunciation from younger speakers; but if so, why does he show a less peripheral position?[17] We will return to this problem below.

Table 3-5 also shows the regular pattern of raising of (æhN) through the six levels of height.

The location of N indicates the range of levels where (æhN) words are to be found; any other environment which is higher than the nasals is indicated to the left. For the men, the series starts with a mode at 4, though as we saw Anderson has a second N_2 group at level 2. N4 is steady for speakers in their sixties and seventies, but begins to fluctuate between 2 and 3 for men in their thirties and forties. The youngest speaker shows some N at the highest level. The pattern for women is essentially the same but advanced one level, with several younger speakers showing an upper high mode for nasals. The strong correction of our young lower middle class speaker Corinne Milner is obvious here. Her vowel system will show some new and radical developments for other more recent sound changes.

While (æhN) is usually peripheral, it is not always the highest allophone. On the contrary, it is found at a low position, behind the stops and fricatives in the speech of the oldest men and women, and becomes the highest allophone only for younger and middle-aged speakers. This phenomenon, first reported in Labov 1972 , shows that no simple view can be advanced that nasals always favor raising of a preceding vowel, etc. As extremely peripheral vowels, low tense vowels before nasals are

TABLE 3-5

DEVELOPMENT OF HIGH (æh) BEFORE NASALS FOR 24 NEW YORK SPEAKERS

	Age	Periph-erality		High		Mid		Low		Direction of raising	Stages
		+	−	U 1	L 2	U 3	L 4	U 5	L 6		
Men											
Andersen	73	N_1	N_2		N_2	FD	N_1			↑	IIa(b)
Clancy	73	N	F			F	N				IIa
Sotnick	60	θ	N_2			(N)	N			↑	IIb
Vanek	57	N				(N)	N			↑	IIb
Schuster	55	N				N					IIIa
Onders	56	N			N	N				↖↑	IIb/IIIa
Greenword	46	N				fN				↖	IIIb
LeNez	37	N				N				↖	IIIb
Alinsky	38	N			(N)	N				↑	IIIb
Wollner	23	N			N					↖	IIIb
Sotnick	13	N		N						↖	IIIb
Women											
Morgan	65	N					fN			↑	IIa
Rafferty	63	N			N					↑	(IIb?)
Nasca	59		N		F	N				↑	IIb
Ricata	57	N_2	N_1	N_1→	F	N_2					IIIa
Fuchs	46	N			D	N				↖	III
Lenk	46	N			N					↖	IIIb
Calissi	42			F	N					↖	IIIb
Palma	37	N			N					↖	IV
Bendato	31	N		N						↖	IIIa
Canzone	23	N		N						↖	IV
Milner	16	N						N			?

low at first and then raised more rapidly than other vowels until they become the highest vowel in the system.

There are a number of different ways in which we might attempt to account for this phenomenon.

I. Rewrite rule (5) as a variable rule with a ⟨-nas⟩ variable constraint, and (6') with a ⟨+nas⟩ variable constraint:

$$(5') \quad [\text{+tense}] \rightarrow \langle\text{-low}\rangle \;/\; \underline{\quad\quad} \;\langle\text{-nas}\rangle$$

$$(6'') \quad [\text{+tense}] \rightarrow \langle\text{+high}\rangle \;/\; \underline{\quad\quad} \;\langle\text{+nas}\rangle$$

But in Table 3-5, N is the highest allophone for Sotnick and Vanek, even though (5') is not completed.[18]

II. Write a variable version of (5') with several constraints, and show how they are gradually re-ordered as the rule goes to completion.

$$(5'') \quad [\text{+tense}] - \langle\text{-low}\rangle \;/\; \underline{\quad\quad} \left\langle \begin{matrix} \text{+cont} \\ \text{-back} \\ \text{+nas} \end{matrix} \right\rangle$$

The re-ordering of constraints in the course of the change would then follow the same pattern as that we observed in the centralization of (ay) and (aw) on Martha's Vineyard (Labov 1972). We might rewrite the three constraints as <+cont> +nas> -back> and then <+nas> +cont> -back>. As the nasal group went completely to mid position, we would write <*nas> +cont> -back> When all members became mid the variable constraint would disappear, and we would have the categorical rule (5).

However, this mechanism presumes that at the early stages ⟨+nas⟩ favors raising to a slight extent. On the contrary, nasality seems to inhibit raising, and a more realistic set of constraints would be simply ⟨-nas ⟨+cont⟩. The reversal of the position of nasals would then be a reversal in the sign of the variable constraint, a phenomenon which we have not observed before. But the data shows that this is indeed a reversal of the effect of nasality.

III. One could dissolve the connection between the various sub-components of the rule and disregard any relation between the raising of nasals and the other (æh) words. This is the route taken by Kiparsky (1971) who reacted to an earlier version of this data in Labov 1972 as an apparent exception to the argument for the universal character of certain phonetic conditioning factors. He suggested that there may have been two separate changes, citing our quotation from Babbitt in 1896 to the effect that older New Yorkers had raised only the broad a words (see page 1 above). The later raising of (æhN) would then be not a reversal of a constraint but a separate change. There is no support for this notion in the data: broad a words and short a words are scattered randomly through the vowel patterns of the oldest speakers. Anderson's lowest nasals in Fig. 3-1 include can't, the archetypical broad a word in New York City. On the other hand, one man and hands are high. Among Morgan's highest vowels in Fig. 5 are broad a words like half, fast, and after; but we also find mad and tag. Among her lowest vowels are the broad a words answer, class and half, along with hand and man.[19]

But beyond the immediate data it is apparent that the raising of (æhN) is an integral part of the entire process of /æ/ raising which we are now studying in most American dialects and many English cities. In the balance of this chapter we will examine some of these wider areas and see that the same basic mechanisms are operating as in New York, with the nasal class most often in the lead. To refuse to consider the obvious connection of (æhN) raising and all other (æh) seems to us a retreat from the work of linguistic analysis.

IV. The key to the reversal of the effect of nasals lies in the relation of raising to peripherality. We must recognize that when a vowel becomes more peripheral in the sense of (7b), it also shows an increase in F1 as well as F2 and becomes a lower vowel in that sense. Nasals are more peripheral than other (æh), by the following rule:

(8) $$[+\text{tense}] \rightarrow \langle x\ \text{peri}\rangle \ / \ \underset{[-\text{back}]}{\underline{\qquad}} \langle +\text{nas}\rangle$$

This variable rule states that tense vowels become peripheral, not only in a categorical sense of being distinguished from non-peripheral vowels, but also with varying degrees of peripherality. One constraint that favors peripherality is a following nasal.

When we say that a nasal vowel subject to (8) becomes lower by (7b), we are assuming a definition of height which is equivalent to the inverse of F1. There are in fact two possible definitions of height to consider, just as for peripherality. Height can be expressed as (9a) or (9b).

For front vowels:

(9a) y high = -F1

(9b) y high = 2F2 - F1

When a vowel becomes more peripheral by (8), it becomes lower in the interpretation of height (9a).

A new and unexpected aspect of the raising of (æh) in New York City is a sudden shift from (9a) to (9b). The last column of Table 3-5 shows the direction of raising for the twenty-four New Yorkers. A vertical arrow indicates that the raising of (æh) involves a decrease in F1 only, and a diagonal arrow an increase in F2 and a decrease in F1. The upward pattern prevails among the first seven males--all those above forty, and among the first four women--all those above fifty. The younger speakers show the diagonal movement following (9b). Firm evidence for this classification is to be found in the examination of the individual allophones which have corresponding members at different F1 positions but the same F2 position. Thus in Figure 3-4a Lucy Ricata has ask at 400 Hz and 550 Hz (as well as the corrected form at 820 Hz) but all at the same F2 of 2560 Hz. There is of course some variation, but the general movement of each allophone is north and not northwest on the F1/F2 map.

Before we can see how this change in orientation affects the relative position of the nasals, we must consider other phonetic constraints on the raising rule and see how other sub-classes are disposed.

3.2.2.2. The effect of preceding liquids. In the class of (æh) words in New York City, there are no following liquids to exert the usual centralizing and lowering effects of /r/ and /l/ since the tensing rule (4) excludes following liquids. But we can observe a similar effect from preceding liquids. This effect is strongest when the liquid is preceded by a stop.[20] In Fig. 3-1 we see the ⟨-peripheral⟩ effect of gr   in grab. In Fig. 3-2 Schuster shows the backing effect of l- in class.

The same <-peripheral> position is assumed by grab and grant in Fig. 3-3b, glassy and clasp in Fig. 3-4a, grand- in Fig. 3-6, brass in Fig. 9, etc. Just as nasals show maximum peripherality, so clusters with liquids show the most centralization, especially when preceded by a voiced stop. This phenomenon shows up for almost every speaker; there are occasional examples of these words with no <-peripheral> effect, but the pattern is generally preserved and never reversed.

This effect of preceding liquids is of considerable importance for the interpretation of historical developments, but the distinction between clusters and single liquids has not been noted before in this connection.[21]

3.2.2.3. Differentiation among the obstruents. The New York City data did not provide very much data on the voiced stops, since (æh) in this environment is not common. In general, voiced stops do not rise as high as the voiceless fricatives, though the tendency is not too regular. In the early stages of the raising of (æh), the voiced stops are occasionally higher than the fricatives but by the time we reach mid position, the fricatives are generally in the lead. Among the voiced stops, the velar /g/ is regularly least peripheral: see for example, the oldest female (Morgan) in Fig. 5 and the youngest (Canzone) in Fig. 10.

Among the voiceless fricatives there are of course no velars to show this effect. As we will see, other dialects often show a low peripheral position for /f/ and /θ/. But this appears only rarely in New York City where on the contrary, half is not particularly peripheral and is found well up among the other vowels. See for example Fig. 5 where Morgan has half at three heights, all in the middle of the (æh) group, and Fig. 3-6 where Bendato has a highly stressed halfies in the high central region of (æh).[22] There is not enough data on /ʃ/ in New York City to make a clear statement at present. For some speakers, /ʃ/ is clearly lower than the other voiceless fricatives--see Fig. 3-6 for dash--but for others it is as high as any other (see Ricata's trash in Fig. 3-4a). For New Yorkers, /ʃ/ is always less peripheral than the other fricatives, so that it is clear that the [+back] feature matches the relative backing of the vowel: velars have the strongest effect, but palato-alveolar /ʃ/ works in the same direction.

An interesting feature is to be noted for (æhns) words like chance, which are generally aligned with the fricatives (see Fig. 3-4) but are often shifted in the direction of the nasals (see the high but less peripheral position of chance in Fig. 3-3a and 3-4a).

3.2.2.4. The effect of stress and syllable structure. When the (æh) syllable is followed by others, we generally see centralization. Since the vowel is usually shortened by prosodic factors, we would expect that it has less time to reach its maximally peripheral target. Among numerous examples, see answered, glassy, family and badly and agate along the less peripheral margin of the (æh) class in Fig. 3-4a; or fashion, handling, and grandfather in the same relative position of Fig. 3-6. Conversely, the most peripheral position will be occupied by stressed final syllables. Preceding syllables have less effect than following ones: compare, for example, the high front instances of understand in Fig. 3-6 which are among the most advanced forms of Bendato with the relatively peripheral and low understanding which lags behind Canzone's pattern (Fig. 10).

Nevertheless, it is not generally true that all polysyllabic forms are lower than monosyllables. In Figs. 1-6 we will find many polysyllables at relatively high positions: fashion, avenue, after, typically appear with low F1. When words like fashion or national are not raised, as in Anderson's Fig. 3-1, we find them occupying the continuum between tense and lax areas, but when they are raised, [as exceptions to rule (4)] they then take up high positions, as in Bendato's fashion in Fig. 3-6. This seems particularly true of polysyllabic forms with fricatives.

Finally, we may note that there are some characteristically intermediate forms which bridge the gap between tense and lax forms, even when the distance is as great as it appears in Figs. 7-10. Velar nasals are typically intermediate: they are lower and less peripheral than the tense vowels but higher and more peripheral than the lax ones. See for example bank and thank in Fig. 3-6. Weak words like that, and, etc. can be found in the same position, along with polysyllabic forms that show tertiary stress on the /æ/: see and and that in Fig. 3-6.

All of the conditioning factors mentioned in the last three sub-sections inhibit peripherality. Their effect can be shown as an additional rule which opposes the action of rule (8):[23]

$$(10)\quad [x\ \text{peri}] \rightarrow \langle x-y\ \text{peri}\rangle \ / \ \langle\langle+\text{cons}\rangle+\text{voc}\rangle \underset{\langle -z\ \text{str}\rangle}{\underline{\qquad\quad}} \left\langle\begin{array}{c}-\text{ant}\\+\text{voc}\end{array}\right\rangle \left\langle\begin{array}{c}+\text{voc}\\+\text{cons}\end{array}\right\rangle$$

Rule (10) shows vowels limited in their peripheral feature by a number of factors. The most important, by the usual convention that following segments have the greatest effect, would be the presence of a back consonant following the vowel.[24] Peripherality is also inversely correlated with degrees of stress. It is disfavored by the presence of a preceding vocalic segment (necessarily a liquid before a stressed vowel) and if this is the case, is even more heavily restrained if a consonant precedes.[25] Finally, peripherality is reduced if a second syllable follows; to a lesser degree if a second consonant follows the original syllable.

3.2.2.5. The raising rule and its operation. We are now in a position to state a simple form of the raising rule which in conjunction with the peripherality rules (8) and (10), and the re-definition of height from (9a) to (9b), will generate the complex patterns we have observed.

(11) $$\begin{bmatrix}\text{+tense}\\ \text{-back}\end{bmatrix} \rightarrow \langle y \text{ high}\rangle \; / \; \underset{\langle x \text{ peri}\rangle}{\underline{\qquad}}$$

Our raising is now stated in terms of a continuous dimension of height, subject to the definitions of (9a) or (9b). It states that front tense vowels are raised to a variable degree, and that this increase in height is favored by increasing degrees of peripherality. We no longer attempt to capture the overlap of mid and high forms of (æh) with a notion of frequency of raising to [+high] but rather reassess height as a continuum and lay the groundwork for writing continuous functions.

We can best observe the operation of the raising rule as seven distinct stages in the history of the (æh) variable shown in Fig. 3-7. At Stage 0 there is no raising evident and no phonetic differentiation of the low front lax vowel. When this vowel is tensed by rule (4), the peripherality rules (8) and (10) are automatically put into effect. Rule (8) makes the whole class peripheral favoring N, and rule (10) distributes other sub-classes in a less peripheral direction yielding Stage I.

In Stage II, (æh) begins to rise by rule (11). The input probability to (11) is a function of time. Raising takes place by (9a) as a decrease in F1. Since N is still most peripheral, it is favored, but being lowest to begin with, it is still the lowest vowel in Stage IIa.

Given the nasal constraint on (11), it is inevitable that if raising continues in a vertical direction, N will become the highest vowel of the system, but for many speakers it is no higher (in F1 terms) than the others in Stage IIb.

A discrete break now takes place in the process. Height is re-defined as (9b), H = F2 - 2(F1). At this point N is no longer at a disadvantage, since the peripheral distribution of the output of (8) and (10) is at right angles to the (9b) dimension. Furthermore, the continued rising of N along this dimension keeps it maximally peripheral, and it quickly outdistances all other vowels in Stage IIIa. In Stage IIIb, N is high, and other vowels are still behind. Stage IV is the termination of the process.

In Table 3-5, the various stages are indicated in the last column. Here again we see a regular progression from Stage IIa (Morgan, Fig. 5) to IIb (Nasca, Fig. 6) to IIIa (Schuster, Fig. 2, 3-2; to IIIb (Ricata, Fig. 3-4) to IV (Bendato, Fig. 8, 3-6; Canzone, Fig. 10). The reversion of Milner to Stage I (Table 3-3) is now seen as a correction to the earliest available stage.

3.2.3. Differentiation of the tensing and raising rules. In section 3.2.1 (p. 48) we introduced the tensing rule which divided the short a class into tense and lax subclasses. The tense subclass is the variable (æh), subject to a number of phonetic processes: fronting, lengthening, development of an inglide, and raising of the nucleus. The fronting or peripheral movement (rule 10) and the raising process (rule 11) are the ones we have concentrated upon, since (11) has the most important consequences for the linguistic system, and (10) is the intermediate process which explains most clearly the variable effect of (11) on phonetic subclasses of (æh). In future studies, we will attempt to define more precisely the relation of length to the other phonetic processes and the conditions governing the development of the inglide.

Earlier treatments of the raising of short a have shown a single rule, converting [æ] into [ɛ:ə], etc. This is certainly a simpler way of handling the situation, and would be preferable if there were not good reasons to differentiate the tensing and raising rules. At first glance, it seems that the same phonetic conditions control both rules: front nasals, for example, are the primary conditioning factor in tensing as well as raising. However, there are many other considerations which show that we are dealing with radically different phenomena.

The tensing rule is a more abstract operation. It is plainly influenced by grammatical features. It precedes such lower-level operations as flap formation: it affects madder but not matter, both realized with intervocalic flaps in New York City; similarly it applies to candy but not canny. It must also precede the t,d deletion rule, since can't is always tense even when the final -t is lost. For some speakers, the tensing rule must precede the vocalization of r; for others, it follows it, though this is not yet completely determined. On the other hand, the raising rule seems to apply simply and directly to all tense $\bar{æ}$, independently of origin, and only the phonetic environment determines the degree of raising.

We cannot contrast the phonetic factors operating on the tensing and raising rules for New York City alone, since the raising can only be influenced by those factors which are already entered in the tensing rule. But there are other dialects in which all short a words are affected by the peripherality and raising rules: the Northern cities such as Buffalo, Rochester, Detroit, and Chicago. When we examine the variable constraints on these rules we will be able to contrast them with the wide range of tensing conditions for the Midland and Southern cities. It will then indeed appear that front nasals are the leading factors in both rules. But whereas voiceless fricatives lead over voiced stops in the selectional rule, there is no such simple relationship in the raising rule: on the contrary, we sometimes find that voiceless fricatives are relatively low (as in Detroit) compared to other subclasses. The effect of place of articulation on the voiceless fricatives is even more strikingly opposed. The feature [-anterior] operates quite generally in the middle Atlantic states to differentiate following palatals from apicals, so that southern New Jersey and Philadelphia have lax cash, bash, mash, etc., as opposed to tense pass, bass, mass. But when cash and mash are in the tense class, they are found everywhere with very high vowels, strongly affected by the raising rule. On the other hand, (æhf) is always one of the most favored subclasses in the tensing rule. Though it is as high as any other subclass in New York City, many other dialects show low peripheral half, calf, laugh, etc. The investigations of other dialects to follow will clearly indicate that the phonetic factors affecting the two processes are similar but distinct, and that there appear to be in addition arbitrary historical and social factors which lead to opposing effects of some phonetic environments in various rules. Most striking of all is the behavior of final voiceless stops, which are the last environments to be affected by the tensing rule; but among the youngest speakers in Buffalo and Chicago, these stops become the strongest influence on peripherality and raising.

The social distribution and social significance of the two rules are also opposed. The raising rule is in some areas a social stereotype, with overt social significance; in other areas, it is a linguistic marker, showing unconscious but regular social correction. But we have yet to find any social recognition of differences in the tensing rule. There are furthermore many cases of idiolectal differentiation of the finer subclasses affected by the tensing rule, without any social or communicative significance that we can detect. Brothers and sisters, husbands and wives may differ on words such as Abbie and Lassie, magic and wagon, and no one is aware of it. On the other hand, many mothers in New York City are so sensitive to the social significance of the raising of tense a that we find children correcting it as early as two years old.

There is also plentiful evidence of lexical diffusion in the history of the tensing rule, leading to well-established sets of exceptional subclasses in the Midland cities. Thus we have tense avenue as a socially uniform exception in New York City (opposed to lax average, savage, etc.) and the word planet generally becoming tense in Philadelphia (as opposed to lax damage, camera, banner, flannel, etc.) On the other hand, we have been unable to detect any evidence of lexical diffusion in the operation of the raising rule. Thus our investigations support the evidence for lexical diffusion put forward by Wang and his associates (Chen 1971, Chen and Hsieh 1971) based upon an entirely different type of data; but at the same time, our findings are not inconsistent with the neogrammarian view that sound change (in the sense of low-level phonetic processes) affects every word in a given subclass. Lexical diffusion may be especially characteristic of higher level, abstract rules such as tensing (or of the latest stages in the overt social correction of phonetic rules).

Such evidence for this differentiation of the tensing and raising rules will be developed in the balance of this chapter, and in Appendix A.

3.3. The raising of (æh) in other English dialects

In our investigations of sound change in progress, the raising of (æh) was a principle concern only in New York City and the northern cities of Buffalo, Detroit and Chicago. In other dialect areas we did not search for data on the detailed distribution of (æh) sub-classes but obtained enough information to show the general position of /æ/ as a whole. Many /æ/ sub-classes are not common in speech, but since /æN/ and /æF/ are the most common we are usually able to compare the positions of these two and their relation to /æ/ before voiceless stops. In a surprising number of these dialects, a tense (æh) class appeared, with the same raising patterns as in New York City. In the light of the analysis of section 3.2, we are able to locate a speaker's (æh) stage if we know (1) the position of (æhN); (2) the position of the main body of other (æh) words, especially (æhF); and (3) the direction of (æh) movement. To obtain the last, we need to see the direction of shift of members of the same sub-class, ideally distributions of the same word.

We obtained sufficient information on /æ/ and (æh) to classify 54 speakers from dialects in various dialect areas. We found no (æh) activity in Scotland and northern England (as in our analysis of six Glasgow speakers) nor in Wales (as shown in our analysis of three Cardiff speakers) nor in Hawaii. In all of these regions, there is one basic low central /a/, with no differentiation into /æ/, /ɑ/, etc., and no separate broad a class. Since we have already indicated that the raising of (æh) is a continuation of the Anglo-Frisian brightening and the general fronting of /a/ to /æ/, it is natural that we would find the absence of (æh) activity in the areas where this step has not taken place. We can term this Stage 0.

In other areas of England, we found a surprising amount of (æh) raising, especially before nasals. The London working-class dialect shows a strong Stage III pattern. There is no clear evidence of change in progress in this aspect of the Cockney pattern but it appears as a peripheral movement of (æhN) which reaches high position in some of the oldest speakers (Figs. 29-32).[27]

The /æ/ treatment of Norwich and Essex is similar in showing a moderate raising. Nasals are generally peripheral, and in some cases are the only clear environment for the raising of (æh)--see Figures 33-37.

Our exploratory studies in New England again showed a pattern of (æh) raising. The oldest New England speakers we have studied, from rural downeast Maine and rural western Maine, both show Stage IIa. The highest (æh) are before voiced stops, since most of the voiceless fricatives are broad a words and are in low central position.

In the South, we find a variety of different patterns but all falling within the paradigm set out above. The Outer Banks of North Carolina, to be examined in detail in Chapter 4, show a regular (æh) progression, though the class is somewhat reduced by a competing rule that converts /æ/ to /æy/. The oldest and most conservative speaker (Fig.42) shows a Stage I pattern, with all /æ/ grouped together and very little phonetic conditioning except a slightly lower position for /æ/ before voiceless stops. All other speakers show a peripheral position for nasals. The other older and middle-aged speakers from this area (including one from the adjoining sections of Virginia) show low peripheral nasals in a typical Stage I pattern (Figs. 41, 43, 35). Younger male speakers show a IIa pattern with voiceless stops but most of the usual (æh) words are not present in that class since they have moved into /æy/.

In East Atlanta, the single family we have studied closely shows no regular progression in (æh). The oldest generation male speaker has a Stage IIIb raising, but his wife shows only low peripheral (æhN), closer to a Stage I pattern (Figs. 46-7). Their children are clearly Stage IIb (Figs. 48-9). The Southern pattern of East Atlanta and the Outer Banks cannot be understood unless we take into consideration the palatal upglide for some /æ/: the conditioning of /æy/ shows a complexity comparable to (4), the selectional rule for (æh) (Bailey 1970 has the most detailed discussion of this pattern). By Principle II of Chapter 4, we would expect the /æ/ nucleus of these words to fall rather than rise. This /æy/ enters into the economy of the /iy/→/ey/→.../ay/ shift, as we see in Fig. 40 for Monnie O'Neill of the Outer Banks (see Ch. 4). A deeper understanding of the whole (æh) question in the South will require a detailed study of this competing sound change.

Our limited explorations of the South Carolina Sea Island area show a very conservative Stage I situation. On the opposite side of the South, in northern Louisiana, we find a Stage IIb pattern. It is obvious that the (æh) situation in the South is quite varied and deserves careful study in its own right. In the limited data we have gathered, the Southern dialects fit into our general paradigm quite naturally, however, since the only cases where (æhN) is not peripheral are Stage IIb. Nowhere do we find (æhN) less peripheral than other vowels, or lagging behind in the advanced stages of raising: only in the one Stage 0 case was (æhN) indistinguishable from all other /æ/.

Our studies of the rural Southwest range over a wide geographic area, from Phoenix, Arizona, to Austin, Texas. We have analyzed (æh) in nine speakers and find the same general progression as in New York City. The oldest speakers show only moderate raising at Stage IIa with low nasals. We have a Stage IIb speaker in the middle generations, Stage IIIa for three subjects in their thirties, and two IIIb patterns for adolescents.

Our major studies of the raising of (æh) outside of New York City are concentrated on the northern cities where this change is most advanced. In the various Southern and Southwestern communities we have just described, there is a complex selectional rule comparable to the one operating in the Midland communities from New York to Philadelphia to Baltimore. The Southern situation is further complicated by a competing /æy/ rule. But the northern cities, Rochester, Syracuse, Buffalo, Detroit and Chicago, have a much simpler selectional rule. There is some sign of a lax /æ/ before voiceless stops in the oldest, most conservative speakers (Fig. 11) but otherwise we find all /æ/ converted to /æh/ and rising as a variable (æh). In the most extreme cases, all members of the class rise to high position--in polysyllables, like _advertising_ and _animadversion_ and weak words as well as stressed monosyllables.

Table 3-6 shows the various stages of (æh) raising across age levels. The first series shows six female speakers from the Buffalo-Rochester area, in a perfectly regular progression. The oldest speaker is at Stage IIb (Fig. 16); two middle-aged speakers are at IIIa (Fig. 17, 18); and two adolescents and a pre-adolescent are at IIIb (Figs. 19-20).

A small sub-series is shown by two older men from Chili, a rural town outside Buffalo. These speakers are

TABLE 3-6

PROGRESSIVE STAGES OF (æh)
RAISING IN THREE DIALECT AREAS

	Stage*						
	O	I	IIa	IIb	IIIa	IIIb	IV
Buffalo				76f			
					54f		
					39f		
						11f	
						17f	
						11m	
						8f	
Chili					81m		
						60m	
Detroit				55m			
					50m		
					15m		
						13m	
			89f				
						64f	
						42f	
					37f		
						42f	
					16f		
						15f	
Southwest			80m				
			21m				
				50m			
					25m		
					30m		
					36f		
						15m	
						13m	

*see Fig. 3-7.

relatively more advanced than the city, and show a progression from IIIa to IIIb (Figs. 3-15, 16, 17).

The second series is drawn from our Detroit studies based on Shuy, Wolfram and Riley's sample. The four males show a progression from IIb (middle-aged) to IIIa and IIIb (adolescent) (Figs. 11-12, and 3-8, 3-9, 3-10); while the five females move from IIa to IIIa, IIIb and finally one Stage IV adolescent with all vowels high (Figs. 13-15, and 3-11, 12, 13). The women are typically more advanced than the men: between the oldest and the youngest speakers there is no clear age-grading.

Our studies of Chicago speech are all drawn from younger informants. Three speakers who give us good data on (æh) show a pattern somewhat different from the above. There is a general peripheral raising of (æh) with (æhN) normally more peripheral than the other sub-classes, but all at about the same level of height as defined by (9b) (Figs. 22-23, but see Fig. 21 at stage IIb).

We will now consider in detail the (æh) patterns of the northern cities. The phonetic conditioning of (æh) raising will be examined, and additional detail added to rules (9-11). We will then consider a parallel conditioning in (o)--the fronting of short o which is the other member of the Northern chain shift, anticipating the discussion of Chapter 4 in order to generalize and deepen our understanding of these phonetic constraints.

3.3.1. <u>The phonetic conditioning of (æh) in the northern cities</u>. Table 3-7 gives data on four phonetic conditioning factors in the northern cities: following nasals, following velars, preceding liquids and liquid clusters. This table can be matched against the data from the New York City study, with some surprising differences. In Table 3-8 we will consider the effect of the voiceless stops, which were not included in (æh) for New York City.

Table 3-8 lists twenty-five subjects from the three northern areas whose speech we have examined. Not every cell has an entry, of course, and some of the data is marginal, since even in an interview of several hours there will be some (æh) categories which are poorly represented. But in these analyses the (æh) situation was our primary concern, and we are able to muster enough data for most of these factors.[28] Figs. 11-23 in the main series, and Figs. 3-8 through 3-15 will provide additional detailed data on these and other constraints.

TABLE 3-7

EFFECT OF FOUR SEGMENTAL ENVIRONMENTS
ON PERIPHERALITY OF (æh) IN NORTHERN CITIES

	Age	Sex	Fig	_N	_k/g	l/r__	K^l/r__
Buffalo area							
Huber	80	m	3-15	+P	±P	--P	-P
Beck	76	f	16	(+P)*	-P	-P	
Ord	60	m	3-16	+P	±P	--P	-P
Black	54	f	17	+P	-P	±P	-P
Danowski	39	f	18	+P	-P		±P
Norton	16	f	20	+P	-P		
Carol	15	f	19	+P	±P	±P	±P
Montagna	11	m		+P	±P	-P	
Katz	8	f	3-14	+P	-P	-P	--P
Detroit							
Violet	89	f	3-11	+P	-P	-P	--P
Hankey	64	f	14	+P	-P		--P
Adamo	55	m	12	+P	-P	-P	--P
Domak	50	m	3-8	+P	-P		
Silverberg	42	f	3-12	+P	-P	-P	--P
Hobart	40	f		+P	±P	-P	
Andak	37	f	3-13	+P	±P	-P	--P
Darba	16	f		+P	-P		±P
Janeski	15	m	3-9	+P	-P	±P	
Kathy	15	f	15	+P	-P		
Adamo	13	m	3-10	+P	-P	-P	-P
Jalinski	13	m	3-10	+P	-P	-P	
Chicago							
Sadat	22	f	22	+P	+P		±P
Spender	18	m		+P		-P	-P
Cole	11	m	21		+P		
Muehe	16	f	23	±P	+P	-P	--P

* by F2 only

3.3.1.1. The effect of following nasals. Column 1 shows the cases where (æhN) was peripheral. It is true in every case. This follows from Table 3-6, since the only Stage where N is not peripheral is Stage IIb. Table 3-6 shows only one case of Stage IIb, and that is the oldest Buffalo speaker Mary Beck. Her nasals and other sub-classes clearly show a vertical upward progression (Fig.16), and move to a position less peripheral than /ey/. However, the nasals are the most peripheral (by F2 only) of the (æh) class and follow directly behind /iy/. The extra-peripheral location of Mary Beck's /ey/ is the unusual feature of this system.

In several of the Stage III speakers, we observe some fully stressed N monosyllables which are not peripheral, but rather at the high position characteristic of Stage IIb. This appears clearly in Fig. 3-13, where Anna Marie Andak shows several nasals back of short /e/ in eggs. There is a man with tertiary stress, and grand held back by gr-, and family which may be conditioned here by the following syllable; but fan and can't would normally be several hundred Herz further front in a Stage III pattern. We can constrast this case with Fig. 3-12 for Sara Silverberg. In the detailed study of her (æh) words, every favored nasal is well to the front. Only words with tertiary stress, initial clusters, or following syllables are less peripheral. We conclude that this Anna Marie Andak has not fully made the transition from rule (9a) to (9b).

Fig. 3-15 shows an old rural speaker from Chili, outside Buffalo, who is more advanced in (æh) than many younger speakers from the city. His nasals are all clearly peripheral and following the diagonal path of (9a). Fig. 3-6 shows the weak words of the same speaker: the nasals are clearly separated in advance of the others.29

The position of /ŋ/ is quite different in the northern cities from New York or Philadelphia where only front nasals were clearly tensed. In those areas /æ̀ŋ/ occasionally shows intermediate forms which are a little higher than other /æ/ words, but /æŋ/ is never in the class of /æn/ or /æm/. But Fig. 11 for Jas. Adamo shows that /ŋ/ can be peripheral in the northern states. We find a number of other cases which show peripheral /ŋ/: Flo Danowski in Fig. 18 has one very peripheral /ŋ/ and one less peripheral. Gregory Janeski in Fig. 3-10 also shows peripheral /ŋ/. On the other hand, some older speakers from Detroit, Mrs. Mary Beck and Bea Black (Figs. 16, 17), have definitely less peripheral /ŋ/. In general, we find

/ŋ/ located well to the peripheral side, lower than /n/ but more peripheral than most non-nasals. Fig. 19 shows three such /ŋ/ words in that position for one of the most advanced Buffalo speakers.

The lesser effect of initial nasals can be observed regularly throughout these charts. Typical is the double-stressed mad at the lower left of Anna Marie Andak's chart (Fig. 3-13).

3.3.1.2. The effect of following velars. The second column of Table 3-7 clearly shows that (æh) before velars is less peripheral in Buffalo and Detroit. There are six variable cases and fourteen where the velars are clearly the least peripheral.[30] On the other hand, the three Chicago speakers show no clear tendency in this direction. Fig. 23 shows the detailed (æh) distribution of Carol Muehe (pronounced [mi]) from Chicago: the only velar words that are well to the back are those with initial liquid clusters--such as cracked. And there are several instances of back and pack which are fairly peripheral, equal to mad and had in this respect, and in the same class as bad or half. In Fig. 3-18, the reading pattern of Carol Muehe does show some less peripheral (æh) before velars, along with a few others which are as centralized as the /ėhr/ class, and the usual backing effect of preceding liquids. In general, the tendency of velars to be less backed is found in connected speech. A clearer example is seen in Fig. 22 for Mary Sadat. Though she is not as extreme a speaker as Carol Muehe[31] she clearly shows peripheral velars. Her back and stagger are well to the front of her bad and half: only the nasals are more peripheral. In Fig. 21 John Cole shows one velar word--act--which is well to the front. Only two words--dad and hand--are more peripheral.

This is an extraordinary finding since we have come to expect the velars to have a centralizing effect on (æh). The non-peripheral position of the velars in New York and the other northern cities seems quite well motivated by articulatory factors. But the alternative treatment of this feature indicated by these three speakers from Chicago is quite contrary to the notion that the conditioning factors are all quite general and can be predicted by universal articulatory or acoustic factors. It will become increasingly plain in this report that most but not all of the conditioning factors can be explained in this way; there is a large margin for the arbitrary social aspect of language, and the distribution of most (æh) sub-classes cannot be predicted in advance.

The Detroit speakers differ from New York City in their treatment of /ŋ/. Not only are /æ/ words before /ŋ/ tense but they become peripheral, in some cases even among other N words. Fig. 3-10 of Gregory Jalinsky shows a clear differentiation in this younger Detroit speaker's treatment of nasal and non-nasal velars. Gang and hang are quite peripheral here, but tag and bag are obviously not less peripheral than dad and had (and even lad), while back is less peripheral than bat. Thus Detroit has moved the velar nasal into the /N/ class, but rule (11) does not appear to produce an /n/-/ŋ/ difference in peripherality as clearly as it does a /t/-/k/ difference or /d/-/g/. There is indication of an unpredictable or dialect-specific factor in this phonetic conditioning as well as the original selectional rule which we expect to find dialect-specific. But the difference between Chicago and Detroit seems to be outside of articulatory explanation. More detailed examination of this difference in velar conditioning with more speakers and more lexical items will be necessary to confirm this indication, which seems to us of the greatest theoretical importance.

3.3.1.3. The effect of preceding liquids. Table 3-7 fully supports the indications of the New York City study on the centralizing effect of preceding liquids and especially liquid clusters. The entries in the third and fourth column are either -P or --P: that is, non-peripheral or maximally non-peripheral. There are no +P entries indicating that the constraint is reversed. In fourteen cases there is enough data to assert that a single l- has a clear effect in backing (æh), and in twelve cases this can be said of obstruent liquid clusters kl-, kr-, etc. In six cases the clusters had more effect than single consonants. In only two cases--the two speakers from Chili--was this effect reversed (Figs. 3-15, 3-17).

3.3.1.4. The effect of a following /ʃ/. In New York City we saw that there was some indication of /ʃ/ lagging behind the other voiceless fricatives. Again, we find that data on /ʃ/ is scarce. But in five cases /ʃ/ is clearly more peripheral and higher than the other fricatives. See cash in Fig. 3-18, national in Fig. 3-18, and the high but non-peripheral fashion of Fig. 17; but there are counter-examples to this tendency as well.

We can also note at this point the action of an obstruent following a fricative in making (æh) less peripheral. Thus we can compare ask with ass in Fig. 3-23

3.3.1.5. <u>The ordering of stops</u>. In New York City, we were unable to make any strong statements about the effect of following stops, except to note that velars were less peripheral. The voiced stops were simply not frequent enough to allow us to order <u>b</u>, <u>d</u> and <u>g</u> in raising and/or peripherality and the voiceless stops were not included in (æh) by the selectional rule. We now have an opportunity to study the effect of place of articulation upon (æh) since we have included in the northern cities (æh) a number of fairly common words ending in <u>-p</u>, <u>-t</u>, <u>-č</u>, and <u>-k</u>.

The ordering of the voiceless stops is a doubly important issue, since we can make a direct comparison between the conditioning of tense (æh) and the effect of the following voiceless stops on (o), the fronting of short <u>o</u>. Since many of the short <u>o</u> words before voiceless fricatives and front nasals have moved out of (o) into the long open <u>o</u> class, the most common (o) words are before stops. This will have important consequences for our understanding of the conditioning factors that affect the raising of tense vowels and how they interact in chain shifts. Is the fronting of short <u>o</u> part of the same movement as the raising of (æh)? Do functional chain shifts operate between similar allophones, or is it the phoneme as a whole which moves in response to the approximation or removal of another phoneme?

We have already seen that velars are less <u>peripheral</u> than other stops. We will therefore consider here the effect of the various stops on the raising of (æh) We must first bear in mind the two possible definitions of raising, (9a) and (9b). We have already shown in Table 3-7 that some speakers in northern cities are operating within a basically vertical framework (Stage II) and some within a diagonal one (Stage III). Our decisions about the ordering of the voiceless stops will reflect this orientation.

Table 3-8 shows the ordering of the voiceless stops in their effect on the raising of a preceding (æh).[32] Column 6 shows the comparable ordering of the voiceless stops in their effect on (o).

If two following consonants are both found in the data but appear to have the same effect, they will be separated by commas. If they are ordered in height, they will be separated by a > sign.

In Fig. 11, Stage IIb James Adamo shows a single (æh)

TABLE 3-8

EFFECT OF FOLLOWING VOICELESS STOPS
ON RAISING OF (æh) AND FRONTING OF (o) IN NORTHERN CITIES

	Age	Sex	Fig.	raising of (æh)	fronting of (o)
Buffalo Area					
Huber	80	m	3-15	t > k	t > p > k
Beck	76	f	16	p > t > k	p > t > k
Ord	60	m	3-16	t > k	t > p
Black	54	f	17	č > t > k	č > t > k
Danowski	39	f	18	t > k	t > k
Norton	16	f	20	t > k	t > b > k
Carol	15	f	19	t > p	d > k
Montagna	11	m			č t, p > k
Katz	8	f	3-14	č > t > p > k	č > t > p
Detroit					
Violet	89	f	3-11	t > k > p	t > č > k
Hankey	64	f	14	t > p > k	t, kt > k
Adamo	55	m	12	č k > (t)	t > k
Domak	50	m	3-8	t > k	p > t
Silverberg	42	f	3-12	t > (k)	t, p, k
Hobart	40	f			
Andak	37	f	3-13	t > k	č > t > p > k
Darba	16	f			
Janeski	15	m	3-9	t > k	p,t > b
Kathy	15	f	15		t > d,p,k
Adamo	13	m	12		t > d,p
Jalinski	13	m	3-10	t > č, k	t,p
Chicago					
Sadat	22	f	22	k > t, p	p > k
Spender	18	m		t > k	
Cole	16	m	21	k >	t > p > k
Muehe	16	f	23	t, k	t > k > p

-č well ahead of -k. The only -t is in a weak word which is embedded in a group of basically unraised /æ/. As we will often find, (æk) often overlaps with the most forward (ot); short o words for James Adamo are still very far back, -t and -č are not fronted more than k, and the voiced b is further behind. Note that the relationship of black to block suggests that /ɔ/ is still a lower mid back vowel and has not fully descended to low position.

Stanley Domak, 50, (Fig. 3-8) shows a clear advance of a -t over -k for (æh) in weak words and also with the extremely peripheral cats. This word is still lower than the nasals; it is in such a peripheral position that it would seem ready to follow the nasal path, at the same F1 position as the fricatives. Like Adamo, Domak shows a low back short o with no clear tendency to move forward and no phonetic differentiation.

Considering next the series of three younger Detroit males we see that Doug Janeski in Fig. 3-9 shows the same position for cats as Domak and a clear advance for (æh) of -t over -k. The short o words stop, shop and hot have moved down to a low forward position.

Chris Adamo, 13, the son of James Adamo, shows for (æh) in Fig. 12 that his -t is more advanced than -k (allowing that he has only weak words in -t). Among the (o) words, the most forward is -kt, with -t just behind, and with -pt considerably further behind. It is interesting to note that (æhkt) is much lower than (okt) which has moved to a point above it.

The oldest Detroit female speaker is Carrie Violet, 89. Her system in Fig. 3-11 is structurally the least advanced, located at Stage IIa with relatively low nasals in can't, stand, grammar, family, etc. and a few high ones which oddly enough have initial liquids (tram, land). The existence of this second higher norm makes her an almost exact parallel with our oldest New York speaker Anderson, 73, in Fig. 1. Though she has this basically older system for (æh), phonetically it is more advanced than that of Adamo in Fig. 11. Violet's (æh) and (o) before voiceless stops are displayed in Fig. 3-11. We see that two -t's lead -k which is in turn higher than -p on this vertical scale. For (o) the movement seems to be clearly upward as well as forward--a (9b) raising. But in terms of F2 or F2/F1, -t leads -k and -č is intermediate.[33]

The second female speaker is Dulsey Hankey, 64 (Fig. 14), who is now clearly Stage III. The voiceless stops are quite central, but there is a clear ordering of -č, -t, -p and -k in close array. Immediately behind them are the (ot) words. There is one ŏ word in -okt (doctor) which is very far front and peripheral, in the position that (æhN) starts from in New York City. Otherwise, -t leads -k except for lot with initial l-. The word got is particularly far forward and already seems to be rising up behind the (æh) words.

Fig. 3-13 for Anna Marie Andak, 37, shows -t over -k for (æh) with the word cat at a very high position (not as peripheral as in some other cat tokens. The (o) words have a very front watch, overlapping jacket, and behind that we find other /č/, then in close order -t, -p and -k. Here again we can arrive at this ordering only through assuming that the (o) words are already on the upward as well as frontward route.

Our most extreme Detroit speaker is Kathy from Detroit (15),(Fig. 15). Most of the (æh) data is in reading style, and as we will see, that is not reliable for the study of conditioning factors. There is no clear evidence of differentiation among voiceless stops, as she is close to Stage IV where such conditioning tends to disappear. But for (o), we have a very clear ordering of -t over -p, -k and other finals. Even more interesting is the fact that the /ahr/ words have begun to move forward along with the (o) words in Kathy's speech.

Reviewing the data for Detroit in Table 3-8, we find that as a very general pattern, -t leads over -k in the raising of (æh). There is no clear evidence for -p vs. -k in terms of height: they are generally very close or equal. The affricate -č was ahead of -t in one case, and behind in another. We would therefore conclude that one clear conditioning factor for the raising of (æh) in Detroit is the lag of -k, which matches its peripherality. This confirms the relation between peripherality and raising even though we are here usually in Stage III and using a definition of raising that is orthogonal to peripherality and formally independent of it.

We do not find the same clear evidence for the advance of -d over -g. On the contrary, the voiced stops (where we have evidence) are not clearly differentiated for raising.

The situation with (o) repeats what we found here for (æh). In the six cases where we have data for -k, it is the least advanced. There is no clear relation between -t and -p in the older speakers, but as (o) moves forward, the -t assumes a prominent position. Words like got and not are often very far forward, in the position of [æ] for most other dialects. The relationship of -č to -t is again mixed: sometimes ahead, sometimes behind.

The Buffalo data is quite similar to Detroit. Again, eight speakers give evidence that -k is behind for (æh) and none contradict that relation. There are several cases where -t is clearly ahead of -p, and one case of the reverse. There is a striking parallel here between the oldest Stage II speakers in Detroit and Buffalo. Mary Beck (Fig. 16) like James Adamo (Fig. 11) shows a comparatively low -t in weak words, though -t is still higher than -k. In general, Buffalo seems to show slightly more advanced stage of (æh) raising than Detroit. The voiceless stops come rapidly to the fore and rise to high peripheral position for younger speakers. Two instances of -č show that this can be even more advanced than -t.

Again, we cannot confirm these relations among the voiced stops, which seem to be generally equivalent in height, with some cases of -g lagging behind.

The short (o) words again repeat the pattern of (æh). The two cases of -č are the most advanced; -p follows next, and then -k. There are no cases where we can compare all four finals, but putting together the relations on Table 10, we observe: palatals have the most raising and fronting effect, next come apico-alveolars, and velars last with the place of -p not fully determined. These facts seem to fit well with an articulatory motivation in which the high vowels are seen as palatal: the closer the consonant is to palatal position, the more effect on raising the vowel and vice-versa.

In the younger Buffalo speakers we can observe that the voiceless -č and -t become quite peripheral, even more than the nasals. Thus for Mary Carol (Fig. 19) the most extreme words are matter and transfer.[34] In Alisa Katz's pattern of Fig. 3-14, the most peripheral forms are hatch and hatched, with cat below: compare these to answer man's, and stand. Thus the Buffalo pattern has made (æh) before voiceless stops the highest and most peripheral allophone. The path of -p, -t, -k seems to follow that of the nasals; the re-orientation from Stage II to Stage III greatly accelerates their raising pattern. The voiceless stops begin as less peripheral and the lowest conditioning agent, and gradually rise to become the most peripheral and highest, even surpassing the nasals. Perhaps this overlap is characteristic of Stage IV: as the change nears completion the pattern of phonetic conditioning that prevailed during the change disappears.[35]

In older Detroit speakers we have seen short o at a fairly early stage of the fronting, and there we find less evidence of phonetic conditioning. The lack of differentiation in the early stages of (o), (Figs. 11, 3-8), is comparable to the situation in New York City in the voiceless consonants. These are all members of /æ/, and are not involved in change of any kind. We have not yet found any pattern of phonetic conditioning by voiceless stops for New York City /æ/.

The (æh) situation in Chicago is then all the more striking. In 3.3.1.2. we found that the velars were most peripheral for the three working-class Chicago speakers we studied. In Fig. 23, we find that there is no evidence for -t leading -k: it is clear that -t is no higher than -k among the (æh) allophones. Furthermore, -k is higher than -p for John Cole in Fig. 21. For Mary Sadat in Fig. 22, it is obvious that -k is among the highest allophones of (æh). The direct relation between peripherality and raising seems well established.

If we examine conditioning of (o) in Chicago, we find no clear pattern. In two cases, -t leads -p, in one -p is ahead of -t. For Carol Muehe (Fig. 23), -k is ahead of -p. Pending more data, we must register the fact that the usual conditioning factors which operate in Detroit and Buffalo do not seem to hold for these three speakers in this area of Chicago (Evergreen Park). It may be because the change is defined as completed for Chicago, but as far as vowel height is concerned, Buffalo is ahead of Chicago.

3.3.1.6. The position of the voiceless fricatives for (æh). The relations of the voiceless fricatives to the voiced stops are clearer in Detroit and Buffalo than they are in New York. Within the voiceless fricatives, we find that -f and -θ often occupy a low peripheral position which we occasionally saw in New York City. Thus in the oldest speakers in the Buffalo area we find low peripheral -f in Fig. 16 for Mary Beck, 76, and in Fig. 17 for Bea Black, 54. In Detroit, it is low (but not peripheral) for Dulsey Hankey, 64 (Fig. 14), partly the same situation for Sarah Silverberg, 42 (Fig. 3-12), somewhat higher and peripheral for Anna Marie Andak, 37,

(Fig. 3-13) and for Sally Hodge (not shown here). Among the younger males, we find -f in low peripheral position for Gregory Jalinski (Fig. 3-10). All three Chicago speakers have low peripheral -f. The -f situation is then clearly quite different from New York, where -f was generally high. Here -f is low in twelve out of fourteen cases; its peripheral status is more variable: -f was clearly peripheral in only eight out of fourteen cases.

In general, the voiceless fricatives for Detroit do not follow the New York City pattern of matching the raising of the nasals. On the contrary, the voiceless fricatives begin as relatively low, and lag behind the stops for most speakers. In a few older subjects, like Stanley Domak (Fig. 3-8), we find very low stops, but after the initial stages the voiceless stops at least are well ahead of the voiceless fricatives. If we examine any of the older women, we can observe the change in progress and see how variable constraints of manner of articulation begin to line up. For Dulsey Hankey, Fig. 14, we see high nasals and less peripheral high voiced stops. Below these are the voiceless fricatives, and next the even less peripheral voiceless stops, with -f bringing up the rear. In Buffalo, Mary Beck shows a very fine-grained phonetic differentiation in Fig. 16. The nasals are again at upper mid position; behind them are the voiceless stops, -t, -p, then the fricatives, with -k behind. Mrs. Black has in Fig. 17 almost the same pattern, but with the voiceless stops reaching higher, and (o) beginning to rise from behind.

We can therefore add to the list of differences between New York and the northern cities the fact that the fricatives favor raising less than stops.

3.3.1.7. The Northern rules for (æh) and (o). The principle differences between the New York City rules (8) and (10) and the northern cities rules are: the high, less peripheral position of /ʃ/ in the northern cities; the entrance of the voiceless stops into the raising rule, and their eventual rise to high peripheral position; and the low position of fricatives, especially -f.

The peripherality adjustment rule (8) seems to be the same at first: it is nasals that are most highly favored. It is only in the final stages that we might have to differentiate the voiceless stops.

We would then have

(12) $$[+\text{tense}] \rightarrow \langle x\ \text{peri}\rangle \ / \ \underset{[-\text{back}]}{\underline{\qquad}} \left\langle \begin{matrix} \begin{bmatrix}-\text{cont}\\+\text{tense}\end{bmatrix} \\ +\text{nas}\end{matrix}\right\rangle$$

Rule (12) now shows two disjunct categories in the following environment--voiceless stops and nasals. There seems to be no simple way to combine or simplify these categories, which form as unnatural a class as any we have encountered. Further investigation of rule (12) for younger speakers in the northern cities may show a more natural continuum of environments.

The limitation on peripherality characteristic of the northern cities would again be quite similar to the New York City rule (10). But it must differ from (10) in at least one respect: since -ʃ does not restrain peripherality, we cannot use the simple notation ⟨-ant⟩ but must add to this ⟨-cor⟩ to include velars but exclude palatals.[36]

(13) $$[x\ \text{peri}] \rightarrow \langle x\text{-}y\ \text{peri}\rangle \ / \ \langle\langle+\text{cons}\rangle+\text{voc}\rangle \underset{\langle -z\ \text{str}\rangle}{\underline{\qquad}} \left\langle\begin{matrix}-\text{ant}\\-\text{cor}\\+\text{voc}\end{matrix}\right\rangle \left\langle\begin{matrix}+\text{voc}\\+\text{cons}\end{matrix}\right\rangle$$

The raising rule for the northern cities will also differ slightly from the New York City rule (11). But it must include the constraints on raising which are not accounted for by peripherality: the ordering of the following voiceless stops č t p,k, the high position of (æhʃ) and the low position of (æhf). We can accomplish this by entering ⟨+cor⟩ and ⟨-ant⟩ as constraints on raising in (14):

(14) $$[+\text{tense}] \rightarrow \langle y\ \text{high}\rangle \ / \ \underset{\langle x\ \text{peri}\rangle}{\underline{\qquad}} \left\langle\begin{matrix}+\text{cor}\\-\text{ant}\end{matrix}\right\rangle$$

Now however we see that the ⟨-ant⟩ feature works in two different ways in (13) and (14). On the one hand it limits peripherality in (13) and thus there is less raising of <u>back</u>, <u>bag</u>, <u>cash</u>, etc. by (14). On the other hand, ⟨-ant⟩ favors raising as a secondary constraint in (14). Since both ⟨+cor⟩ and ⟨-ant⟩ favor (æhʃ) and disfavor (æhf), rule (14) will naturally dispose of these elements in accordance with our data. But rule (14) gives us no clear indication of the status of velars -<u>k</u>, <u>g</u>, since they are favored only by the secondary constraint ⟨-ant⟩ in (14) but disfavored by ⟨+cor⟩.

There is some evidence that these conflicting influences are actually represented in the data. We find that younger speakers begin to favor the palatals much more heavily than older speakers, and as we noted above, younger Chicago speakers actually show high (æh) before velars. There seems to be a re-ordering of the constraints on (14) which leads to (14') among younger speakers:

$$(14')\quad [+\text{tense}] \rightarrow \langle y\ \text{high}\rangle \ / \ \underset{\langle x\ \text{peri}\rangle}{\underline{\qquad}} \left\langle \begin{matrix}-\text{ant}\\ +\text{cor}\end{matrix} \right\rangle$$

A second conflicting element is seen in the relatively high position of polysyllables among older as well as younger speakers. This works against the centralizing effect of following syllables but again seems to become more predominant as the sound change progresses. Thus the most general form of the raising rule for the northern cities might be (14"):

$$(14'')\quad [+\text{tense}] \rightarrow \langle y\ \text{high}\rangle \ / \ \underset{\langle x\ \text{peri}\rangle}{\underline{\qquad}} \left\langle \begin{matrix}+\text{cor}\\ -\text{ant}\end{matrix} \right\rangle \ C_0 \ \langle -\text{cons}\rangle$$

We can now consider briefly the form for the rule for the fronting of (o). There is some question about the definition of fronting, since as we have seen the most advanced forms tend to show lower F1 as well as higher F2, and the (o) words may be following the same upward path as (æh) in a chain shift. But for the moment we can best express this as a simple decrease in backing of the vowel:[37]

$$(15)\quad [+\text{low}] \rightarrow \langle -x\ \text{back}\rangle \ / \ \underline{\qquad} \left\langle \begin{matrix}+\text{cor}\\ -\text{ant}\\ +\text{tense}\end{matrix} \right\rangle$$

This rule shows the same environmental constraints as the raising rule (14), especially when we consider that the ⟨+tense⟩ stops are also favored in (14) as a result of their appearance in the peripherality rule (12).[38] Rule (15) may take a different form when we consider in Chapter 4 the nature of the chain shift involved. We may want to consider short (o) as a tense vowel in the northern cities, which would increase the resemblance of (15) to (14).

Rules (12-15) are all written as variable rules over a scalar or continuous output of peripherality, height or backness. At this point we might want to re-examine the issue as to whether a more discrete rule might be written, based on the binary features of [±low] and [±high]. Figures 11-23 are not encouraging in this respect. The Detroit and Buffalo speakers seem to show a continuous range of raising of (æh) in relation to the fairly stable /ey/ and /iy/.[39] For Adamo in Fig. 11 we might write all (æh) as [+low], and similarly for Domak in Fig. 3-8. But beginning with Hankey in Fig. 14 we see a range of (æh) that is partly high, covers all of the mid range, and extends downward into the low range. Even within a single allophone or for a single lexical item (<u>hand</u>) we can expect such fluctuation over the binary categories.

In the long run (Fig. 19) we may come very close to [+high] for all (æh), but that is the end result of the change, not the process itself.

3.4 The use of word lists and reading passages for (æh)

The tables which establish our basic relations often show empty cells, and in many cases we draw conclusions on the basis of one or two lexical items in the speech of a given person. It is obvious that this situation could be remedied by giving the speaker a long list of words or a reading passage in which the words we want are concentrated. This is a common procedure, and we have elaborated this formal apparatus in our sociolinguistic studies (Labov 1966; Labov, Cohen and Robins 1965).

Word lists can be quite revealing in that they show the overt or covert norms of the speakers. We use the direction of shift from casual to careful speech to reading style in order to infer how such norms are structured. In Fig. 3-3b we showed how a working-class speaker shifts dramatically away from his vernacular forms when he is reading.

In the northern cities we do not find such a dramatic downward correction since (æh) is not a sociolinguistic marker. On the contrary, the situation is similar to what we find for a few New Yorkers, who do not correct their (æh). In reading, their pronunciation moves upward and the various forms cluster more tightly around a higher norm.

In Chapter 2 we gave a number of examples of this upward shift. Fig. 3-18 and 3-19 showed that the tight clustering which we get in reading eliminates most of the fine phonetic conditioning which we are studying here. This may indeed reflect the norms of the speakers, and the contrast between speech and reading will illustrate one aspect of linguistic change. But it eliminates much of the machinery which operates in the course of linguistic change, and has little value in this chapter.

Fig. 3-18 shows the (æh) vowels used by Carol Muehe in reading, and it may be contrasted with Fig. 23 which shows her connected (in this case mostly casual) speech. The reading passage gives us a tightly clustered group of vowels a little higher relatively than Fig. 23: in upper mid position, equal to the highest /ey/. The most peripheral forms are nasals, but the relations of fricatives and stops are no longer as evident; -f is now absorbed into the main body of (æh) forms instead of showing the distinct low position of Fig. 23.

Figure 15 for Kathy from Detroit utilized a reading passage for many of the (æh) forms. They are plainly higher than (æh) from casual speech. These forms seem to show the basic relationship we find in other young speakers: high peripheral nasals, back velars, the effect of preceding liquid clusters, and the high position of voiceless stops. But we must employ such forms with caution, calibrating and justifying them against the basic pattern of connected speech. Fig. 3-19 isolates the reading forms for comparison.

The difference between reading passages and spontaneous speech appears more clearly when there is a discrete break between two realizations of an original word class as in New York and Philadelphia (æh) vs. /æ/. In Chapter 2 we discussed the on-going work on the selectional rule for (æh) in the periphery of Philadelphia. Here the assignment of lexical items to one class or the other was regularly different in word lists and speech, even though there is no overt stigma attached to high (æh) in these rural areas. The over-all view of the selectional rule is quite different and is more advanced in speech than in these more normative readings.

All of this discussion has a strong bearing on the problem of studying lexical diffusion. We find no strong evidence for lexical diffusion in the (æh) patterns of Detroit and Buffalo and Chicago. Despite some initial oscillations the (æh) word class seems to move upward as a whole, with fine phonetic conditioning in the process. There is some indication that the word mad is lower than its phonetic class would justify for several speakers. See Fig. 3-13 where it is low and peripheral, and Fig. 20 where it is both low (two instances) and high. It also appears as low and peripheral in the reading passage for Vinney M., an 11 year-old Syracuse boy. Since in other dialects we find that initial m- does have a raising effect, the low position of mad as compared to bad, ads, etc., seems to be lexically determined. But we would hesitate to come to grips with an issue of this size without a much larger scale study of many lexical items in each category.

The solution which we are now following in the Philadelphia area is to move towards longer interviews--three or four hours of conversation with one subject--and to direct the conversation towards critical lexical items (like cab, badge, cash, etc.). But the interviews used here have been carried out with many goals in mind and it is not usually until the work is completed that all of the crucial variables are known. In our current explorations of Philadelphia, we are beginning to develop techniques to enrich the study of (æh) with these problems in mind.

The basic strategy, however, will be to show how the constraints we are dealing with are replicated in many speakers. Linguistic relations are so uniform that they should demonstrate this kind of uniformity. We have seen this in the effect of nasals, the raising of the voiceless stops and the centralization of velars. But when we are dealing with such marginal phenomena as the raising of -ʃ or the position of -f, we must be more cautious and look for richer data to confirm the relations in a larger number of items and speakers.

3.5 The development of (æhN) in Cardiff.

One of the strongest findings in our work so far is the effect of a nasal consonant on the raising of tense vowels. The general pattern seems to be that free nasal vowels fall but that vowels before nasal consonants generally rise.[40] The explanation for this principle is not yet clear, though one can advance various speculative arguments for particular cases. But a development in Cardiff (Wales) re-doubles the strength of this principle by converging on it from an unexpected direction.

We visited Cardiff in the series of fifteen English cities because it was generally known that Cardiff had fronted /ahr/, similar to Boston. However, an additional fact about Cardiff /ahr/ came to light after a number of interviews. The basic Cardiff vernacular is stigmatized, and corrected or avoided by middle-class speakers. One element that is frequently mentioned is a "nasal a." This is the folk term often used to describe the raised (æh) in New York or Philadelphia, usually meaning (æhN) (Camden) but sometimes including words with voiceless fricatives or voiced stops after (æh) (pass, bad). But the Cardiff stereotype does not pertain to reflexes of short a but rather reflexes of /ahr/. The word Cardiff is often used as a stereotype: [kæ̃^·dɩf].

Cardiff is an r-less dialect, and the postvocalic /r/ after /ah/ is always vocalized in pre-consonantal and final position. When that happens, the basic Cardiff vernacular supplies nasality to represent the /r/. Thus we have in connected speech and in word lists:

[haʃ]	'hash'
[hã·ʃ]	'harsh'
[kat]	'cat'
[kã·t]	'cart'
[ham]	'ham'
[hã·m]	'harm'

The substitution and distinctive use of nasality is quite systematic in the vernacular. There are some working-class speakers who do not use nasality in this way, relying primarily on length to distinguish these pairs, but the main pattern is the one shown above.[41] For our purposes the important fact about Cardiff /ahr/ is that it moves front and up, leaving short a in place as [a]. Fig. 25 shows the vowel system of Eddie Powell, an older

Cardiff speaker: /ahr/ and /a/ occupy the same positions. Fig. 26 is the system of Gerry Huxton, 26, a young man of working-class background moving into a lower middle-class position. Huxton's nasal /ahr/ is beginning to move forward, disjoining itself from the /a/ and /ah/ words. Only two /a/ words are further front, and most of them are lower and backer than the new variable (ahr). The word <u>are</u> is already in upper low position, equivalent to the <u>early</u> stages in the raising of (æh) in New York City.

The Cardiff sound change is a dramatic demonstration of our basic principle that long, tense vowels, especially nasal ones, will follow an upward path, leaving behind any contrastive set of vowels which are shorter or laxer by contrast.

3.6 The raising of the back tense and ingliding vowels.

So far we have been considering only half of the typical situations involving the raising of (æh) to [i·ə]. In the northern cities, we are dealing only with the front half of what is a symmetrical situation in New York. In Chapter 4 we will return to the third member of the Northern chain shift, the lowering of /ɔh/. But this chapter is focused primarily on the raising of tense and ingliding vowels, and we will therefore consider the symmetrical back development in New York City and elsewhere.

In Figs. 1-10 the New York City chain shift is displayed: /ah/→/oh/→. It involves first a symmetrical raising of the variable (oh) in <u>caught</u>, <u>lost</u>, <u>off</u>, etc. Fig. 3-20 shows the co-variation of (æh) and (oh) in New York (from Labov 1966). A group of older Jewish speakers in the upper left of this diagram have low (æh) but high (oh). Otherwise the main sequence follows from lower right to upper left, tightly correlated with the generation of the speaker. Sections <u>a-d</u> of Fig. 3-20 show the progressive upward movement of (ah) and (oh) for four speakers: Anderson, Schuster, Nasca and Calissi. The rising (oh) moves back along a peripheral path and (ah) moves behind it. In addition, there is a corresponding movement of the word classes before morphophonemic <u>r</u>: /ahr/→/ohr/→/uhr/, seen in the corresponding Fig. 3-21. Here there is a third element encountered, /uhr/ in <u>sure</u>, <u>lure</u>, <u>moor</u>, etc. We see that the variable (ohr) moves up and to the back and quickly rises to the same height as (uhr). Most New Yorkers report that sure and shore are "the same," and label these classes as merged (see Chapter 6 below).

In our earlier studies we showed that the symmetrical raising of (æh) and (oh) showed certain oscillations according to ethnic group and social class. But in the long run, both vowels become maximally high, and there results a simple system of three ingliding vowels: /ih/, /uh/ and /ah/. The closest approximationto this final result may be seen in the system of Bendato, Fig. 8. But it should be noted that the word classes of (æh) and (oh) are still distinct from /ih/, /eh/ and/uh/. They are corrected in formal styles with little confusion of lexical items, and even in natural speech they show an overlapping asymmetrical distribution in which (æh) can be lower than (ih) but not vice-versa.[42]

Unlike (æh), the raising of (oh) does not depend upon any active selectional rule. The differentiation of short o and long open o was accomplished in New York City quite a long time ago and is relatively stable. The same general classes are important in the tensing of /ɔ̄/ as for /æ/: voiceless fricatives and nasals. In the case of the back vowels, we would expect to see the influence of back nasals and voiceless fricatives emphasized instead of front ones. If a simple articulatory mechanism is involved, /ŋ/ should have the place in the back for (oh) which /m,n/ have for (æh). We do observe that common words before /ŋ/ are tensed: long, wrong, song, as opposed to King Kong, ping pong, etc., which are variable but favor [a] instead.

We also observe a tendency for low F2 values with (ohn) but it is not as strong a peripheral effect as with front vowels. A detailed examination of the phonetic conditioning of the raising of (oh) would have great explanatory value for interpreting the conditions for (æh).

New York City is not the only area where this symmetrical raising of tense and ingliding vowels can be observed. Philadelphia has a strong /ahr/→/ohr/→/uhr/ chain shift which has resulted in a categorical merger of moor, and more, boor and bore, sure and shore, etc. The path of the /oh/ category which does not precede /r/--caught. law, etc.--is not so clear: there seem to be radically different tendencies among different sections of the population.

In Wisconsin we have observed the development of ingliding vowels in the word class which is elsewhere /ow/. In the area of Fond du Lac, Wisconsin, we find monophthongal [o·] and [e·] in the speech of many adults, influenced by a strong German and Scandinavian component of the population. Among younger speakers, the [o·] has broken to [o·ə] or [ü·ə], adding a new element to the ingliding series: [pu·əl, po·əl, pɒ·əl, pɑ·əl] correspond to pool, pole, Paul, poll. The form for pole is exactly the same as for New York City Paul, and Eastern speakers have great difficulty in deciphering this series. The inglide is quite general: it is heard even in [muətɚ buət] for motor boat, for example.

We have also gathered data on the ingliding [i·ə] and [u·ə] for long ē and long ō in the speech of Newcastle (Gateshead), England. Among young males in lower working-class areas, this tendency is most pronounced, so that there is a direct contrast between monophthongal [i·] and ingliding [i·ə], for beet vs. bait, and monophthongal [u·] and ingliding [u·ə], for boot vs. boat. This is a long-standing tendency in the surrounding area, and it would be wrong to think of it as the advancing edge of a new sound change, as in New York City or Fond du Lac. Nevertheless, the mechanism of this rising and ingliding pattern is definitely strongest among the lower working-class males, and a detailed investigation of this pattern should throw light on the broader questions concerning the raising of tense ingliding vowels. One problem which immediately confronts us is that of the "next step." Given the raising of (æh) to [i·ə], it is unlikely that the mechanism which produced the change from [æ] to [i·ə] would have no further consequences. There is of course social correction in New York City, which has restored low vowels in the speech of many upper middle-class youth. But if the vernacular does not disappear, where would the ongoing course of sound change move [i·ə]?

There are two basic possibilities which we can observe in the historical background to be discussed below: (1) monophthongization and (2) a shift of the nucleus to produce a rising diphthong [jə]. The latter seems more likely in view of the consequences of merging the many word classes involved in (æh) with /iy/. It is also possible for the new /ih/ to stay put, and for /iy/ to follow the path to /ey/ and /ay/ as we will see in the next chapter. In that case, /ih/ might become monophthongized. In 3.8, we will consider the historical precedents for these possibilities; Ch. 5 is a general exploration of the routes for change of sub-systems.

3.7 The raising of (æw).

In New York City, the raising of (æh) is followed by a general fronting of /aw/ to forms approximating [æo]. Figs. 4-4 and 4-5 show the most extreme forms which we typically find in New York City. But in Philadelphia, the nucleus of original /aw/ is already identified with /æ/, and the base form from which sound change can depart is thus /æw/. In that situation, we observe a growing tendency for Philadelphians to identify the tense vowel of /æw/ with the tense nucleus of (æh) rather than /æ/. Given these two alternant realizations of the nucleus, we can expect that discrete sound change is more likely than in the case of the raising of (æh) in New York or the northern cities. We are currently exploring the raising of (æw) in Philadelphia as a new variable to see if it is indeed discrete or continuous and discover whether or not it moves ahead with the higher forms of (æh) or stays at mid position as [ɛo].

In other regions, the same raising of the nucleus of (æw) has taken place with even more striking results. See for example the sequence of Fig. 46 (Henry Gratton, 60) and Fig. 48 (Barbara Gratton, his daughter) where /æw/ moves up to mid position. An even more extreme raising can be seen in the Outer Banks, (see Nora Herbert) Fig. 41, where an upper mid norm for /æw/ can be observed.

A theoretical issue of some interest revolves about this continued raising of /æw/. If we consider that functional nucleus-glide differentiation is an important factor in the sound changes we have been studying, we would expect Middle English /iy/ to become maximally differentiated to [ɒi] and /uw/ to become maximally differentiated to [æu]. These diphthongs would then be relatively stable. But we do not find this to be the case. The nuclei of these optimal diphthongs become tense (i.e., peripheral) and then follow the upward path of (æh) in the front and (ah) in the back, yielding such such forms as [ɛo] or [oi].

The fronting and raising of /æw/ in the Outer Banks also involves a fronting of the glide, part of a process which yields six front upgliding diphthongs in <u>bee</u>, <u>bay</u>, <u>buy</u>, <u>boo</u>, <u>bow</u> and <u>bough</u>. This must be understood in the light of the general fronting of nuclei which will be discussed in Chapter 4.

3.8 Historical parallels to the raising of tense and ingliding vowels

In this section we will discuss briefly some of the past changes which illustrate the same mechanism as those current changes examined in this chapter. We will try to indicate the nature of the theoretical problems which will be illuminated by a deeper comparison of the present and the past.

The raising of tense and in-gliding vowels is of course not limited to English. The symmetrical pattern

$$\begin{array}{ccc} \bar{i}^{\text{ə}} & \quad & \bar{u}^{\text{ə}} \\ \uparrow & & \uparrow \\ \bar{e} & & \bar{o} \end{array}$$

can be observed in a wide variety of languages.

3.8.1. *Parallel developments in Germanic.* Other Germanic languages show a number of cases where high in-gliding vowels developed from long mid vowels. Old High German, for example, shows graphic forms *uo*, *ua*, *ie*, *ia* (Rauch 1967) from earlier long mid vowels. Such a development immediately creates a problem for historical interpretation which we have elsewhere called the *transition problem*. First we must interpret the grapheme *ie*, and no matter what solution we arrive at, decide by what path or mechanism the vowel became translated into something which was so different as to require now two letters instead of one. There are four basic interpretations that are made when a word class written with a single grapheme *e* or *o* is suddenly rewritten as *ie* or *uo*.

(1) The vowel has added a palatal on-glide.
(2) It has risen to a monophthong halfway in between *i* and *e* or *u* and *o*.
(3) The vowel has added a centering in-glide and then risen.
(4) The nucleus of the vowel rose as tense (peripheral) gradually to high position, simultaneously developing a lax inglide.

The first possibility is sometimes assumed in cases where the final result was a rising diphthong [jɛ]. The second possibility is supported by many historical cases where graphemes were used in this way. The third must be assumed by those who believe that _ie_ represents a diphthong and who believe that sound change is abrupt. The fourth is the one indicated if the historical development of _ie_ and _uo_ are parallel to the sound changes we have been describing in this chapter.

In the case of Old High German, (1) and (2) are not likely, since the Upper German dialects today have ingliding vowels corresponding to _ie_ and _uo_ in that language. Older spellings like _heer hear hiar_, which preceded _hier_, also argue strongly against interpretations (1) and (2). Either (3) or (4) are most probable routes for the Germanic examples. It does not seem likely that the historical record will offer decisive evidence to distinguish these two possibilities; we prefer (4) on analogy with current sound changes, in which the raising of the nucleus from a low position occurs first, and the glide developed at mid position. Breaking is also an important phenomenon in West Frisian (Markey 1972) and is accompanied there by a series of raisings which are quite parallel to the raising of (æh) studied in this chapter. "Anglo-Frisian" brightening which originally carried [æ·] to [e·] was continued in West Frisian, where original long ā went to [ɩ·ə] and then shifted to [jɛ]. According to Markey, this involved a chain shift after breaking in which long ē rose to high position (merging with i) and long ā and ɛ̄ (merged and) rose to ɩ. Thus in our symbolism /æh→ɛh/→/eh→ih/→ yielding an opposition of [ɩ·ə] to [i·ə] which was then differentiated further by breaking into [jɛ] and [jɩ] respectively. Given the rich dialectal differentiation of the Frisian dialects, we would expect to find many illuminating parallels in these developments.

Another Germanic sound change shows the influence of nasals in the raising of long ā: MHG ā>ō/__nasals (Chambers and Wilkie 1970).

3.8.2. _Romance developments_. In Spanish, French and Italian there is a general pattern of rising diphthongs which resulted from an early Proto-Romance development of tense and ingliding vowels from tonic free open _e_ and _o_.

Lat.	Fr.	It.	Span.
pĕtram	pierre	pietra	piedra
pĕdem	pied	piede	pie
ŏvum	oeuf	uovo	huevo
fŏcum	feu	fuoco	fuego

(Pope 1934, Brunot and Bruneau 1949). There are opposing views on the interpretation of this sound change: opposing (1) to (3) or (4). Since all modern reflexes are rising diphthongs or seem to have passed through that stage, some scholars question the widely accepted view that these were first falling diphthongs. Purczinsky (1970) follows Schuchardt in arguing for an original rising diphthong which then differentiated the glide upward and the nucleus downward--i.e., interpretation (1) above [ɛ·→ɛɛ́→iɛ́]. Schürr (1956, 1970) holds that this situation was the result of a conditioned diphthongization before [j] (from velar fricatives) as in Lat. lectum→liɛit and noctum→nuɔit. Since in the South of France the diphthongs iɛ and uɔ are found only before this [j], it would seem that this was the favoring case from which all diphthongization spread. Schürr's view does not of course resolve the issue as to what the phonetic form of the ie or uo was, since such complex triphthongs could be interpreted in many ways.

The standard view that the Romance diphthongs were originally falling and were produced by a gradual raising of the first element is supported by the Algerian inscriptions which contain the earliest examples of Latin diphthongization. These inscriptions have ee (meeritis for meritis) as well as ie, just as in the German examples.

Evidence from the Swiss French dialects of the Valais can play an important role here (Gauchat, Jeanjaquet and Tappolet 1925). In most French dialects, the reflexes of an earlier uo are front rounded monophthongs as shown above. But in the Eastern Valais, this fronting never took place. Thus we find in Miège, Grône, Grimentz and Evolène that Vulgar Latin tonic free open ɔ is found as monophthongal [u]. Now this monophthong could easily have developed from an ingliding diphthong [uə]. In fact, loss of inglide is the most common of the changes which affect [uə] in the languages we have studied. If, on the other hand, Vulgar Latin and Gallo-Romance uo represented [wɔ], the transition to [u] is much less natural. It follows that the other French dialects which now have fronted vowels in this position may also have passed through a stage of [uə] parallel to the German phenomenon. We will return to the Valais evidence when we consider the Romance chain shifting in Chapter 4.

In Vegliote, the extinct Romance language at the head of the Adriatic, we also find a raising of lower mid vowels to diphthongal forms (Hadlich 1965). This took place at a stage which preceded the lowering of monophthongs (Hadlich's Stage III) and plays an important part in the general principles of chain shifting discussed below where we necessarily interpret [jɛ] as coming from [ɩ·ə].

3.8.3. Balto-Slavic developments. In Standard Lithuanian and Lettish we find ingliding vowels uo, ie for Proto-Indo-European long ō and ei (Senn 1966). McKenzie (1916) argues that this ei could not have gone to in-gliding ie directly, but must have passed through a monophthongal stage ē, and reviews the history of in-gliding diphthongization in seven languages to support his point: Romance, Old Irish, Finnish, Lappish, Livonian, Icelandic, Old High German. He argues for a gradual process of raising as again indicated by ee forms: "Nous avons trouvé que l'ee a représenté successivement ea (17e et 18e siècles) et īa ou ie (19e)."

The raising of Proto-Indo-European long ō in Lithuanian is part of a chain shift in which PIE ā was raised to ō. In Lettish, on the other hand, long ā did not rise except for one subclass: ā<an. In Lettish an, en, in and un lost their nasal element. In and un were monophthongized to long i and u, but an and en became uo and ie respectively. Since long ā did not go to ō in Lettish generally, but only the reflex of an, it thus appears that the nasal monophthong must have been backed and raised further than the other long monophthongs, until it was able to participate in the general raising to uo. Lettish dialects have many important consequences for our general theory of chain shifting (Endzelin 1922). In East Lettish, the above-mentioned ingliding diphthongs were monophthongized. This left room for a second cycle of the rising of tense and ingliding vowels. The new long ē rose to [i·ə] and long ā rose to [uə].

We find the development of tense and ingliding vowels in many branches of Slavic as well. Thus Kuraszkiewicz notes

> In many local dialects of Polesie and Podlasie as well as in Southern Belorussian dialects as far as Vilna, the lengthened stressed vowels ō and ē in checked syllables and short e have not yet turned into ī, but have remained at some preceding stage of development uo, ue, uy, üi, iᵉ or a plain vowel u, y, ü.
>
> (Kuraszkiewicz 1963, cited in Herzog 1965:167)

The processes noted here involve the same raising of long mid vowels to ingliding high vowels and their subsequent monophthongization that we have noted elsewhere.

In other branches of the Indo-European family such as Old Irish we find parallel developments (see McKenzie 1916).

The development of high ingliding vowels from mid vowels seems to be an areal feature, since we find it in Finnish and Lappish as well as the Baltic languages.

3.8.4. Examples outside of Indo-European. The Semitic languages offer several examples of this raising of tense and ingliding vowels, despite the fact that the vowel systems are relatively simple compared to Indo-European. Cantineau notes the following about the Bedouin dialects of Tunisia:

> Parfois, comme à l'interieur au mot, les anciens ā longs en finale peuvent, une fois passes au timbre e, subir une "fracture" s'ils sont accentuès; ainsi dans certains parlers de nomades Tunisiens ...on trouve des formes commes mí^{a} (de mą'), 'eau', mší^{a} (de mašā) 'il a marché'...
>
> (Cantineau 1960)

In Maltese we find that the same process has taken place independently and unconditionally (Cohen 1966; Cowan 1966). It was already completed by 1611 when a German traveller published a Maltese word-list in which old ā is rendered ie. The same words in modern Maltese have [iə] and, in one case, [je] (Cowan 1965).

In West Syriac Nöldecke notes that the influence of a nasal can be seen in the raising and backing of long ā:

> Theilweise findet sich der Uebergang von ā zu ō schon früher besonders vor n, tamōn 'there'...(1880)

3.8.5. General characteristics of the raising of tense ingliding vowels. In these examples of the raising of tense vowels to ie and uo, we find a number of common features which emphasize the parallels to the sound changes in progress we have studied here.

> a. It is long vowels that are affected and not short ones. In Romance, we see this process conditioned by a phonetic lengthening in open syllables even when there is no phonemic length, so that it is free vowels and not checked ones that are affected.

b. The inglide appears with the high vowels, and only with those high vowels that have come from mid vowels. That is long ī does not in these cases spontaneously develop an unconditioned glide. The West Frisian unconditioned diphthongization of ī is of course a counterexample to this rule, but even there it is interesting to note that only "Old Frisian ī <Germanic ē^2 is subject to breaking, while Old Frisian ī, Germanic ī and compensatorily lengthened ī after loss of nasal before f, þ, s is not" (Markey 1972). In general, this strong trend reflects the fact that ie and uo are the results of a gradual raising of the mid vowels similar to the ones that we are observing. (The West Frisian examples are closely connected with an upward chain shift). In our own studies we find that the nucleus becomes peripheral, and the more peripheral it is, the faster it goes up. The lax inglide that develops is thus increasingly differentiated from a tense nucleus.

c. There are some indications of the influence of following nasals in promoting this raising of tense ingliding vowels, which appears prominently in our own studies.

d. When the change is completed, and the nucleus reaches high position, the next step is usually either monophthongization or a shift to a rising diphthong.

These considerations give general support to interpretation (4) above, rather than the unmotivated suggestion that we have here a sudden addition of a nucleus or a glide before or after a vowel. In further studies of these phenomena we hope to find details which illuminate our understanding of present processes and improve our interpretations of past events.

CHAPTER 4

CHAIN SHIFTS I: CHANGES OF PLACE WITHIN THE SUB-SYSTEM

Among the various types of sound change, chain shifts are perhaps the most interesting to linguists, since they demonstrate convincingly the systematic character of the phonemic system. Chain shifts such as Grimm's law or the Great Vowel Shift of English illustrate what Martinet has termed the functional economy of the sound system (1955). Chain shifts may be regarded as a reaction of the system to sound change--the preservation of phonemic distinctions by further changes--and in this sense the system itself may be regarded as the cause of further changes. On the other hand, some sound changes may be the reaction of the system as a whole to a single force acting equally on all parts of it.

Martinet has dealt with the systematic interrelations of elements in a chain shift, and Haudricourt and Juilland have (1949) further elaborated the conditions under which such shifts take place; as for example, the observation that the full chain shift we call Pattern 3 below takes place only when there are four degrees of height in back. The two examples of vowel shifts in Martinet (1955) and the further cases explored by Haudricourt and Juilland are confined to this pattern. In this chapter we will consider a much wider variety of chain shifts in on-going and completed changes within the view of phonological space which has developed from our spectrographic studies. Three general principles of chain shifting will be put forward, in which these processes are seen as one-directional and irreversible. We will show how the basic types of chain shifting are combined into a limited set of more complex patterns, and illustrate these patterns within present-day English dialects. The principles developed here inevitably reflect on the phonological rules which were active in the past and are embedded in our own systems today as completed changes. The long-standing controversy concerning the Great Vowel Shift in English can be clarified and perhaps resolved in the light of these new principles drawn from the study of sound change in progress.

4.1 Some general principles of vowel shifting

In this section we will state three general principles which govern the chain shifting of vowels.[1] We will first state these shifts in the form which applies to the current sound changes we are studying spectrographically; in a later section, we will consider the application of these principles to completed changes.

I. <u>In chain shifts, tense vowels rise.</u>

II. <u>In chain shifts, lax vowels usually fall, particularly the lax nuclei of upgliding diphthongs.</u>

III. <u>In chain shifts, back vowels move to the front.</u>

The first and third of these principles have no exceptions in the data we have reviewed, and looking ahead to the historical data, appear to have no exceptions in completed changes. The second principle applies equally strongly in regard to upgliding diphthongs, but not in relation to short vowels. We have only a small number of examples of short vowels falling in chain shifts, and one or two possible counter examples of short vowels moving in the other direction.

In order to interpret or explicate these principles it is necessary first to define tense and lax, and secondly to define a chain shift. In 3.1 we discussed the property of peripherality which was the realization of tenseness for the ingliding vowels. There is no proposal here to identify tenseness with peripherality, since there are obviously central vowels which are long steady-state monophthongs with all other properties of tenseness. But for the front and back vowels we find that those properties associated with tenseness regularly accompany extreme position on the two-formant plot, approaching the outer perimeter of phonological space. We can therefore translate Principles I and II into forms that can be corroborated on our two-formant displays:

I'. <u>In chain shifts, peripheral vowels rise.</u>

II'. <u>In chain shifts, non-peripheral vowels usually fall.</u>

By the vowel rising or falling, we mean of course that the nucleus of the vowel moves in that direction. These principles will hold for either definition of height utilized in Ch. 3 (9a) or (9b): -F1, or some weighted combination of F1 and F2.

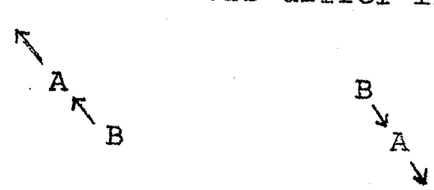
The third principle needs no adjustment to accomodate our two-formant measurements, since it is stated in terms of backing and fronting. This will apply to the lowering and raising of F2, but as we will see, the variety of accompanying movements of F1 raises a challenge for prediction and explanation.

We define a chain shift as a change in the position of two phonemes or allophones in which one moves away from an original position which is assumed or approximated by the second. Thus a chain shift is distinguished from mergers (or near mergers, Ch.6) in that a merger is a change in the position of relations of two vowels in which one assumes or approximates the position held by the second. Chain shifts preserve relations while mergers alter them. Extended chain shifts are of course combinations of minimal chain shifts.

In schematic representations of chain shifts, we will show the initiating element as A, the one which responds as B, etc. In most chain shifts, A is the phoneme which moves away from the position which is then occupied by B (drag chains) though many cases are indeterminate or simultaneous, and there are cases where the first movement is the approximation, that is, push chains.[2]

In a linear representation of a chain shift, we will represent cases where a phoneme A moves to the position of phoneme B while B moves away as /A/→/B/→. But if A is merely moving to a <u>position</u> B, we will show it as /A→B/ (as opposed to /A/→/B/). In more complex cases this notation will be useful in distinguishing a whole series of shifts from a series of movements, both obeying the general principles of chain shifting. Thus a single vowel may move /A→B→C→D/ as in the case of /i·→iy→y→εy→ay/ following Principle II. On the other hand, we will have similar patterns followed by chain shifting phonemes of the form /A/→/B/→/C/→ /D/→ as in /iy/→/ey/→/ay/→/oy/→.

Principles I and II make clear predictions about the basic cases where two vowels differ in height.



(i) (ii)

In these simple cases Principles I and II[3] assert that (i) but not (ii) is possible for peripheral vowels and that (ii) is strongly favored for non-peripheral vowels. We frequently see configurations such as

↑
A A'
↑ ↓
B B'
↓
(iii)

If change takes place, Principles I and II predict that the two sets of vowels, AB peripheral and A'B' less peripheral, will move in opposite directions. In many cases, the A vowel is high or low, and cannot move away in the same direction.

A →   B
↑   ↓
B   A →

(iv)   (v)

These non-linear movements of A usually involve changes to other sub-systems, which will not be considered until the next chapter.

When we go beyond minimal chain shifts, we will find moot cases involving sets of three vowels, one low and two mid in a symmetrical situation such as

A   A'

B

(iv)

From this information alone we cannot predict the direction of a shift. But we do find in current observations that if A rises and B follows, that they will do so as peripheral vowels; if A' then falls as part of this chain, it will do so as a less peripheral vowel.[4]

We find exemplifications of the three Principles of chain shifting in many current dialects, but it would be redundant to consider them as separate principles. We would find ourselves returning to the same dialects several times, since the three principles are combined in various ways in the four major patterns of extended chain shifts shown in Figure 4-1. Pattern 1 involves symmetrical movements of front and back vowels--a combination of Principles I and II. The front and back peripheral vowels rise by Principle I (a,b) and the less peripheral vowels fall symmetrically by Principle II (c,d)--usually as the nuclei of upgliding diphthongs. This is the pattern of the English Great Vowel Shift. We found no current sound change of this type operating in current-day dialects, although forms of Pattern 4 resemble Pattern 1 in several ways.

Pattern 1' is a further extension of Pattern 1 in which the vowels which fell in the c and d sections become tense nuclei and rise again as e and f by Principle I. This extension of Pattern 1 can be observed in many English dialects today, as we will see below: New York, Philadelphia, the Outer Banks, etc.[5] Pattern 2 is basically an application of Principle I: the upward movement of front vowels, accompanied by a forward movement of a low back vowel. This vowel is usually short o: its lowering and unrounding to [ɑ] is an isolated application of Principle II which took place at the beginning of the nineteenth century.[6]

In general we find that there is one most open position for low vowels, and any movement among them is up from that position or down to it. Our map of phonological space is thus generally triangular, based on the general configuration of many speakers who show one most open nucleus [a]. Movements from that position are usually upward towards [æ] or [ɑ]. But there are also a number of sound changes which move to the front or the back among the low vowels, since at a short distance upward from the perimeter there is room to do so. The fronting of the short open o class in the Northern cities is one such movement. The Pattern 2 chain shift of Buffalo and Detroit that we examined in 3.3.1.7 consisted of a forward movement which follows Principle III and an upward movement following Principle I.

Pattern 3 is another combination of Principles I and III, but much more common than Pattern 2 (see 4.5). The a section is the same upward chain shift of tense vowels that was observed for New York City in 3.4. But New York does not include the b section which we find in many Romance and Germanic languages: the fronting of /u/, /u:/ or /uw/ to a high front rounded vowel. A third section of Pattern 3 is often observed--a splitting of the mid vowel, which may show a conditioned fronting (umlaut, etc.) while other mid vowels rise according to the usual section c pattern.

Pattern 4 is perhaps the most complex of these extended chain shifts. Tense vowels rise in section a; the nuclei of lax diphthongs fall in section b; another set of tense diphthongs rises in section c. Pattern 4 resembles Pattern 1 in its front portion, except that there is only one vowel rising but several vowels falling, instead of the other way around. After the second diphthongization of the high and mid vowels, there are at least two upgliding vowels which can participate in section b of Pattern 4. This is the most common pattern of chain shifting that we find in English dialects; usually combined with Pattern 3 as in the dialects of London, Norwich, Essex, Philadelphia, the Outer Banks, Atlanta, and central Texas.

4.2 The extension of Pattern 1.

The striking symmetry of Pattern 1 is not exemplified in any current sound change, since all of the on-going processes which move the back vowels show more fronting than Pattern 1 allows. The fall of M.E. ū to a back upgliding [ou] and so to [ao] is what preserved the symmetry of the process. It allowed many conservative dialects of English to arrive at a symmetrical pair of upgliding diphthongs /ay/ and /aw/ with the same low central nucleus [a] not shared by any other phoneme. That is the situation in the speech of northern New Jersey [W.L. dialect] and for most of our subjects in the northern cities. Thus James Adamo does not depart notably from that model and younger speakers in Detroit and Buffalo show only small movements away from it. Though /ay/ and /aw/ are now shown on most Northern cities charts, Kathy (Fig. 15) shows how slight the typical frontings and backings are. In any such series, there is always some movement beginning with the nucleus of /aw/ slightly back of center and ending with it slightly forward of the nucleus of /ay/. But /ay/ and /aw/ are not involved in the major sound changes in the northern cities.

To deal with the shifting of the nuclei of /ay/ and /aw/ concisely, we will use the phrases "/ay/ moves" or "/ay/ is located" to mean 'the nucleus of /ay/ moves' or 'the nucleus of /ay/ is located.' We will also identify the major allophones of /ay/ by writing /ay°/ for /ay/ before voiceless consonants, and /ay^v/ for /ay/ before voiced consonants and final. (To identify the free allphone specifically we will write /ay#/). Abbreviations for allophones of /aw/ or any other phoneme will follow the same pattern.

In New York City we can observe a strong movement in the fronting of /aw/ and the backing of /ay/ as they gather momentum in the youngest generation; it is useful to designate them the sociolinguistic variables (ay) and (aw) since they cross large areas of phonological space. The (ay) moves to the back along with the movement of (ah) and (ahr) noted in the last chapter. At the same time, (aw) moves in the opposite direction.[7] The two branches of Pattern 1 labeled e and f are represented by (ay) and (aw) respectively. The New York City development can be traced in the progression of Figs. 4-2 through 4-5. Fig. 4-2 is the oldest and most conservative system of Chris Andersen, 73. The /aw/ diphthong is well back of center, in a line directly underneath /uw/ and /ow/. His /ay/ is split into /ay^o/ and /aw^v/; /ay^o/ is the back one, coincident with /aw/. /ay^v/ is lined up with /iy/ and /ey/

just as /aw/ is lined up with /uw/ and /ow/. The sound changes in New York not only reverse the relative positions of /ay/ and /aw/, but also the differentiation of /ay/ allophones that we see here.

Fig. 4-3 shows the system of Schuster, 57, with concidence of /ay/ and /aw/. As we have seen in Chapter 3, Schuster has a fairly advanced raising of (eh) and (oh), and his conservatism here shows that the differentiation of (ay) and (aw) is a later change.

The end-point of the current change in New York is seen in the system of Rose Bendato, 31 (Fig. 4-4), who gives us also the most advanced view of the raising of (æh) in Fig. 8. The back-gliding (aw) now has a front nucleus, higher than /æ/ and approximately in the position of the raised allophone [æ^] which existed in the early stages of the raising of (æh) (Fig. 1). Her (ay^{o}) is now quite front, though distinctly backer than (aw), while (ay^{v}) is well to the back, extending up from the position of /ah/ in <u>odd</u>, <u>job</u>, etc. Thus (ay^{o}) and (ay^{v}) are reversed from the original system of Andersen in Fig. 4-2.

The (ay-aw) system of Sue Palma, Fig. 4-5, is essentially the same as that of Bendato, but shows an interesting development in the location of (awN) higher than the other allophones of (aw). A systematic search of (aw) among younger speakers may show that the influence of nasals extends beyond (æh). As we have informally noted in Philadelphia, it affects the raising of /æw/ to /ɛw/ as well; a favored form is <u>down</u>.

The movements of (ay) and (aw) are typically secondary phenomena, in that they take place against a ground in which other changes occur. It is quite possible for /ay/ and /aw/ to have independent nuclei, not phonetically identified with any other phoneme. But if a movement of (ay) or (aw) passes a region in which a simple nucleus is located, such an identification may take place. The movements of (ay) and (aw) may then be seen as more abrupt than those of tense monophthongs moving across a relatively unstructured phonetic space; further investigation of this pattern may reveal the conditions under which such identifications take place.

Our general theory of vowel shifting indicates that when the nucleus of a diphthong reaches maximum nucleus-glide differentiation (and so reaches low position for an upgliding diphthong) it becomes tense (or peripheral, by definition). It will then follow the upward path of other peripheral nuclei and lose its optionally differentiated character. This is plainly happening with (ay) and (aw) in some of the more extreme reflexes of types of Pattern 1'. The most advanced example that we have encountered is in the dialect of the Outer Banks of North Carolina. Figs. 38-41 show the development of Pattern 1' there. The most conservative older speaker, is Jethroe Midgett, 72 (Fig. 38). For him (aw) is already front, somewhat lower than /æ/, and (ay) is back, a slightly less peripheral counterpart of /ahr/.[8]

In Fig. 39, Earl Quidley (42) shows another version of this system with (aw) not quite as far forward, and several allophones of (ay) distributed in a low back position: (ay^{v}) has the most peripheral position, just behind /ahr/ which has risen to mid position.

Monnie O'Neill's Fig. 40 shows the full development of the Outer Banks variable of (ay) which here extends up to mid back position considerably more peripheral than /ahr/.[9]

These younger speakers from the Outer Banks seem to have receded from the high tide of (aw) raising which appears in Fig. 41. Nora Herbert, 61, is the extreme exemplification of the Outer Banks pattern. She shows several norms for (aw): the highest has a mid nucleus, and the lowest is low front. A corresponding correction of (ay) may be seen in the back vowels. The symmetry of (ay) and (aw) here extends to both correction as well as raising, and leads us to emphasize the difference between these rural examples and the urban patterns we examined in Chapter 3. There the most extreme forms are consistently the youngest speakers. Here we seem to be viewing a recession from socially marked rural forms of the older generation. Since the Outer Banks dialect is recessive and subject to correction from standard English, this process is understandable.[10]

It is common to find such multiple norms among Southern speakers, since style shifting is an even more important feature there than in most areas. The male speakers in Figs. 38-40 show no obvious correction from vernacular norms but the continuing process of covert correction may lead to a recession from an original vernacular extreme in succeeding vernaculars.

In other dialects of the Lower South, we would not expect to find branch e of Pattern I' since /ay/ has been monophthongized. But the fronting of /aw/ continues as we see in the Atlanta dialect of Figs. 46-49. The father has a moderate fronting of (aw), in the position of old /æ/; the more spontaneous speaker among the daughters is Barbara (Fig. 48) who shows (aw) rising as a peripheral front vowel. The shape of the ellipse shows as it usually does the direction of movement.

A similar Southern example can be drawn from Central Texas (Fig. 50) where (aw) matches the raising of (æh) point for point and (ay) is monophthongized. Here it is clear that the nucleus of (aw) is identified with the nucleus of (æh).

In our oldest Cockney dialect, (aw) is located at low center (Fig. 29). But for the younger London speakers, the pattern is advanced as in New York or Philadelphia, with (aw) to the front and (ay) to the back. The most extreme speaker is Marie Colville, whose (aw) is low front but peripheral, and contrasts with /uw/ and /ow/ which are front but not peripheral (Fig. 30).

These reviews of the Pattern I' situation in English show that the fronting of (aw) is a very general pattern, apparently uni-directional. In each case, we find that the younger speakers have made some progress in the fronting and differentiation of (aw) and (ay).[11]

What is the cause of this general drift? The general principles of chain shifting do not apply directly since (aw) is no longer involved in a chain with other back upgliding diphthongs. If there is any joint movement, it is a simultaneous fronting as in the Outer Banks (Fig. 41) on parallel tracks. The answer to this question is not at all obvious at this point.

The general phenomenon might be called "bottoming out." The movement which leads the nucleus of (ay) and (aw) to become as low as possible leads to a peripheral status for those vowels. And peripheral vowels in English have been engaged in a raising process for several millenia; not only chain shifts but isolated movements as well. The raising of low central a begins with the raising of long ā in bat to bɔt, followed by the raising of new long ā in name to [ne·m] and now continuing with various raisings, backings and frontings of the nucleus of (ay) and (aw). Nucleus-glide differentiation must play a major part, since monophthongized /ay/ regularly moves to the back. But as pointed out above, the system does not stop at optimal differentiation, and the only force that can explain the continued raising of (aw) is the one which has been operating behind Principle I for some time.

4.3 Pattern 2 shifts in current-day English

In Chapter 3 we studied in some detail the Pattern 2 chain shift /a/→/æh/→ in the northern cities. There were no counter-examples to the steady forward movement of short o (as the unrounded /a/). It reached the position of old /æ/ and went even further in some cases to a position that would be heard as [æ^]. The main body of short o words has not yet reached [æ] position, but the more advanced forms are so extreme as to lead to misunderstanding for outsiders. This would be most apt to occur whenever an Easterner with lax /æ/ before some environments heard a speaker of this dialect use an (o) word in that environment. Thus at one point Tony from Chicago, 17 years old, was telling W. L. about his friend Marty who went out on the lake.

> Tony: Well Marty, he went in the [læks] ...and he got stuck in there, and they had to tow him out. [General laughter]
>
> W. L. What do you mean...in the where?
>
> Tony: In the [læ˃ks], you know, the [læ˃ks]. [Laughs]
>
> W.L. Whassat?
>
> Floyd: For a boat, you know.

Kathy from Detroit recognized this situation spontaneously when she remarked what was funny about New York City speech.

> Kathy: "You know, they say [bɑ̜t̬l] for [ba˂t̬l] and they say [bæt̬l] for [bɩət̬l].

Her [bɩᵊtl] is so extreme that many listeners from other areas cannot decipher it. Kathy recognizes that Pattern 2 has led to a complete rotation of the system.

Even when other dialect speakers may be used to the extreme raising of (æh) they may not be prepared for the extreme fronting of short o. Tony introduced W. L. to his friend [ǰæn], and for some time he was convinced that this name was spelled Jan. These behavioral anecdotes give behavior evidence for the rotation of the system and show at what point we can begin to worry about the problem of dialect intelligibility and how it is achieved.

Which are the most advanced forms in a sound change? The principle of least effort would hold that it is lax pronunciation which favors the shifting of sounds, but that is certainly not the case with any sound change we have studied. On the contrary, the new forms are usually pronounced with more effort than the most stressed. In some cases, with subjects who do not correct, we find that the forms used in reading reflect these new norms, as we have shown in Figs. 3-18 and 3-19. But for most adult speakers, reading forms recede from the advancing edge of sound change, even if there is no overt social correction involved.

We have regularly marked double-stressed forms in our records, and there is no doubt that these are usually more peripheral than ordinary forms. If greater peripherality leads to more raising, it would then follow that the more stressed forms ("how it should be said") would be the best indicators of where the sound change is heading. However, there are a number of counter-examples which show that we cannot apply it as a regular rule.

We can illustrate this point by examples from the Buffalo area. The advanced status of doubly stressed forms can be seen in the high front hand of Frank Huber in Fig. 3-15 and the extreme transfer of Mary Carol in the upper left of Fig. 19, as well as the extremely fronted model in the lower left. But the doubly stressed has at the extreme left of Fig. 13 of Carry Violet is not particularly high. A heavily stressed at is to be found in the center of Ord's Fig. 3-17, at an F1 of about 530 Hz, not particularly distant from the other voiceless stops. Aliza Katz has a doubly stressed that in the same relative position of Fig. 3-14, and a weakly stressed that is to be found to the further left and slightly higher up. It is possible that each allophone of (æ) or (o) has an ideal target of its own, and that heavy stress will aim at that point; and that sound change is the shifting of such normative targets. But present indications are that deliberate speech which reflects such norms is not so easily systematized, and the unreflecting vernacular is more systematic.

The importance of allophonic differentiation was quite clear in our study of the (o)→(æh)→ shift. There was frequent overlap where the most advanced forms of (o)-- *not*, *got* were further forward than the most retracted forms of (æh)-- *back*, *black* . The functional shifting which preserves distinctions might therefore be seen as taking place between allophones. If this were the case, then we would expect no functional pressure on those (æh) allophones which had no or very few (o) counterparts: (æhf) or (æhʃ) for example. Such allophones could then easily shift over into the (o) class and be reassigned in the dictionary. There may be such a tendency, reflected in the late movement of (æhf), but it seems difficult to substantiate. Despite the strong correlation of the -*t* and -*k* relation in (æh) and (o), the basic movement is the (æh) variable as a whole.

If there were such functional pressures on individual allophones, we would not find the selectional rule in New York City operating as it does. The tensing rule responds to general phonetic tendencies which favor front nasals and voiceless fricatives. The same tendencies have operated upon short *o* in the past, depleting the stock of short *o* words before voiceless fricatives and nasals. If functional pressures were important, we would now see less of a tendency for these classes to be moved by the tensing rule; but that is not the case.

There is a third element in the chain shift of the northern states (the "Northern shift") which we have not considered: long open *o* or /oh/ in *caught*, *bought*, *law*, *off*, *dog*, etc.[12] Our first principle of chain shifting states that peripheral vowels do not fall in chain shifts, but rise. Here we apparently had as an original configuration:

oh

æ o

If the tensing and raising of /æ/ is followed by the fronting of /o/ and the falling of /oh/ we seem to have a counter-example. From the abstract scheme

↗
C

A B ↗

Principle I would have predicted an upward movement of C instead of an upward movement of A and a downward movement of C.

This question can be examined by studying the Northern shift as a whole in a series of Buffalo speakers: Mary Beck, 76 (Fig. 16); Bea Black, 54 (Fig. 17); Flo Danowski, 39 (Fig. 18); Joyce Norton, 16 (Fig. 20) and Mary Carol, 15 (Fig. 19). Figs. 4-6 through 4-9 focus on this process by outlining the over-all positions of the three vowels. In older speakers like Mary Beck /oh/ is a lower-mid peripheral vowel, extending along the back perimeter of the vowel system (Fig. 4-6). It is balanced against an (æh) which extends to upper and lower mid position, while (o) shows only slight signs of moving forward. In middle-aged speakers there is a tremendous range for all three vowels. In Fig. 4-7 the (æh) now extends from lower high to upper mid and (o) now reaches almost to front position with the favored, doubly stressed <u>not</u>. However, (o) still extends very far back with -k and -p. At this stage, one can see the way in which the beginning of a sound change opens up the possibilities for phonetic differentiation which shows up clearly here in the <u>-t</u>, <u>-p</u>, <u>-k</u> ordering. (oh) now enters the picture as a variable, showing the same kind of phonetic ordering: apicals <u>boss</u>, <u>bought</u> and <u>brought</u> highest, and velars <u>walk</u> and <u>talked</u> much lower. The general path of descending (oh) is non-peripheral, extending inside the backest (o) words,and is clearly less peripheral than <u>father</u>.

The younger adult speaker Flo Danowski in Fig. 4-8 is beginning to arrive at a balance of low (oh) and (o) as against high (æh). The (æh) variable is now clearly concentrated in the upper mid region and extends up to high in several cases, and there is a further edging forward of (o). As we saw in Chapter 3 (Fig. 18), some forward (o) are definitely rising: note the <u>got</u> in mid position, near <u>care</u> at about 1900 Hz. (oh) shows the same phonetic differentiation as in the last figure but without the centralizing tendency.

The two younger speakers plainly show that the route for (oh) is not simply a lowering, but a fronting as well which brings it above the (o) class on a path much less peripheral than /ahr/. For Norton (Fig. 4-9) and Mary Carol (Fig. 19) the (æh) is now definitely high and there is a large gap between it and the low vowels. Mary Carol shows a much more extreme fronting of (o) than Joyce Norton. But she also shows a splitting of (oh) into two sets, one of which overlaps (o) and the other stays at a peripheral mid position. Most importantly, the pattern of phonetic conditioning which we observed in the adult speakers is here reversed. Instead of -t being the highest allophone of (oh), it is now the lowest and most forward. This indicates that there may be a redefinition of the whole (oh) movement in the course of the Northern shift.

This overview of the Northern shift demonstrates clearly that the functional economy of the system involves all three vowels. While it is true that (oh) was originally in low back position, it had risen to a mid position for older speakers, especially (oht). This motion and the distribution of the allophones has been reversed for younger speakers. But when (oh) falls, it is falling in a less peripheral position subject to strong fronting, according to Principles II and III rather than Principle I. The movement that we see in Norton and Mary Carol is a forward shift of (oh), in a less peripheral position than (o). In fact, we now seem to have reversed the relative positions of (o) and (oh) from the original pattern of English dialects (Fig. 30) or in conservative American ones. To the extent that tense and lax are reflected in peripherality, (o) is the tense member of the pair. In the next sub-section, we will encounter an overlap of short /e/ and short /o/ which is probably to be resolved as lax vs. tense.

The Northern chain shift is one of three resolutions to the most unstable relationship in English phonology: short vs. long open o. It appears that this opposition is difficult to maintain in its original form: [ɔ~ɔ·]. In many dialects, these two are further differentiated along the lines of Principles I and II (which operate generally in sound change, as Sweet noted, but without the compelling force that we see in chain shifts). The long or tense member rises in many dialects: London, New York, Philadelphia. In America, except for Eastern New England and some coastal Southern areas, the lax or short member unrounded to [ɑ] in the nineteenth century. In Eastern New England, the /o/ and /oh/ fell together, as a low back rounded vowel; this also happened in Western Pennsylvania and in most of the West (see Chapter 6). In the northern cities we find a third resolution. Instead of /oh/ rising, /o/ moves to the front.

The original disposition of /oh/ in the older Buffalo dialects shows a reflection of the tendency of /oh/ to rise as a peripheral back vowel (Fig. 4-6).

The forward movement of (o) has reversed any such tendency. The orientation of the allophones of (oh) also seems to have been reversed. In the oldest speakers, the effect of final consonants follows the general principles that alveolars condition higher nuclei and labials and velars lower ones with <u>-l</u> well to the back. Thus we have a rule such as

(1) $$\begin{bmatrix}+\text{back}\\+\text{tense}\end{bmatrix} \rightarrow \langle x \text{ high}\rangle \;/\; \_\_\_\_ \left\langle\begin{matrix}+\text{cor}\\-\text{voc}\\+\text{tense}\end{matrix}\right\rangle$$

which favors apicals and palatals over labials and velars, obstruents over sonorants, and voiceless over voiced. But the re-orientation of /oh/ has led to a different rule:

(2) $$\begin{bmatrix}+\text{back}\\+\text{low}\end{bmatrix} \rightarrow \langle -x \text{ back}\rangle \;/\; \_\_\_\_ \left\langle\begin{matrix}+\text{cor}\\-\text{voc}\\+\text{tense}\end{matrix}\right\rangle$$

Now the same constraints operate on the fronting rule, so that the <u>-t</u> allophones lead, <u>-d</u> follows, <u>-k</u> and <u>-g</u> are behind, and <u>-l</u> in the rear. The constraints are the same, but the vowel is now defined differently--as a low back vowel rather than the tense back vowel which is paired with (æh).

Rule (1) has the same general form as the raising rule for (æh) in New York City--rule (11) in Chapter 3. But we did not attempt to generalize rule (11) to the back vowels in New York since we do not yet know how degrees of peripherality affect the raising of (oh). Given the interaction of Principles I and III in the back vowels, it does not seem that such a rule will be entirely symmetrical with the operation of the front vowels, though the obvious parallel can be captured in generalizing the rule without any constraints.

The reversal and re-orientation of the constraints on the Northern fronting of (oh) leads us to believe that we can make such a generalization for the (oh)→(o)→ portion of the Northern shift.

(3) $$\begin{bmatrix}+\text{low}\\x\text{back}\end{bmatrix} \rightarrow \langle x-y \text{ back}\rangle \;/\; \_\_\_\_ \left\langle\begin{matrix}+\text{cor}\\-\text{ant}\\-\text{voc}\\+\text{tense}\end{matrix}\right\rangle$$

This rule introduces the formalism which we will use for chain shifts. The variable x applied to the feature [back] indicates that the rule may apply to low vowels with any degree of backness. Backness may be here taken as a discrete series of positions or a continuum. The fact that x appears on both sides of the arrow makes it plain that the original relations between any two low vowels are preserved after subtracting the quantity y: if one is more back than the other before the rule applies, it will be more back afterwards. We have less information on the low back vowels than on (æh); the more abstract form of the constraints reflect this (+cor but not ±ant). But it may be that there are differences between the two rules: there is no indication yet that front nasals or voiceless fricatives play a major role in the (oh)→(o)→ portion of the Northern shift. It therefore seems that the Northern shift involves ordered rules. Rule (3) follows the tensing and raising rules (12-15) given in Chapter 3 and therefore does not apply to (æh) which is then no longer low.

4.3.1. <u>The extension of Pattern 2: chain shift downward of short vowels</u>. In the course of our investigations of the Northern shift, we discovered an unexpected extension of Pattern 2. A section c is now added to this pattern, parallel to the section c of Pattern 1: a downward movement in the less peripheral channel of the front vowels. But whereas the corresponding downward movements in Patterns 1 and 4 are the lowering of the short lax nuclei of upgliding diphthongs, this movement is a lowering of the short vowels /i/ and /e/.[13]

In New York City and nearby areas, the short vowels /i/ and /e/ are stable. But in some of the older speakers of Detroit and Buffalo we see a tendency for extreme centralization of /i/ and/or a lowering of /e/. In Fig. 11 of Jas. Adamo, for example, /i/ appears to be a mid vowel and /e/ a lower mid. In Fig. 14, Mrs. Hankey shows a very central /i/, close to /ʌ/, and a range of /æh/ which reaches from lower mid to upper low, overlapping the rising (ot) forms. Her mid /e/ forms are <u>bet</u> and <u>neck</u>, while <u>help</u> and <u>went</u> are low. These are conditioned lowerings, but are more extreme than we would normally expect.

The lowering of /i/ and /e/ is not as regular a process as the raising of (æh). The younger Detroit subjects do not show this tendency. But it appears strongly in some of the younger Chicago subjects. In the speech of Mary Sadat (Fig. 22) /i/ and /e/ are highly centralized and in this very compact system /e/ overlaps the /ahr/ class. The most extreme form is again conditioned by -*l*, at this point well back of center.

The most extreme example of downward shifting of /i/ and /e/ is seen in Fig. 23 of Carol Muehe. Here all /i/ are mid, and /e/ ranges from well below mid, to upper low vowels. The /e/ forms overlap the class of (o) words, and one extreme example--*head*-- is as low as any vowel in the system. When Carol Muehe's pronunciations of *red*, *dress*, *seven*, etc. are isolated, they sound like varieties of [æ].

We thus have a fairly extensive rotation of the front vowel: /æ/ has risen to a high vowel, /i/ fallen to a mid vowel, and /e/ to a low vowel. If a sentence like *That ended that* is isolated, the rotation becomes quite clear, but in connected speech, listeners seem to have no trouble in understanding Carol Muehe; some automatic adjustment in the perceptual system is being made.

We can write a chain shift rule moving the lax vowels downward:

$$(4)\qquad \begin{bmatrix} -\text{back} \\ -\text{tense} \\ \gamma\text{high} \end{bmatrix} \rightarrow \langle \gamma - x \ \ \text{high} \rangle$$

To express the simultaneous movement of tense and lax vowels, it would be possible to write:

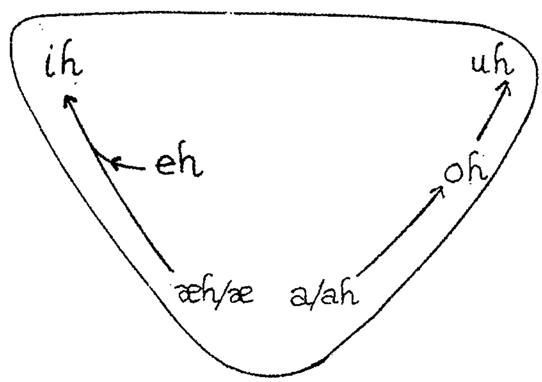
$$(5)\qquad \begin{bmatrix} -\text{back} \\ \alpha\text{tense} \\ \gamma\text{high} \end{bmatrix} \rightarrow \langle \gamma + \alpha x \ \ \text{high} \rangle$$

This would lead to a chain shift upward for tense vowels and a chain shift downward for lax vowels. But such a condensation would contribute nothing to our understanding of the raising of (æh), since it is empty to express this rule as a chain shift, and we would not then be able to enter the variable constraints on (æh) worked out in Chapter 3. The lowering of the short vowels is best considered an incipient change following the raising of (æh), and only connected to it by the general principles of sound change and the fact that the /æ/ position is no longer occupied by short *a*.

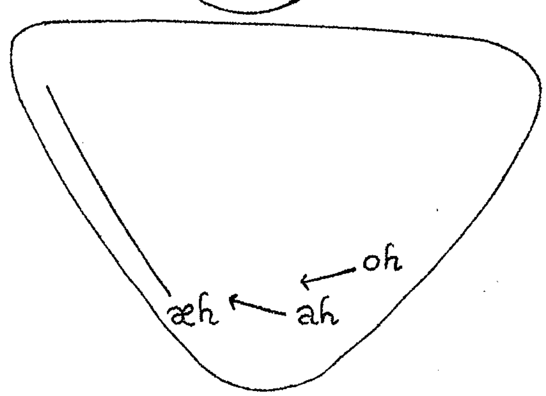
It is puzzling then to note that the position formerly occupied by short *a* is now occupied by short *o* in the system of Carol Muehe. There is now a clear overlap between short *e* and short *o* words or between the variables (e) and (o). What distinguishes the *head* of Fig. 23 from being recognized as *hod*? Impressionistically, it seems to be a lax vs. a *tense* pronunciation, since (e) has not yet reached peripheral position as a whole. But given the overlap, there remains the question as to how /e/ and /o/ are distinguished. We are not yet satisfied with any solution to this problem, which must depend upon studies of more Chicago speakers and a closer examination of duration, formant contour and amplitude contour of these vowels.

Finally, as we consider the Northern shift it is pertinent to ask why New York City did not follow this path, but Detroit, Buffalo and Chicago did. The answer must lie in the form of the New York tensing rule (4) of Chapter 3. The largest block of /æ/ words which were left in low front position were just those words which contrast with the short *o* class: *pat* vs. *pot*, *pack* vs. *pock*, *cap* vs. *cop*, etc. The New York City short *o* class therefore stayed in central position as /a/ (or in some extreme cases, began to shift toward the back along with /ah/). The factor which permitted the Northern shift to take place was the tensing of the /æ/ class as a whole to /æh/, and its gradual rise as the variable (æh). New York was involved in a contrary shift in the opposite direction, the raising of peripheral back vowels, as discussed in Chapter 3. To compare the two systems, we will convert the /o/ symbol we have been using for the northern cities into its equivalent in the New York City notation: /ah/. We then have:

New York:



Northern cities:



The New York pattern depends upon two conditioned splits: æ/æh and a/ah. The first has been studied more carefully than the second, but both show intricate conditions and irregular lexical patterning. In the northern cities, all word classes involved are treated as a whole. The /ah/ class derived from short o words merges with the broad a class of pajama, father, etc., and moves as a whole to the front. The northern cities ingliding vowels are preserved quite distinct from the vowels before /r/ since there is no vocalization of final /r/ at all.

4.4 Pattern 3 movements in English

The raising of back vowels and fronting of /u/ (Fig. 4-1) is a pattern which is not usually associated with English. It is most familiar to scholars as a French phenomenon, reflected in English spelling of ou adopted from French ou for [u·] which went to [ao] by the Great Vowel Shift, while French u became a mixed form which was resolved into the diphthong [ɩu] or some variety of it (see section 4.7). We do find a truncated form of Pattern 3 in the New York City shift of (ah)→(oh)→ and (ahr)→(ohr)→(uhr) (see Fig. 3-20 and 3-21). But this does not involve any fronting of the high back vowel (the section b of Pattern 3); instead, /uw/ and the new /uh/ remain in high back position. The latter is ingliding, and the former is upgliding or monophthongal, so the two classes remain in contrast without change of place.

There are however a number of Southern British dialects in which /uw/ is fronted to a diphthong [ʉu], a central [ʉ·] or a fronted [ü·], including London and Norwich, which we will examine first. It is found in Philadelphia, which contrasts with New York in this respect. And most Southern dialects show this fronting: here we will examine the Outer Banks, and Atlanta, with a glance at other areas. These movements are usually accompanied by a parallel fronting of /ow/. Both vowels may be fronted directly across the system, or may fall to relatively low positions. In some cases, /ow/ follows a path similar to that of M.E. ū in the Great Vowel Shift (see Fig. 32). The paths of /ow/ and /uw/ do not make up a chain shift: they are parallel movements responding to some common cause. It is not at all obvious that that a chain shift is involved in this situation, since there seems to be no back upgliding vowel which moves up behind /uw/ and /ow/ to assume their positions and which might have been held back by high back /uw/. In the following sub-sections we will consider these four dialects and see what internal mechanism may be operating here under Principles I and III.

In these cases we will not be dealing with new sound changes which are just emerging in the northern cities, like the northern cities shift which is documented here for the first time. The English and Southern United States fronting of /uw/ has been widely recognized, may have already reached its peak, and is certainly subject to overt social correction along with other vowel shifts in the system.

When we encounter adult speakers of a stable non-standard dialect we can expect to find correction, reflected in our spectrographic records by two discrete clusters of vowels. It is not always easy to distinguish such correction from the opposite phenomenon: an older speaker borrowing the newer norm which he has heard from younger speakers. The second case can exist only when change is in progress, and before considering this possibility we would have to be satisfied that this is the case. The distribution of the two forms is important here. In a system with stereotyped forms which have been stigmatized for some time, we would expect to see a pattern similar to that for (æh) in New York City, (rather than (æh) in Detroit, which is not subject to overt social correction and does not show such sets of discrete norms). Given the nature of our interview, we can estimate that the amount of correction found in the main body of speech is roughly comparable to that found in New York City (æh): a small percentage of corrected forms in the main body of the interview, and an increasing number in more formal portions with a preponderance of corrections in word lists.[15] We will observe such dual norms in a number of older speakers in England and the South, and in some younger speakers as well (particularly young women). We can generally correlate the over-all style of the subject with his tendency to correct: a number of older men, in London and in the South, assume an oratorical stance in interview which is associated with the correction of overt social stereotypes in phonology.

The correctness of our analysis of these dual norms does not, however, bear on our analysis of the processes of chain shifting. Whether we are dealing with correction of a stigmatized form or the acquisition of an advanced form, comparison of the two norms will show us the direction of change and the path through phonological space followed by the vowel. We will not be able to trace this path in the same detail, or with the same controls as in New York, but many significant features of the chain shifts will emerge in four dialects to be considered below.

4.4.1. The London chain shift. We will present here the vowel systems of five working-class speakers of London English: Tom Stokes from Bethnel Green, 83 (Fig. 29); Marie Colville, 39, from Millwall (Fig. 30); Bob Frost, 31, of Southall (Fig. 31); Tom Gale, 23, of Chelsea (Fig. 32); and Marie's son Stephen Colville, 11, of Hackney (Fig. 4-11).

Our oldest speaker Tom Stokes is essentially an orator, and shows the dual norms we would expect. His /uw/ is fronted moderately to [ʉu] but he also has a second /uw/ norm in high back position. The position once held by /uw/ is now occupied basically by /oh/ which has risen to [+high], while short /o/ is lower in a less peripheral position. Somewhat less peripheral in lower high position is the group of broad ä words, can't, chance, last, etc. A second broad ä norm is found in a peripheral lower back position; this is evidently the corrected forms. None of the younger speakers show high broad a forms, a tendency which appears to have been corrected in the speech of later generations.

We also see /ow/ moderately fronted in Fig. 29. What interaction can we posit between the fronting of /uw/ and /ow/ and the raising of /oh/? There is no question that the /uw/ and /ow/ are back upgliding phonemes: their glides are quite marked. Our notation shows /oh/ as a long and ingliding form, but it appears in checked position in Cockney as upgliding.

We find back [u] glides after the /oh/ nucleus even in relatively short forms of bought, brought, short, etc. Both /ohr/ and /oh/ not before underlying -r are affected in this way. In Sivertsen 1960 we find that all /oh/ words are written as [oᵛo̞]. This tendency towards converting /oh/ to [o̞o] is quite consistent in our younger Cockney speakers; it appears variably in the speech of the older. The first step in the Cockney chain shift is therefore a rule which alters a centering glide to a back upglide (automatically rounded) after the low back tense nucleus.

$$(6)\quad [+\text{cen}] \rightarrow [+\text{back}] \;/\; \begin{vmatrix}+\text{back}\\+\text{low}\\+\text{tense}\end{vmatrix} \;\; \frac{\qquad}{[-\text{cons}]} \;\; [+\text{central}]$$ [16]

We are now faced with some intricate problems of rule-writing if we are to capture all of the relations within the Cockney Pattern 3 shift. The basic problem is that the shift takes place along two independent dimensions--at least in terms of the conventional feature system. To write such a chain shift "around a corner" is obviously more complex than to write a linear one as in the two cases considered above. We will begin with relatively abstract features within a binary system, and search for the notation which will display the process most clearly, showing not only one end state, but the transition to that state and alternate routes as well.

To describe the chain shift of the newly upgliding /oh/ and /uw/, /oh/→/uw/→, we can use the following notation:

$$(7)\quad \begin{bmatrix}\alpha\text{high}\\+\text{back}\end{bmatrix} \rightarrow \begin{bmatrix}+\text{high}\\-\alpha\text{back}\end{bmatrix} \;/\; \frac{\qquad}{[+\text{tense}]} \begin{bmatrix}-\text{voc}\\-\text{cons}\\+\text{back}\end{bmatrix}$$

This rule converts any non-high back vowel to a high back one and a high back vowel to a non-back one. Both of these nuclei are tense (peripheral in a lower level terminology) and both continue to follow the path predicted by Principles I and III. But though this rule does describe the chain shift, it does not show any relation to the fronting of /ow/. To do so, we have to resolve the chain shift into distinct rules. First we will need a rule which removes /uw/ and /ow/ from the path of the rising /oh/. We cannot do so by making them both [-peripheral] because /uw/ is at the top of the vowel system and will be peripheral throughout. To make them both categorically [-back] would play false to the facts of Fig. 29, since Tom Stokes' /ow/ is not consistently front of center (as we will see other Cockney speakers lower /ow/ in a clearly [+back] position). One way to show the process as it occurs is to write a variable rule which begins the fronting of vowels before back upglides--that is, nucleus-glide differentiation.

$$(8)\quad [\quad] \rightarrow \langle -x\ \text{back}\rangle \;/\; \underline{\qquad} \begin{bmatrix}-\text{voc}\\-\text{cons}\\+\text{back}\end{bmatrix}$$

In its simplest form this will of course precede (6). Like many of the rules we will state here, (8) is no doubt subject to many environmental constraints similar to those we investigated in Chapter 3, but here we will be considering these rules in their skeletal forms. After (6) applies we will then have a chain shift raising rule which can include /ah/ as well as /oh/, following Principle I in raising tense nuclei.

(9) $$\begin{bmatrix} +\text{tense} \\ +\text{back} \\ y\text{high} \end{bmatrix} \rightarrow \langle y+z \text{ high}\rangle$$

Before considering other possibilities for unifying these processes, let us consider the other speakers who display the London chain shift, bearing in mind that younger subjects do not necessarily show changes in progress in any simple sense.

As Figs. 4-12b-d show, our other three adult speakers use variants of the same pattern, but without the raising of /ah/ or /ahr/. Bob Frost shows some backing of these vowels in Fig. 31, but they are quite low. The /oh/ vowel is high and back for all speakers, though Tom Gale's /oh/ shows a wider range than the others' (Fig. 32). There is considerable variation in the extent of the fronting of /uw/, which is moderate for all three men and maximal for Marie Colville, reaching to a full front [ü] position. Her /ow/ has fallen sharply to upper low position, quite similar to the path of /u $\rightarrow$ aw/ in section d of Pattern 1. The paths followed by /ow/ for Bob Frost and Tom Gale seem to indicate a strong lowering process which for Tom Gale allows /ow/ to reach low position. The nucleus seems to reach the same position as the nucleus of descending /ey/ (see below). In the meantime, /aw/ reaches a predictable front position, with a nucleus as front or fronter than short /æ/ (Figs. 30-32). One of the most challenging questions which remain to be solved is to discover what determines the path of /ow/ as it crosses from front to back following Principle III. To the extent that the nucleus of /ow/ is defined as a lax vowel, it should also fall by Principle II, and that happens for all three speakers to a varying degree. On the other hand, the nucleus of /uw/ is being fronted as a peripheral vowel, and there is no reason to expect it to fall.

There seems to be a qualitative difference in the paths followed by /ow/ in Fig. 4-12 which may be related to the low central point which is the target of descending /ey/. Marie Colville shows /ow/ on a back non-peripheral track, with minimum fronting. Her son Stephen shows the same back path in Fig. 4-11. Tom Gale's /ow/ is distributed along a back, non-peripheral path and only Bob Frost shows an /ow/ path tending towards a target distinctly front of center. We can then consider the path of /ow/ to be essentially a falling one for the first three speakers.

The further progress of /ow/ and /uw/ can be captured with binary features if we use peripherality as the governing constraint. First we must insert a rule specifying peripherality for the back vowels with upgliding diphthongs. /uw/ remains peripheral since it is high, but the nucleus of /ow/ becomes non-peripheral.

$$(10) \quad [+\text{voc}] \rightarrow [\alpha\text{peri}] \;/\; \underset{[\alpha\text{high}]}{\underline{\qquad}} \begin{bmatrix}-\text{voc}\\-\text{cons}\\+\text{back}\end{bmatrix}$$

This rule would of course precede (6). Rule (11) then achieves the London Pattern 3 vowel shift for all three elements involved:

$$(11) \quad \begin{bmatrix}\alpha\text{high}\\\beta\text{peri}\end{bmatrix} \rightarrow \begin{bmatrix}-\alpha\text{back}\\\beta\text{high}\\-\beta\text{low}\end{bmatrix} \;/\; \underline{\qquad} \begin{bmatrix}-\text{voc}\\-\text{cons}\\+\text{back}\end{bmatrix}$$

The way in which this rule operates can best be seen by a table:

	input values				effect of the rule			
	peri	high	back	low	peri	high	back	low
/uw/	+	+	+	-	+	+	-	-
/ow/	-	-	+	-	-	-	+	+
/oh/	+	-	+	-	+	+	+	-

Although this is a relatively complex rule, it is compact, and its value would be considerable if it could be modified to take into account the fronting of /ow/ in Bob Frost's pattern. This is only a slight modification of the other system, and as we will see it is the more common one when we pass beyond London. But (11) cannot accomodate a pattern for /uw/, /ow/ and /oh/ of [−, −, + back]. To solve this problem, we must turn to a simpler representation which operates with continuous values of height and backness, still using peripherality as a categorical feature with $\pm$ values. Rule (12) must be ordered before rule (6) so that it applies only to /uw/ and /ow/:

$$(12)\quad \begin{bmatrix} y\text{high} \\ \alpha\text{peri} \end{bmatrix} \rightarrow \left\langle \begin{matrix} y+\alpha x \ \text{high} \\ -z \ \text{back} \end{matrix} \right\rangle / \ \underline{\qquad} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ +\text{back} \end{bmatrix}$$

This rule governs a variable process in which height is increased for the peripheral vowel and decreased for the non-peripheral one. Backness is decreased for both. Rule (12) will therefore produce the pattern of Fig. 4-12d. Can we use the same mechanism for Fig. 4-12a, b, c, which rule (11) accounted for? In this situation, we need a formalism which will not change the backness of /ow/ but will steadily decrease the backness of /uw/. This can be accomplished by the following rule:

$$(13)\quad \begin{bmatrix} y\text{high} \\ z\text{back} \end{bmatrix} \rightarrow \left\langle \begin{matrix} y+\alpha x \ \ \text{high} \\ z-\frac{x\alpha x}{2} \ \text{back} \end{matrix} \right\rangle / \ \overline{[\alpha\text{peri}]} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ +\text{back} \end{bmatrix}$$

This rule has no effect on the backness of non-peripheral vowels, since if α is −, $x\alpha x = o$ and backness is unaffected, remaining at the original $\underline{z}$ value. For peripheral vowels, backness is increased by the function $\underline{x}$. Given the force of Principle III, it is understandable that rule (13) would be replaced by (12), which seems to be happening in most areas where Pattern 3 is found. That is, there is a great cost in rule complexity to hold back /ow/ and front /uw/. Rules (12) and (13) are complex in their assignment of quantities but simple in the features used. They show how the various forms of Pattern 3 can be governed by the basic feature of peripherality, which we suggest is the most important determinant of chain shifting. Once (12) and (13) have applied, the raising of (oh) would then be accomplished by the same process as that which raises (æh).

It is clear again from the complexity of these rules that the path of /ow/ in Pattern 3 is a difficult and challenging problem. Part of the difficulty is in the binary backness dimension. In the re-statement of the rules to follow in 4.7 we will present a much simpler version of (10-13) on the basis of a finer resolution of height and backness.

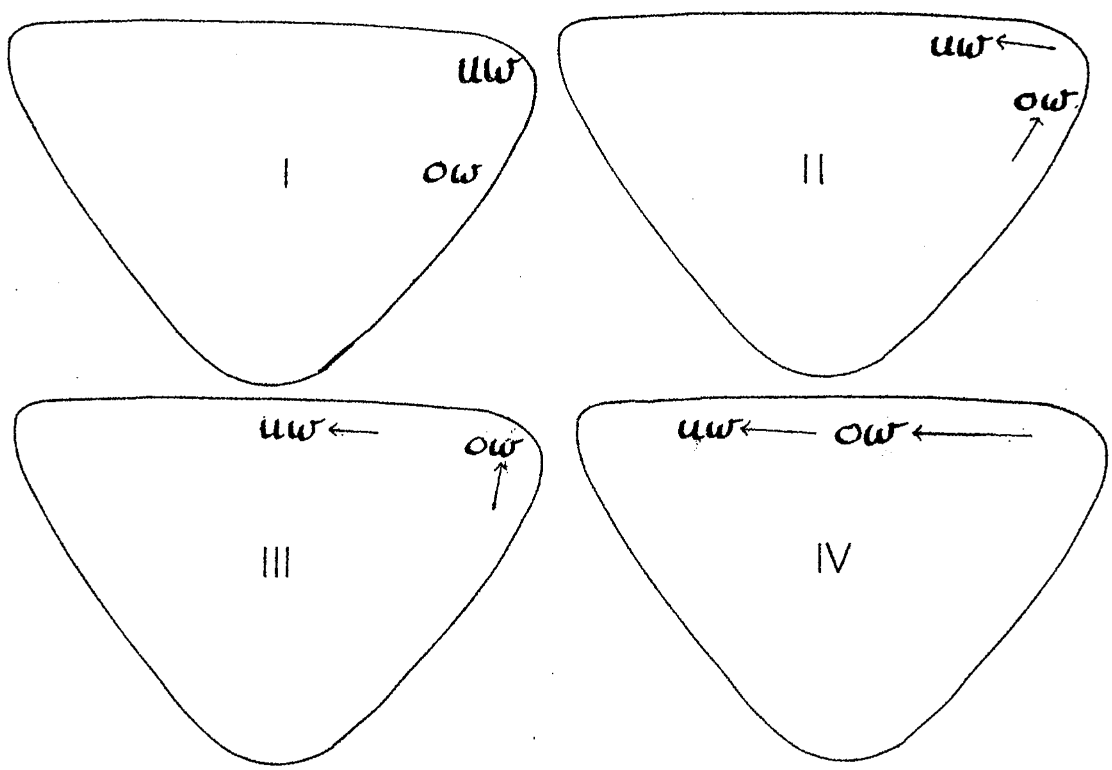
4.4.2. Norwich. Our Norwich series also includes five speakers (Figs. 33-37). As in London, we have one parent-child pair. The oldest speaker is James Wicks, 74, who shows the dual norm for /uw/ that we observed in the speech of Tom Stokes. In this case, there is also a split for /u/. Norwich is a small city, exposed to a number of dialect influences from the countryside, and there are several competing norms from various dialect sources which are discussed in Trudgill 1971. There is also a strong tendency to correct certain sociolinguistic variables. Trudgill has amply documented these shifts along the dimensions of social class and style.

Fig. 33, the system of James Wicks, will illustrate the difference between the basic London and Norwich pattern. Here /uw/ is fully fronted, but /ow/ has scarcely moved forward at all. The vertical striping in the /uw/ ellipse indicates that the glide moves front of center towards [ü]. We also note the presence of a third back upgliding phoneme: /ɔw/. This is not the result of the London process of adding a back upglide to /oh/, but rather the historical reflex of a word class which was originally separate from long o and in Norwich has never fallen together with it. It includes all words from M.E. /ɔw/: tow, snow, row, etc., along with words of the roll, poll class, so that /ow/ and /ɔw/ are contrasted in toe vs. tow, and role vs. roll. We thus have the series /ɔw/ - /ow/ - /uw/ and a shift which comes closest to the pure Pattern 3 that we originally presented. While /uw/ is fronted to central position, /ow/ rose to high position as a monophthong. There also developed a diphthongal norm for /ow/. We then had a further fronting of the nucleus of /ow/. The pair were further differentiated by a fronting of the glide of /uw/, while the glide of /ow/ stayed back; for some speakers only the glide distinguishes the pair.

In this situation, /ɔw/ did not rise, but remains as a lower-mid back vowel. The fourth member of the back up-gliding set moves steadily across the system, aiming apparently towards a low-front target of [æᵒ] for /aw/.

The system of Les Branson in Fig. 34 is somewhat more conservative than Wicks. He also has two norms for /uw/, a very front one and a single instance of a high back form. Both /aw/ and /ow/ are further back than Wicks, and /ow/ is not located at high position here. When we move on to Tony Tassie, a sixteen year-old working-class boy, the situation is clearer. /uw/ is in a high front position, higher than /iy/, and as indicated for all speakers, the glide is towards a high [ü] position, aiming just back of high front /iy/. /ow/ is in high back position, along with /oh/, but already moving forward slightly towards the center. It is now higher than the short /u/ of good, looked, and (shortened) room. Finally we note that the /ɔw/ nucleus has descended to mid central position, and is now differentiated from /aw/ by gliding to the back instead of gliding to the front. Tony's friend Jean Suffling has a /uw/ which is equally advanced and an /ow/ which is moving across in relatively high front position. There is some tendency for the nucleus of /ow/ to fall to a lower high position, so that it is not actually following /uw/.

Finally we can turn to the speech of David Branson, age fourteen, the son of Les Branson, whose speech pattern plays a central role in Chapter 6. David shows the multiple norms characteristic of Norwich; his /uw/ is spread out over the entire high range of the vowel system, with front, central and back representatives. His /ow/ also shows three norms: one in high back, one in upper mid back; but the main body of /ow/ is clustered in high position, just behind center. It contrasts with the main body of /uw/ in central position by the direction of the /ow/ glide which is strongly towards the high back position, while /uw/ glides slightly forward. In David's speech, we see the most advanced stage of the Norwich chain shift.[17] Fig. 4-13 shows the outlines of the Norwich Pattern 3 shift in four of our speakers. We can sketch the presumed progress of the pattern in the following stages:



In our base diagrams we can observe the latter part of these developments, bearing in mind the existence of competing norms with monophthongal vs. diphthongal varieties. We also observe that /aw/ follows a downward path across the vowel system without necessarily going first to low position. Finally, we see that the /ɔw/ phoneme seems to be acquiring a less peripheral nucleus than short /ɔ/. It descends directly and independently in a path parallel to /aw/ but further back. We thus see in Norwich the fronting of four back upgliding elements. Two are converted into front-gliding forms, and two remain back-gliding, so that the direction of the glide rather than the position of the nucleus becomes the defining characteristic.

We can use rule (7) to generate the first three stages of the Norwich chain shift, but deleting the requirement that the glide must be [+back]. Since all other upgliding forms have lax nuclei (except /iy/), it will not be necessary to specify /uw/ and /ow/. (The rule can apply vacuously to /iy/).

$$(7') \quad \begin{bmatrix}\alpha\text{high}\\ +\text{back}\end{bmatrix} \quad \begin{bmatrix}+\text{high}\\ -\alpha\text{back}\end{bmatrix} \; / \qquad \begin{bmatrix}+\text{tense}\end{bmatrix} \begin{bmatrix}-\text{voc}\\ -\text{cons}\end{bmatrix}$$

To continue the chain shift, we simply need a general fronting and lowering rule for all /uw/, /ow/, /ɔw/ and /aw/. Rule (12) seems appropriate in its present form, though again the glide specification is a problem. The simplest solution to differentiate the front upgliding diphthongs from all others by specifying [-front] rather than [+back]. If we were convinced that all the glides were rounded, it would be possible to specify [+round] for the four phonemes listed, but this remains to be proven.

4.4.3. The Outer Banks. With this background, we can now examine more briefly several Southern dialects in the United States. Some of our most detailed studies are in the Outer Banks of North Carolina, where we have interviewed speakers over a wide age range in two areas. The first is in the central region: Manteo and Wanchese just inside the Banks, and Nags Head and Rodanthe on the Banks themselves. The second series is in a more isolated rural area, Arapahoe, northeast of New Berne. The most conservative system recorded there is that of an

89-year-old man, Landers Roberts (Fig. 42). It is evident that /uw/ and /ow/ are only slightly fronted in his speech.[18] Fig. 4-14 shows four successive stages in the use of the back upgliding vowels in Arapahoe beginning with Roberts. A more advanced stage is seen in the speech of Duval Hardison, 58, who shows two distinct norms for /uw/ as we have seen in Norwich and London. The largest group of /uw/ is considerably more fronted than /ow/: the mid vowel is not as strong a sociolinguistic marker as /uw/, shows less correction, and is presumably a later development. The degree of fronting of /uw/ and /ow/ can be seen by comparison with the furthest back point in the system, which is always /ohr/, or by comparison with the allophones before -l which are usually not fronted in this area (as in England or Philadelphia). Fig. 4-14c shows the system of Nellie Willis, 67, and 4-14d that of her daughter, Carolyn Price, 39. In the mother's speech the fronting process is accompanied by a strong lowering movement. The pattern of Nellie Willis is particularly interesting in that the /uw/ nucleus is falling towards a low front position, while /ow/ is descending towards low center. In the other cases we have examined, the nucleus of /uw/ maintains its high position. In Carolyn Price's system neither the /uw/ nor /ow/ show the marked orientation towards lower position.

The rules which produce the Outer Banks system might be shown as a chain shift which fronts /uw/ and raises /ohr/ to high back position. But in the Outer Banks there is no necessary connection between these two movements since they are not in contrast (but see below for other areas). We will therefore simply state the fronting of /uw/ along with /u/:

(14) $\begin{bmatrix}+\text{high}\\+\text{back}\end{bmatrix} \rightarrow \langle -x\text{back}\rangle \;/\; \frac{\quad\quad}{\langle +\text{tense}\rangle}$

The rule favors the tenser member /uw/, and /u/ follows behind. We then have a rule which makes the nuclei of both /ow/ and /uw/ lax.

(15) $[\quad] \rightarrow [-\text{peri}] \;/\; \frac{\quad\quad}{[-\text{low}]} \begin{bmatrix}-\text{cons}\\-\text{voc}\\-\text{front}\end{bmatrix}$

We must now specify the glide as [-front] rather than [-back], since rule (14) can and does apply to the glide as well as the nucleus. We then have a lowering and fronting rule, with the phonemes now positioned so that /uw/ will be ahead of /ow/ and will not merge with it.

(16) $[-\text{peri}] \rightarrow \left\langle \begin{matrix}-x\text{back}\\-y\text{high}\end{matrix} \right\rangle \;/\; \underline{\quad\quad} \begin{bmatrix}-\text{cons}\\-\text{voc}\\-\text{front}\end{bmatrix}$

The fronting of the glides in Arapahoe has a special interest, since it affects all back upgliding phonemes, /uw, ow, aw/, and because it is not always clear whether the resulting glide is distinct from /y/, at least to outsiders.

4.4.3.1. The North Carolina Glide Test. In the speech of several speakers from the Outer Banks we noted that words with /uw/, /ow/ or /aw/ were often mistaken by outsiders for front upgliding words: house for highest, true for truly, etc. The most striking example of this fronting of the glides was Nellie Willis. Figs. 4-15a, b,c show the orientation of her glides in high vowels, mid vowels and low vowels respectively. In Fig. 4-15a, it appears that two of her /uw/ words glide towards a point well back from front ([ü]), but one glides in the same direction as /iy/ and has a nucleus almost in the same position. In Fig. 4-15b we see that then the nuclei of /ow/ are further back than /ey/, though not by very much, and only one glides in a distinctly different direction. Among the low glides in 4-15c, it is clear that /aw/ nuclei are quite distinct in location from /ay/ but again, the angle of the glide is not clearly distinguishable.

From the speech of Nellie Willis we extracted thirteen words with upglides: eight fronted back glides and five front glides. We prepared a test tape in which each of these words is heard three times in a row, with approximately half-second intervals. The nuclei and glides of nine of the thirteen stimulus items are shown on Fig. 4-16. We have not yet administered this test to natives of the area, but results with speakers of other dialects were quite uniform.

Twelve subjects from a variety of educational and geographic background were tested. We found no serious difference in response between those trained in phonetics, naive subjects, or children, in reaction to the tests. The results are shown in Table 4-1. For each word the correct identification is given and the glide or a type of final element heard by subjects. The Vw words are heard uniformly as /Vy/ in the great majority of cases. Of the Vy words, only one was heard as Vw, No. 5 (me) and in this case only by two speakers. We can sum up the findings of this test as follows:

underlying form has	heard as y	w	other
y	39	2	19
w	56	12	28

TABLE 4-1

RESPONSES TO NORTH CAROLINA
GLIDE TEST, SERIES I

	original word	heard as						
		Vy	Vw	Vh	V	Vn	Vl	None
1	true	9			1			2
2	house	4	3	1	4			
3	know	6	2	2	1			1
4	too	11						
5	me	6	2		1	1	1	1
6	road	8	4					
7a	die	11						1
7b	out	3	1					8
8	know	8	2		1	1		
9	day	8			4			
10	week	8	1		3			
11	two	7		3	1			1
12	day	6			4	2		

When we say that a given word is heard as "Vw" we mean that the identification of the word, phonetically or orthographically, indicates the perception of a rounded glide distinct from the front unrounded glide y. Thus a phonetic report of true as [trøü] will be registered as Vw, but [trud̥i] or "truly" will be recorded as Vy.

In all cases, the subject is given the benefit of the doubt in these ratings. If either a phonetic or an orthographic response can be interpreted to indicate the correct identification of the word, it is recorded as such, even if the accompanying response contradicts this. The basic issue is whether or not the non-peripheral direction of the fronted glide will be sufficient to mark it as not being a Vy glide, and so serve to distinguish the whole set of sue, so and sow from see, say and sigh. It is still an open question whether or not the two-formant plot will register the acoustic correlates of rounding (or whether there are any consistent acoustic correlates). But in tracing subjective reactions to the movement of nucleus and glide from back to front, we hope to throw more light on the mechanism of Principle III, in current dialects as well as completed sound shifts.

The results of this preliminary test are quite clear. For those outside the dialect area, the fronted back upglides of Nellie Willis are not identifiable as distinct from front upglides. When the words are played to subjects in the context of a sentence, they have very little difficulty in understanding them. Trained phoneticians were not necessarily different from naive speakers in this identification. If the front upglides are not different from the fronted upglides, then Arapahoe has six front upgliding diphthongs to differentiate by the position of the nucleus, which seems unrealistic when we examine how close these nuclei are.

When we examine the particular Vw vowels, we find that /uw/ had the strongest tendency to be heard as Vy, and /aw/ the least.

	heard as	
word has	y	w
/uw/	27	0
/ow/	22	8
/aw/	7	4

In 1972, we carried out a second series of trials with the North Carolina glide test (Series II), using a class of 39 students at the University of Pennsylvania. These students had a wide range of phonetic skills; four could be considered expert phoneticians (by these and previous tests); a larger number possessed moderate skill, and six had no phonetic training at all. Their geographic backgrounds were varied, including seven who were not native speakers of English. None had any degree of contact with North Carolina dialects in general, nor with the specific Outer Banks dialect. Four black students were familiar with the range of Black English spoken in Philadelphia, which incorporates the influence of a number of Southern dialects, although the extremes of Southern vowel systems are generally levelled out in the urban vernacular of the North. There were five foreign students, all with moderately good command of phonetic transcription.

Series II differed from Series I in that it was administered to the group as a whole. The test tape was played through a Nagra IV tape recorder and an Ampex AA-620 amplifier, with more than sufficient power to reach all subjects. But in any group test of this sort, there will be variation in the clarity with which each word is heard by each subject, and previous experience shows that those who are directly in front of the amplifier hear better than those on the periphery.

The results of Series II were quite similar to Series I. Table 4-2 shows the comparative accuracy of subjects in Series I and Series II in their identification of Vy and Vw. We find the identical low percentage of success in identifying correctly words with underlying /Vw/ as back upglides. The consequent misidentification of words shows a lower percentage with front upglides, and more of the other categories--short vowels ending in -d, -r, etc. For words with underlying /Vy/, there was a lower percentage of correct identifications; and more heard as words with short or ingliding vowels. Responses to Series II show a greater dispersion which is characteristic of group tests. But the identification of /Vw/ words through the perception of a back or rounded upglide remained at 12 1/2%; and this fact shows that whatever signal reached the subjects, it was not of a character to suggest a glide distinct from /y/. True was normally heard as Trudy, tried, truly, or trees and less often as trilling or truant. No one correctly identified it as true. The subjects often heard the

TABLE 4-2

PERCENTAGES OF CORRECT IDENTIFICATIONS IN NORTH CAROLINA GLIDE TEST, SERIES I AND II

		heard as				
Word has	Series	Vy	Vw	other	Tot	N
Vy	I	65.0%	3.0%	32.0%	100%	60
	II	44.5	14.5	41.0	100	195
Vw	I	58.0	12.5	29.5	100	96
	II	48	12.5	39.5	100	312

rounded nucleus as shown in the responses Trudy and truly, and even when they guessed tried or trees, their attempts at phonetic transcription often showed such a back rounded nucleus. Thus two subjects who identified No. 1 as tried wrote phonetically [trụɩd] and [trɵ^{ɩn}d] and another who heard try wrote [trɵ^{di}].

Table 4-3 compares Series I and II in the percentage identification of the individual words as Vy or Vw. With the exception of No. 2, house, we find the same relative magnitudes and proportions for each word. The only Vw word which showed a high percentage of identification as Vw is No. 6, road, which is 33% Vw in Series I and 41% Vw in Series II. The minimal identification of Vy as Vw was for No. 9, day, which showed 0% in each case. In Figure 4-16, we see that the glide for No. 9 is very short, but it clearly aims in a high front direction. Those who did not hear this word as Vy heard it as a short vowel; there were no other identifications which would indicate the perception of a back glide or inglide. It is clear that the small differences in the directions of the glide are not effective in signalling Vw as against Vy, since No. 1 glides most clearly in the direction of phonetic [ü] but this was rarely heard as Vw. These preliminary results clearly underline the importance of obtaining similar reactions from native speakers of the Outer Banks dialect to determine whether there are acoustic features which reliably differentiate the two series.

We can profitably examine the full range of response to some individual words in Series II. As pointed out above, No. 1, true, was not identified correctly by anyone. Eleven subjects heard a first syllable /tru/ but the fronted glide was perceived as some kind of additional syllable of the form /Ky/, where the K was a lateral or a flap. A few heard the glide as a final consonant such as /d/. Altogether, 23 of the 39 subjects heard this word as ending in a fronted glide, and the rest heard an inglide or simply a final stop. The four good phoneticians (Group A) are differentiated from the others by more accurate transcription: two heard a less peripheral glide [ɨ] and one heard a front rounded glide, but none were able to identify the word as a Vw type. The average phoneticians (Group D) showed a strong tendency to hear the final glide as a stop (5 of 20). The black students all agreed in hearing a form VwKy, yielding an identification such as truly.

TABLE 4-3

IDENTIFICATION OF INDIVIDUAL WORDS AS Vy OR Vw
IN NORTH CAROLINA GLIDE TEST, SERIES I AND II

No.	Word	Vowel	Series I heard as Vy	Series I heard as Vw	Series II heard as Vy	Series II heard as Vw
1	true	uw	75%	00%	54%	10%
2	house	aw	33	25	51	05
3	know	ow	50	16	39	15
4	too	uw	92	00	51	08
5	me	iy	50	16	39	23
6	road	ow	67	33	18	41
7a	die	ay	92	00	82	03
7b	out	aw	25	08	62	08
8	know	ow	67	16	46	05
9	day	ey	67	00	58	00
10	week	iy	67	08	26	05
11	two	uw	58	00	62	10
12	day	ey	50	00	13	05

Word No. 4, too, was identified correctly by only one subject, an average phonetician of Group D. Ten subjects identified it as the word too /tuw/ followed by some other word or consonant, such as too it or to him or do followed by it or -in'. This clearly reflects the tendency of the speaker to relax the velic towards the end of a syllable. (This also appears quite strongly in No. 3, know, and explains why No. 3 is not identified as clearly as No. 8.) Again, the nucleus of the word was perceived as a back rounded vowel by at least ten subjects, but this did not allow them to identify the word correctly since the fronted glide was not heard as the completion of a /uw/ syllable. A surprising number heard the nucleus as a centralized back or unrounded vowel. Three of the four good phoneticians wrote [ʌ] or [ə] and the subjects often heard dirt or dud as well as toy, tie and die. As Figure 4-16 indicates, this may be due to the fact that No. 4 glides downward first and then upwards. Again, accurate phonetic perception did not help in the identification of the word, and only one quarter of each group of subjects heard the nucleus as /uw/.

Word No. 2, house, was identified correctly by only two of the thirty-nine subjects, both of them average phoneticians. All four of the good phoneticians identified the word as a monophthong ending in a sibilant, hearing fast or pass, even though the glide is quite pronounced as shown in Figure 4-16. No one heard this word as Vw. Almost half of the phonetic transcriptions showed a monophthong, and almost half of the words guessed were monophthongal. Any account of this fact must assume a complex mechanism of perception and identification. Hearing a phonetic form such as [ha·ɩs], the subject may first perceive it as an unfamiliar combination of nucleus and glide, possibly a Southern form of Vy. The best known feature of Southern dialects is the monophthongization of /ay/ to [a:] as in [ha:] for high. This may induce the listener to hear the form as monophthongal, and even identify it as a monophthongal word even though he has passed through the intermediate stage of recognizing it as a monophthongized diphthong. In any case, he does not hear it as a fronted form of Vw.

Responses to the forms of know, Nos. 3 and 8, showed great difficulty in identifying the nucleus as Vw. Most of these were not phonetic transcriptions, but guesses at the word involved. Examining these guesses alone, we find only three subjects hearing No. 3 as a Vw type, and two identifying No. 8 as Vw. The other identifications are scattered evenly among Vy and Vk, and a surprising number of Vhr forms such as nor, more, and lord. In many cases, the characteristic release of the syllable led to the perception of a final /r/ after Vy (liar, etc.) as well as the expected nasal (nine, etc.). When we examine Figure 4-16, it appears that No. 8 and No. 3 have similar nuclei and similar glides, so that any difference in the pattern of identification is most likely due to the character of the final release.

Finally, we may examine the responses to two Vy words. No. 5, me, was correctly identified by more speakers than any other: 9 of 39. Again, we find no clear advantage for the good phoneticians: about one quarter of each group heard this word as me, except for the seven non-native speakers who did not show any correct identification. The second favorite choice was mud, registered by seven subjects. The centralized position of the nucleus led to a large number of similar identifications, and may also be responsible for the fact that eight subjects guessed a Vw word such as mooing or moon. Here again the mechanism of perception seems to be quite complex: these subjects may be identifying the word through the nucleus alone and then adjusting their perception of the glide accordingly.

Word No. 10, week, was identified correctly by only two subjects, both average phoneticians of Group D. Eight other speakers heard a form such as wake, we or Willy which indicated a correct identification of the nucleus as Vy. But a surprisingly large number heard the word as work: seven subjects heard a /əhr/ nucleus. This may be due to the knowledge that a centralized nucleus and front upglide is a phonetic realization of /əhrK/ words such as work and bird in a number of vernacular dialects: older New York City, Atlanta, New Orleans, etc. Again, it is clear that the backed position of the nucleus of the Vy words created almost as much difficulty as the fronting of the nucleus and glide of the Vw words.

Figure 4-17 is an extended study of the four major diphthongs in question in the speech of Nellie Willis: /iy, ey, uw, ow/. As a whole, the nuclei are distinct. There is some overlap between /iy/ and /uw/, but it is largely through differently conditioned allophones, such as those before /l/. There is a serious overlap of the nuclei of /ey/ and /uw/. Since we have seen that outsiders cannot differentiate the glides, it remains to be seen how speakers of the dialect distinguish these two vowels. In the North Carolina Glide Test, words with /uw/ were rarely heard as having high nuclei, unless they were identified as Vw: thus for No. 1, true, we typically have tried, try, trodden, train; the nucleus was heard as mid or low. This is even more the case of No. 4, too, which begins at a higher point, but as Figure 4-16 shows, glides down before it rises. Thus we have dirt, toy, die, day, door, dime, etc. for No. 4. In that smaller percentage of cases where Nos. 1 and 4 were correctly identified as /uw/, they were heard as having high nuclei: we seldom have /ow/ interpretations. This result poses a further challenge for exploration.

4.4.4. East Atlanta. The vowel systems of the Gratton family of East Atlanta are shown in Figs. 46-49. We will not attempt to deal with them in detail here; their general features are the same as we have seen in other Pattern 3 dialects. We observe multiple norms for /uw, u, ow/; a strong fronting of /uw/ and a weaker one for /ow/; considerable variety in the degree of lowering of /ow/; and the high back position occupied by /ohr/. Henry Gratton, 60 (Fig. 46), shows both backed and fronted /ow/. His /ɔh/ phoneme is a member of the same back upgliding system, /ɔw/, and occupies the same lax place as /ɔw/ in Norwich. His wife has lowered /ow/ along the same non-peripheral back route as Marie Colville and her son (Figs. 30, 4-11). There is reason to think she is correcting strongly here, for all /uw/ is in high back position. The high back place of /ohr/ is significant here, since this is an r-less dialect. The ingliding [o·ə] in door, more, four, etc. often loses its glide by a general Southern vernacular rule giving [po] [do], etc. (Labov, Cohen, Robins & Lewis 1968:3.4.8). This is a stigmatized form, and is used mostly in a jocular sense by many educated speakers, but there is reason to think that monophthongal [o] from [ohr] was one of the basic outputs of the rule system. As noted above, /uw/ in high back position is usually monophthongal, and it is not until it begins to move to the front that it is clearly diphthongal. We therefore wish to point out the possibility that the movement of /ohr/ is part of the general Pattern 3 chain shift: /ahr/→/ɔhr/→/ohr/→/uw/→. These Southern dialects distinguish /ɔhr/ from /ohr/ in for vs. four, storm vs. port, etc. In the system of Henry Gratton (Fig. 46) /ɔhr/ has moved one unit ahead of /ɔh/, which coincides here with /ahr/, and /ohr/ has moved from mid to high. One reason for the frequency of a second /uw/ norm in high back position is that there is not a direct contrast today with /ohr/: the schwa deletion rule is stigmatized and no longer predominant. But its stronger position in the past may have been involved with the mechanism of the shift.

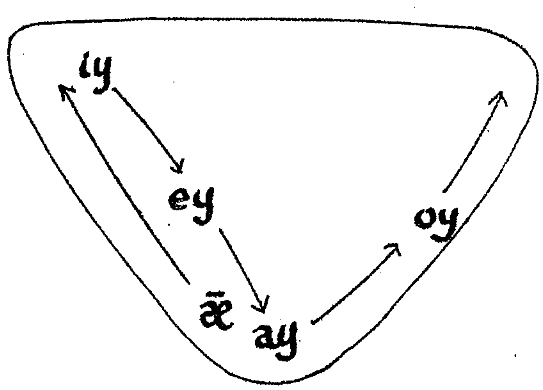
4.4.5. Other areas. Our base diagrams show two systems which illustrate the basic Pattern 3 shift. The central Texas pattern of Jerry Thrasher (Fig. 50) shows a number of the features that we have discussed in their most extreme form: the fronting of /uw/, overlapping /iy/; a very low position for /ow/; and /ohr/ in high back position. Steve Haller of Philadelphia (Fig. 24) shows a moderately developed system of younger working-class speakers which is similar to several of the London and Southern patterns we have examined in the fronting of /uw/, the falling of /ow/, and the rise of /ohr/ to high back position. Philadelphia offers a very rich area for exploration of this shift, and we hope to profit from a close study of its development through a detailed sociolinguistic survey in the near future.

The extreme forms of Pattern 3 offer interesting evidence on the proposal for a linguistic universal that a fronted /ü/ does not exist in any language without a back /u/--that is, a front rounded vowel implies the presence of a back rounded one (Sedlak 1969). In this section we have seen many vowel systems (such as those of Steve Haller, Fig. 24) which have no phoneme in high back position except a limited word class before final r. The fact that many Philadelphia high school students have great difficulty in learning French [u] but none with [ü] shows that they do not recognize a phoneme in the high back area.[19] The universal seems to be primarily a product of scribal and phonemic practice which does not register the fronted forms of a phoneme if there is no back phoneme to contrast it with.

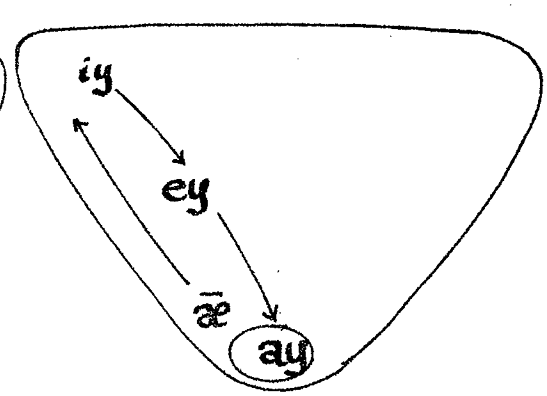
4.5 The development of Pattern 4

To study Pattern 4, we return to the same dialects in which Pattern 3 was observed. This is a remarkable fact, and not immediately predictable: in London, Norwich, Philadelphia, the Outer Banks, East Atlanta and Central Texas we observe the co-occurrence of Patterns 3 and 4. Pattern 4 is weaker in Philadelphia, but equally strong in the other areas.

At first glance, Pattern 4 appears to be the same as the left-hand side of Pattern 1, in the outline of Fig. 4-1. However, there is an important difference: in Pattern 1 there is a true chain shift within the upgliding tense vowels, with three or four items involved, and only one vowel descending in a less peripheral position in section c. In Pattern 4 the situation is reversed: we have only one vowel ascending as a tense vowel--(æh), which may also include the nucleus of (æw). On the other hand, there is a series of three or four upgliding vowels involved in the downward less peripheral track: /iy/, /ey/, sometimes /æy/, and /ay/. There are two basic variants of Pattern 4, depending on the path followed by /ay/:



Pattern 4



Pattern 4'

Pattern 4' is truncated since /ay/ is monophthongized to [a]. It is usually fronted somewhat at the same time and then may be further fronted as it enters track a. Otherwise, diphthongal /ay/ moves up and to the back on track c by Principle I. Section c of Pattern 4 is in fact the same as section e of Pattern 1'; in our studies of current English dialects we are referring to the same movement.

The Pattern 4 movements that we will study are more extended chain shifts than the Pattern 3 types we considered in the previous sections. They involve the interrelated movements of at least five phonemes as /æh/→/iy/→/ey/→/ay/→/oy/→. The reason that current Pattern 4 is distinct from older Pattern 1 is of course the intervening diphthongization rule which converted new long /i·/ from M. E. ē and ɛ̄ to /iy/ and new long /e·/ from M. E. ā and ay to /ey/. This occurred long after the original diphthongization of high vowels which produced /ay/ from M. E. ī. The issue as to how this ī descended to /ay/ is a long-standing torical controversy which we will re-consider in the next section in the light of our findings here. As far as the dialects we are discussing here are concerned, /ay/ already has a low nucleus, so that /ey/ and /iy/ enter the system of front upgliding vowels after /ay/ has passed them by.

The various forms of Pattern 4 in the dialects to be considered are much more uniform than Pattern 3, and will give the strongest evidence to support our view that phonological space contains two distinct paths in both front and back: a peripheral path along which vowel nuclei rise, and a less peripheral path on which they fall.

4.5.1. London. We could not state with any confidence that we observed sound change in progress in the Pattern 3 forms of London speech; but it is clear that the Pattern 4 chain shift is developing across age levels. The most active element is /ey/, which is one of the major stylistic variables of London speech. The more casual forms of the vernacular have more open nuclei; in more careful speech we get forms closer to mid.[20]

Tom Stokes' /ey/ in Fig. 29 is basically a mid vowel. There is one instance of a second norm in low position, but we are inclined to assign this to the influence of a later generation, since the main group is tightly clustered. His /iy/ is firmly in place as a high vowel. On the other hand, his /ay/ has moved up to high back position, along with broad a. As we have seen, Stokes is more advanced in this respect than younger speakers. We do not know how general this pattern is in the older generation; the opposition of peripheral /oy/ vs. non-peripheral /ay/ is part of an older pattern which we will examine in the dialect of Essex in Chapter 6. It does not recur in any of the younger London speakers.

Marie Colville also shows a high /iy/ in Fig. 30 but /ey/ has descended along a non-peripheral track to upper low position. It is not the lowest vowel in the system, but it overlaps /æ/. The direction of movement is indicated by the instance of lower mid /ey/ in they which is not as far advanced as the others. In the back, we see that /ay/ extends along a peripheral track in opposition to the non-peripheral nuclei of /ow/, /o/ and /oh/; /ay/ moves up directly behind /oy/. We thus have as peripheral vowels /ä/ and /ahr/, /ay/, /oy/, /ohr/ and /uw/ before -l. As non-peripheral vowels we see /u/,/ʌ/, /ow/, /o/ and /oh/.[21] Fig. 4-18 shows four stages in the development of the London Pattern Vy system, with Stokes, Colville, Frost and Gale. Note that the /iy/ of Frost is considerably centralized, though it is still a high vowel. But /ey/ has fallen to be the lowest vowel in the system, as low as /ahr/. We observe a split between the /ay^{v}/ and /ay°/ allophones with the /ay^{v}/ leading as we have seen in New York City. The /oy/ has now reached the highest point in the system. In the fourth section of Fig. 4-18 we see the system of Tom Gale, where /ey/ is now the lowest vowel, extending well below /æ/. The /iy/ nucleus now extends down from high to mid position, almost to the position of /æ/. Short /i/ and /e/ are now front and peripheral as compared to the centralized nuclei of /iy/ and /ey/. Finally, we can examine the system of Stephen Colville in Fig. 4-11, who shows the most extreme lowering of /iy/ and /ey/. In his speech, the /iy/ nucleus has left short /i/ well behind.

4.5.2. Norwich. The Vy pattern of James Wicks (Fig. 33), the oldest speaker in the Norwich series, is comparable to that of Stokes of London. We see a lower mid /ey/ with one instance of the lower norm. The high vowel /iy/ is still peripheral, and /ay/ (Fig. 4-19a) is in mid back, less peripheral position. For Wicks, /oy/ is still relatively low. Fig. 4-19 isolates the successive Vy patterns for four Norwich speakers so that this progression can be seen most clearly. For Les Branson, 42 (Fig. 34 and 4-19b), the pattern has developed considerably further. Though /iy/ is still a high vowel (as it remains for most Norwich speakers), /ey/ has descended to upper low position, coincident with /æ/, and the /ay^v/ allophone has moved to the back; /oy/ is now the highest Vy vowel in the system.

Tony Tassie (Fig. 35 and 4-19c) shows the full range of /ey/, extending from upper mid to the lowest vowel in the system. Trudgill points out (1971) that /ey/ is one of the most important sociolinguistic variables in Norwich, and the developments of younger speakers bear this out very well. The /ay/ vowel for Tony is now quite high and peripheral, with the /ay°/ allophone also peripheral and in this case distinctly higher than /ay^v/. Finally /oy/ is located in upper back position.

We also observe in Tassie's system the beginning of a tendency to centralize and lower /iy/. This does not appear in the speech of Jean Suffling (Figs. 37 and 4-19b) where /ey/ has descended to its maximally low position. One mid vowel is left behind, but the main body of /ey/ is considerably lower than either /æ/ or broad <u>a</u>. The /ay^v/ allophone is peripheral but not as high as with Tassie, and the /ay°/ allophone is less peripheral; /oy/ has reached its highest position except as usual for the allophones of /uw/ before -<u>l</u>.

In Norwich we then observe a regular downward progression of a less peripheral /ey/ along the non-peripheral track until it becomes low and peripheral in the final analysis. We see some variation in the upward path of /ay/ for the voiceless allophones, but /ay / follows systematically behind /oy/ with which it directly contrasts.

The rules that generate Pattern 4 begin with a general rule which makes vowels non-peripheral before upglides.

$$(17) \quad \begin{bmatrix} +\text{voc} \\ -\text{cons} \end{bmatrix} \rightarrow [-\text{peri}] \ / \ \underline{\quad\quad} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ +\text{peri} \end{bmatrix} [-\text{voc}]$$

This rule states that any vowel must be non-peripheral before a peripheral glide (as opposed to a centering glide) as long as the next segment is not a vowel. Since this is a rule of nucleus-glide differentiation which will further motivate the actions of Principles I and II, we may well generalize it further to include the tensing of nuclei before inglides--rule (3) of Chapter 3.

$$(17') \begin{bmatrix} +\text{voc} \\ -\text{cons} \end{bmatrix} \rightarrow [-\alpha\text{peri}] \;/\; \begin{bmatrix} \overline{} \\ -\text{low} \\ \beta\text{back} \end{bmatrix} \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ \alpha\text{peri} \\ \beta\text{back} \end{bmatrix} [-\text{voc}]$$

Rule 17' specifies that /iy/ and /ey/, /uw/ and /ow/ have non-peripheral nuclei, and that mid and high ingliding vowels have peripheral nuclei. The rule applies only to vowels which have the same backness as their glides (and not to /oy/, for example, which remains peripheral). Low vowels, which seldom show inglides, are also excluded, so that /ay/ is unaffected. Most importantly, [ɔu] derived from long open o̲ is excluded from the rule, and retains its tense nucleus. The development of low vowels is still not predictable, since Norwich /ɔw/ becomes non-peripheral like /ow/. The tensing of /æ/ or /o/ is therefore a separate process which must be accounted for in individual dialects, while (17')seems to apply across a great variety of dialects.

For London and Norwich, we now have a rule which operates upon Vy forms to produce Pattern 4: peripheral nuclei rise and non-peripheral nuclei fall.

$$(18) \; [\text{y high}] \rightarrow \langle \text{y}+\alpha\text{x high} \rangle \;/\; \underset{[\alpha\,\text{peri}]}{\underline{}} \begin{bmatrix} -\text{voc} \\ -\text{cons} \end{bmatrix}$$

This simple chain shift rule declares that any given degree of highness in the nucleus of a diphthong is regularly increased or decreased according to whether it is peripheral or not. Rule (18) is then our most general chain shift rule which will apply to Pattern 1 and 1', section a of Pattern 3, and Pattern 4.

4.5.3. The Outer Banks. The lowering of the front upgliding vowels is only a moderate tendency in the Arapahoe dialect which we examined in section 4.4. The oldest speaker, Landers Roberts (Fig. 42), shows a range of /ey/ from lower high to lower mid; but /iy/ remains high and /ay/ is low. Duval Hardison, 58 (Fig. 43), shows a shift of one /iy/ norm towards the center (coinciding with his major /uw/ norm) and a lowering and centralization of both /ey/ and /e/ to a remarkable extent. The /ay/ is shifted well to the back, but has not started to rise. Nellie Willis (Fig. 44) who showed the extreme fronting and lowering of the Vw vowels now shows a more extreme development of the front vowels. Not only has short a become peripheral, but all the short vowels are now front of the Vy set. We thus see a peripheral series of /i/, /e/, and /æ/ while /iy/, /ey/ and /ay/ are located on the non-peripheral track. Furthermore, /i/ and /e/ have risen while /iy/ and /ey/ are falling. The low vowel /ay/ has already begun to rise from its low position in the Pattern 4 movement.

As we review the Vy front vowels of Nellie Willis, it becomes apparent that the relationship between the short vowels and the upgliding vowels is the paramount issue here. In Landers Roberts' system the Vy were higher and more peripheral than V in the front, as in most dialects. For Duval Hardison, /i/ and /e/ are centralized along with /iy/ and /ey/. But for Nellie Willis, the short vowels are now tense, high and peripheral. The same is true for her daughter Carolyn Price (Fig. 45). The phonological space utilized by Carolyn Price has an unusual shape with all three short vowels well to the front at the same level of height--differentiated by F2 rather than F1. Behind these vowels, with lower F2, is /iy/, which is scattered in both high and low F1 positions. Slightly behind /iy/ and above it is /ey/. The inversion of /iy/ and /ey/ in the speech of Carolyn Price is one of the oddest vowel systems which we have encountered and which will require further study before it can be understood by any general principles. The back vowels behave quite normally as far as the usual Pattern 3 criteria are concerned, but in the front vowels, F2 ordering seems to be substituted for F1.

A paradigmatic Pattern 4 can be seen in our other Outer Banks series, concentrated around Manteo and Rodanthe. This dialect has been well described by Howren (1962) in the form encountered in Ocracoke, south of Rodanthe. Many of the Outer Banks features which appear in Figs. 38 through 41 were perceived by Howren in one of the most accurate and penetrating dialect reports that we have encountered. However, the impressionistic transcriptions are necessarily vague and indeterminate by comparison with spectrographic analysis and tend to understate badly the actual extent of dialect differences.

The second Outer Banks series begins with Jethroe Midgett, 72, of Nags Head (Fig. 38), who shows a conservative position similar to Landers Roberts. However, his short /e/ is peripheral as compared to non-peripheral /ey/. A similar system is shown by Earl Quidley, 52 (Fig. 39), with further progress made in the backing of /ay/. Monnie O'Neill of Wanchese, 36 (Fig. 40), shows a perfectly regular reversal of the short vowels and Vy vowels as outlined in Fig. 4-20. The further progress of the Pattern 4 movement is shown by the extensive raising and backing of /ay/ in peripheral position. The fact that /ey/ does not fall as far as it does in London or Norwich is now explained by the presence of a new upgliding phoneme occupying low position: /æy/. Most of O'Neill's short a words ending in voiceless fricatives and velars show palatal upglides: bass, lash, drag, bank. These words form a new upgliding class and enter into the Pattern 4 non-peripheral track with low nuclei. They effectively block any further lowering of /ey/ while /ay/ moves to the back in the typical Outer Banks fashion. The regularity of O'Neill's F1/F2 relations can be seen by comparing Fig. 4-20b with 4-20a. The three Vw vowels are lined up in non-peripheral position just as the three Vy vowels are.[21a]

The tensing of the short vowels in Southern diaects is usually registered in the dialect literature as a schwa inglide after the short vowels (Kurath and McDavid 1961) or as a raising effect so that Howren (1962) registers Ocracoke short /i/ as [ɩ˄ə˄] or [ɩə]. Degrees of fronting are usually not recorded in impressionistic phonetics, though Howren does note that short /e/ is [ɛ˂˄ə] as well as [ɛə]. If we mark these ingliding vowels as tense or peripheral they will be raised by (18) as it stands. This might be achieved by adding an inglide: rule (17) will make them peripheral and rule (18) will raise them.

This solution seems unsatisfactory. It would have more explanatory force to say that the short vowels become tense (in an abstract sense) or peripheral (in a more concrete one) and then develop inglides as a consequence. From a synchronic viewpoint it appears that front lax vowels have become tense and tense vowels become lax. Such a reversal rule seems to fit the Outer Banks situation quite well. We may therefore write the following rule to precede (18), simpler than rule (17'), where the tense-switching is conditioned by the nature of the following glide.

$$(19)\quad [\alpha \text{peri}] \rightarrow [-\alpha \text{peri}] \; / \; \begin{bmatrix} \overline{+\text{voc}} \\ -\text{cons} \\ -\text{back} \end{bmatrix}$$

This rule applies only to the front high and mid vowels: it does not reverse any /æ/ classes, and does not affect the back vowels at all. A more extreme exemplification of the pattern appears in Fig. 41 for Nora Herbert, 61, of Rodanthe. The differentiation of peripheral /i/ and /e/ as against /iy/ and /ey/ is carried even further in her speech. The height rule (18) seems to be suspended; instead we have a symmetrical extension of the backing rule:

$$(20)\quad [\alpha \text{back}] \rightarrow \langle -\alpha \text{xback} \rangle \; / \; \underline{\quad\quad} \begin{bmatrix} -\text{cons} \\ -\text{voc} \end{bmatrix}$$

In Fig. 41, this back exchange rule has continued until the former /iy/ is well back of /uw/. The approximation of /ey/ and /ow/ resembles that of Nellie Willis, but the glides of Nora Herbert are more distinct. Fig. 4-21 shows that her /uw/ and /ow/ glide toward [ü] a target back of center; three out of four cases are sharply distinguished from the front glides.

4.5.4. <u>Pattern 4' in the Lower South</u>. The converse of the Outer Banks situation is one in which /ey/ can move to the position occupied by /ay/ without /ay/ changing place. This occurs when /ay/ is monophthongized as in the Atlanta dialect of the Grattons (Figs. 46-49). The monophthongization holds for all speakers, but the lowering of /ey/ seems to be a relatively new process or at least shows a regular increase across age-levels. Henry Gratton, 60 (Fig. 46), has the highest /ey/; his wife shows /ey/ in a lower position (Fig. 47); and the two daughters Barbara and Gail (Figs. 48 and 49) both show a further lowering of /ey/, which overlaps the low vowels. Again we note the direction of change in the shape of the ellipse. The only speaker who shows a comparable movement of /iy/ is Gail; Fig. 49 shows a second centralized norm for the high diphthong.

In all of these diagrams we observe the strict preservation of peripheral and non-peripheral tracks. On the peripheral path we see the rising /æh/ and /aw/, and the descending diphthongs on the non-peripheral one.

4.5.5. Extensions of Pattern 4 in the Southwest. A further development of Pattern 4 can be seen in the south central Texas dialect of Jerry Thrasher, 20 (in this case Pattern 4'). Fig. 50 shows /aw/ and /æh/ rising to the front, and /iy/ and /ey/ falling on the non-peripheral track. The /ey/ phoneme completely overlaps /ay/ which is always monophthongized. Note that short /i/ is the highest vowel in the system, and that short /e/ is just behind it, very much higher than /ey/--though not as peripheral as in the Outer Banks. Thrasher's system would be generated by rules (17), (18) and (19) after the monophthongization of (ay) removes it from the Vy sub-system.

Jerry Thrasher represents one anchor point of our Southwest series. As we move west from central Texas, the vowel shift Patterns 3 and 4 steadily recede. We will examine several speakers from the transition zone where a number of Southern features give way to western ones. Before considering the chain shift patterns, we can orient a number of speakers along an independent dimension concerning the relations of /ahr/, /ɔhr/ and /ohr/. We can set up three discrete types within Texas:

<u>c</u> Central Texas	<u>cw</u> West Central Texas	<u>w</u> West Texas
/ahr~ɔhr/	/ahr/ /ɔhr/	/ahr/
/ɔhr/	/ohr/	/ohr~ɔhr/

Thrasher shows the central Texas system. He has a group of low /ahr/ words and a second group in a higher position mixed with /ɔhr/. We can find as usual a certain amount of oscillation in the relations of /ahr/ and /ɔhr/. This has led to the folk stereotype in some areas of a reversal of /ahr/ and /ɔhr/, as in rural Utah, "Put the harse in the born." In Chapter 7 we will consider evidence for such reversals, and,in particular, data from the Southwest and Central Texas on a possible flip-flop of these two phonemes.

Sonora, Texas, is located in the transition zone. Figure 51 shows the vowel system of Bud Stokes, 80, the head of a family of three generations of horse wranglers and breeders in this small town. His Vhr plainly falls into Type w, as his /ohr/ and /ɔhr/ are mixed together in high position. At the same time his /uw/ is fully fronted to the same position as short /i/, with short /u/ trailing behind. The fronting may be considered part of a Pattern 3 chain shift only in a limited sense, as /oh/ remains in mid position, and the only vowels in high back position are allophones before /r/. Both /ow/ and /ey/ are in a symmetrical upper mid position, with only a moderate tendency towards centralization of the nuclei.

Fig. 52 shows the vowel system of Bud Stokes' grandson Wade, 21. Both grandson and son are local to Sonora, and have lived all their lives in this small town. Wade shows several signs of shifting towards the Central Texas pattern. First, his back vowels before r are Type c with /ɔhr/ and /ɑhr/ both in low back position, and /ohr/ quite distinct in the upper back. Secondly, he has shifted /aw/ well forward so that some forms, especially before nasals, are identified with [æ] instead of sharing the nucleus of /ay/ as in his grandfather's system. His /æ/ phoneme is in low position, with peripheral nasals and palatal upglides for forms before fricatives.

When we examine the mid vowels in Wade Stokes' system, it is clear that there is an on-going lowering of /ey/, which now overlaps slightly with the low vowels. The /iy/ forms are quite stable in high front position, more peripheral than /i/, while /ey/ is low and central, leaving /e/ behind.

A similar pattern to that of Wade Stokes can be seen in the vowel system of Mike Graham, 14, of Sheffield, a short distance to the West (Fig. 53). His Vhr system is Type c, the same as Wade Stokes, although the less peripheral position of /ɔhr/ indicates that it may not be fully merged with /ahr/ (see Ch. 7). Pattern 3 is more fully advanced in this system: /uw/ and /u/ are both front of center. The mid vowel /ow/ is almost as front and the corresponding short vowel /ʌ/ is high and front--a feature we have not observed before. The Pattern 4 shift is strongly in evidence: /ey/ is down shifted to a tight cluster with the backest members of the /æ/ class, and /ay/ (not monophthongized) has started to move towards the back.

We can contrast this advanced stage of Mike Graham with the much more conservative system of Norbert Hoolster, 80, of Balmorhea in West Texas. Here we see a Western pattern in Type w Vhr, with /ohr/ and /ɔhr/ merged; only moderate fronting of /aw/; /uw/ and /ow/ essentially back vowels along with /u/ and /ʌ/; and no tendency towards the reversal of tense and lax in the front. The /ey/ nuclei are slightly lower than /ow/, in lower mid position, but they are located on the peripheral track along with /æhN/.

We cannot attribute the difference between Mike Graham and Wade Stokes on the one hand and Norbert Hoolster and Bud Stokes on the other to a purely internal development of the vowel system. There is considerable westward movement in Texas, and the Southern pattern may be expanding by contact and diffusion.[22] A closer study of the transition zone in west central Texas is planned to clarify this issue. The Vhr system switches abruptly in the area of Ozona, where we located several Type cw speakers, and this may be a promising region to investigate the direction of diffusion vs. internal development, if that issue can be resolved at all. We will take up some of the more westward points in the Southwest Series in Chapters 6 and 7.

4.6 A review of our findings on chain shifting

In this chapter we have presented evidence from a wide variety of English dialects: all of these dialects conform to the regular principles of chain shifting stated in the first section. These samples are not as systematically constructed as in the New York or Detroit studies. We have shown in each case a succession through age levels, drawn from members of the same family in many cases, which suggest the presence of change in progress. But whereas Chapter 3 clearly demonstrated the existence of change through age levels of the population, in this chapter we are not primarily concerned with whether the systems are actually in the process of change or not. The distribution through age levels may reflect a process of age grading in part; in some areas the diffusion of a neighboring pattern or the influence of the standard language/ and for some cases (the fronting of /uw/) the most advanced forms are shown by older as well as younger speakers, especially in England. Our main concern here is to show the direction in which the vowels have moved or are moving in relation to the earlier forms, and relations between parts of the vowel system which necessarily hold in the course of such movements.

We cannot avoid some conclusions on the existence of change in progress through these dialects. Whereas the fronting of /uw/ and even of /ow/ is an older pattern, in many areas, the complete lowering of /ey/ does not appear in the speech of any of our oldest subjects, and reaches a low position only with young speakers. Throughout the South there is strong evidence for the advance of Pattern 4, which seems to be a later development than Pattern 3.

At this point it is appropriate to ask in what way the writing of phonological rules contributes to the investigation of sound change in progress. The major principles can be stated without such formulations, as we have done in 4.1, and the formal notations necessary to express some developments in a single schema are quite complex.

The rules in this chapter govern only isolated sections of the phonological system. But they appear to be applicable to a wide range of dialects. The formal summary of vowel relations in a single rule forces us to look at the full extension of these processes, and the possible existence of parallel or related movements. Rules (9), (12) and (18) each describe a very large part of the vowel system, and justify the application of the term "Pattern 3" and "Pattern 4" to the movements we have been describing as isolated elements.

The further development of these rules depends upon closer examination of the contextual conditions which favor fronting, backing or lowering, in the manner of Chapter 3. The study of such environmental conditioning has proved quite fruitful in the case of the Pattern 2 shift of the northern cities, where we observed in Buffalo the importance of the relations of final apicals and velars to the direction of movement. Even in this area our investigations are still preliminary, for we find a mixed situation in Detroit, which we have not yet fully resolved, and we can certainly not claim the same degree of confidence in our conclusions as those we have drawn from the study of (æh).

As we develop a more detailed view of the internal constraints on chain shifts, we will be able to establish more clearly what movements are "the same" in the sense that they are governed by the same rules. The model for such a linguistic argument is developed in our study of the contraction and deletion of the copula (Labov 1969) where the same set of variable constraints was found to operate upon both rules.

We have written rules which utilize the governing feature [±peripheral]. In many cases it would be simpler to return to the abstract category of [±tense], which we may need in any case at a higher level of abstraction. Thus the Outer Banks pattern may be written in terms of a reversal of tenseness rather than peripherality. But we have not yet solved the problem of the relations between tenseness and peripherality in the central vowels, since some of the fronted /ow/ forms may have features we would like to subsume under [+tense]. Until this problem is solved, we prefer to adhere to the use of the peripherality feature which has the major advantage of being derived directly from the study of spectrographic data.

4.6.1. <u>The shape of phonological space</u>. In Chapter 3 we advanced a definition of peripherality which was oriented only towards the front edge of the perimeter of phonological space. In this chapter we have used [+peripheral] freely in relation to the upper, back or lower boundaries of that space, without developing formal expressions for that distance. There are several open questions on the shape of this perimeter. We still do not know what portion of the low vowel area should be considered [+peripheral], a problem which came to a head in dealing with the Northern shift. Nor do we know whether there is a movement among the low vowels which can be considered merely fronting or backing without any component of raising or lowering. If there is a maximally low vowel in the system, then any movement from that point of a peripheral vowel would necessarily be either front raising or back raising.

Our earlier impressionistic studies of New York City assumed that the backing of /ah/ from [ɑ] to [ɒ] was independent of the raising of /oh/. But our spectrographic studies have corrected this error, and it appears clearly in Chapter 3 that the chain shift /ah/→/oh/→/uh/ is a linear raising; it does not pass around "the corner" as we have represented Pattern 3. The system of distinctive features which shows [a]→[ɒ] as an increase in gravity or backness, and the movement of [ɒ]→[u] as an increase in height is inadequate to describe such chain shifts. It forces us to develop complex α,β relations, even though the spectrographic data shows a single movement along the back perimeter of the vowel system in the F1/F2 plots.

The acoustic display of phonological space in our diagrams may itself be misleading in showing a triangular pattern. The high back corner is sometimes lower than the high front corner of this space, as in the South (Fig. 46), or level with it (Fig. 47), or sometimes higher (Fig. 49) even within the same family. Nevertheless, the few studies that have been made of tongue position show that there is no high back corner; there is instead a steady upward progression from low back to high front in an elliptical shape. This is the pattern shown in Jones (1962) and in the study of tongue height in Ngwe reported by Ladefoged (1972) (reproduced here as Fig. 4-22). If the dialects we are dealing with show this type of articulatory configuration, it would follow that the movement of a vowel from [a] to [u] to [ü] is a continuous increase in height, and it will not be necessary to construct rules of the complexity of (7), which switches features in the middle of the chain. It would then follow that Principle III is only an extension of Principle I, and the raising of [a] to [u] and [u] to [ü] would be dictated by the same principle. Principles I and III share the same compelling character. It is plausible that they are really the same principle and that all chain shifts are governed by it. We have seen relatively few examples of Principle II applying to short vowels, and there are numerous contrary movements of individual short vowels which follow behind the long vowels in chain shifts. Most of our Principle II cases apply to the lowering of diphthongal nuclei, and may be governed by a more general principle of <u>nucleus-glide differentiation</u>. That this cannot be an absolute principle of chain shifting is clear from the the fact that /aw/ moves beyond the optimally differentiated [æu] and /ay/ moves past optimal [ɔi] as we have noted above. But once a nucleus reaches peripheral position it is subject to Principle I, and if we make nucleus-glide differentiation subordinate to this higher principle, further motions of the system are predicted.

Such a simplification of our current statement of three principles of chain shifting rests on the possible revision of our present view of phonological space. It is not likely that we will be able to accumulate data on tongue position for the various vernaculars we have been studying. One way to investigate the problem is to obtain measures of tongue height from a few individuals and then study the range of their vernacular with acoustic measures. By extrapolating from a small series of such relations we may be able to infer the tongue height configurations which underlie the acoustic data presented here.

4.7. Restatement of the phonological rules for vowel shifting.

In the course of Chapters 3 and 4, we have outlined a series of phonological rules which condition or generate the sound changes recorded in our spectrographic analyses. As the discussion proceeded, it became increasingly evident that the feature of peripherality played a crucial role in these rules. The abstract category of tenseness is still required at this higher level, differentiating consonants as well as vowels. But the intervening construct of peripherality is required to relate the rules of sound change to the acoustic facts. When first introduced, this is a binary category, similar to other binary features which seem to be indispensable at the more abstract levels of phonological organization, such as those which govern the tensing rule (page 48). But it was apparent that most ongoing sound changes must be recorded as movements in a continuous phonological space, rather than independent binary (or trinary) dimensions indicated by the ± notation. In particular, the dimensions of high-low and front-back must be charted on a continuous scale in order for us to incorporate the data on vowel shifts into our rules.

In the following re-statement of the phonological rules, we will introduce conventions for converting the abstract, binary feature system into an n-ary system which in turn may be regarded equally well as discrete or continuous. A first step will be to set up a five-step scale of height, including semi-vowels, in order to account in an economical fashion for the vowel shifts which have already been completed. The variables needed to register these rules may refer to discrete values of height and frontness for completed changes, but to continuous or discrete values for ongoing changes. The notation we will adopt will be neutral to the decision on discreteness or continuity, since the integral values of height may be subdivided to any degree within the rule framework. The influence of sex, age or social membership may eventually be registered as variable constraints upon rules with discrete applications or as continuous variables in a continuously varying rule output.

In the presentation of sound changes so far, we have begun with a generalized English representation which postdates the Great Vowel Shift. Thus the vowels of see, say and sigh have been classified as /iy/, /ey/ and /ay/ without regard to the phonetic forms actually occurring in the dialects being studied.

It is an open question as to whether the underlying representation for all such vowels should be /ē/, /ā/ and /ī/ respectively, as Chomsky and Halle 1968 present them. Wang (1968) and Krohn (1969) argue that only those words involved in alternations with lax members, such as divine and divinity, should show such abstract representations in the underlying form, and others should be entered with forms closer to surface representation such as we have used. Chomsky seems to recognize himself that children in their formative years may have access to only a small proportion of the Romance vocabulary that most strongly supports the vowel shift rules (1964).

Without attempting to resolve this issue, we will begin our phonological representation with the more abstract underlying forms in order to show the consistency and homogeneity of the vowel shift rules, past and present. Our system of rules presents a model which shows how a speaker would reconstruct the completed vowel shifts from the evidence he can observe around him in ongoing shifts (such as the stylistic shifting of /ey/ in London and Atlanta, or /ow/ in Philadelphia and Norwich). It is not intended as a claim that speakers actually do reconstruct these forms since we lack the controlled experimentation which would argue this important point. The theoretical model put forward is consistent with the notion of "anywhere" rules as they operate in the lower level rules of condensation shown in Labov et al. 1968 and Stampe 1972. One model of economy or simplicity is to insist that a given rule apply only once, and arrange the ordering or cycling to insure that this is the case. An opposing view, which we adopt, is that the most efficient way to use rules is to apply them at each stage of the derivation that they seem applicable, much as a carpenter may pick up a plane, chisel, rasp and file whenever they are needed. The difficulty here is that the rules take slightly different form in successive cycles, primarily because in current dialects we tend to have few tense vowels and many lax nuclei, as opposed to the sixteenth century when the opposite situation seems to have prevailed.

Another way to view the rules proposed below is in the light of Stockwell's proposal that our phonological rule system should reflect the reality of historical developments if there are no contradicting synchronic facts (1966). The rules for the Great Vowel Shift proposed here fit in precisely with the spirit of Stockwell's proposals for a [-peripheral] assignment to the nuclei of *bite* and *bout* (see 4.8.2.2). Our rules differ from Stockwell's in that [-peripheral] does not mean [+central] or [-front, -back]. Our view of peripherality, based upon the acoustic study of current changes and a considerable body of historical evidence to be presented in Chapters 4 and 6, shows it to be a feature subordinate to frontness and backness, and that this appears to resolve effectively the contradiction between Stockwell and Chomsky (4.8.2.3 below).

Furthermore, our proposal for a historically realistic model of English phonology is based upon the empirical observation that the historical principles are repeating themselves. We find that speakers of a great many dialects are continually exposed to vowel shifts in their daily life which reiterate a great part of the earlier vowel shift, and so make such rules intelligible in their own grammars. We do not deceive ourselves into thinking that we know exactly what rules speakers do use or what relations they perceive, any more than we argue that our view of the history of the Great Vowel Shift is an established experimental fact. The recapitulation of the earlier vowel shift presented here will form the basis of our review of historical treatments in the following sections, in which we hope to use the present to illuminate the past, yielding a most probable view of what did in fact take place, without claiming the same certainty that we can achieve in dealing with the unlimited data of the present.

4.7.0. *The feature system*. The features which define English vowels in the most abstract representation that we will use are presented below.

	i	e	æ	a	ɔ	ʌ	o	u	y	w	h
voc	+	+	+	+	+	+	+	+	-	-	-
cons	-	-	-	-	-	-	-	-	-	-	-
high	+	-	-	-	-	-	-	+	+	+	-
low	-	-	+	+	+	-	-	-	-	-	-
back	-	-	-	+	+	+	+	+	-	+	+
round	-	-	-	-	+	-	+	+	-	+	-
tense	±	±	±	+	±	-	±	±	+	+	-

In this matrix, redundancy rules have supplied values of rounding, tenseness, etc., where they are not specified by the original distinctive features. The [±tense] indicates that there are two vowels in the system, one [+tense] and the other [-tense]. We show lax /ʌ/ as a basic vowel, and do not attempt to derive all /ʌ/ from short /u/ by the vowel shift rule (Chomsky and Halle 1968:203). The only productive alternation between tense /ū/ and /ʌ/ is before nasals, and we will assume here a special rule which unrounds and lowers /u/ before nasals.[23]

No diphthongs are shown in this matrix. For the dialects we have studied, we can note that there exist combinations of the following vowels with glides in the underlying representation:

ɔ̄y (boy, Lloyd, etc.)

āw (hawk, caught, talk, all, etc.)

yū (cute, beauty, new, tune, etc.)

In some dialects, such as Norwich, the independent status of the yū diphthong is in question, since the glide has disappeared in all environments, and there is extreme fronting of boot as well as beauty. Among the dialects we have studied, Norwich is also unique in having preserved two earlier diphthongs which have disappeared entirely elsewhere:

ɔ̄w (snow, row, tow, roll, etc.)

ǣy (say, maid, day, etc.)

As we have seen, the class of /ɔ̄w/ in Norwich is radically different from /ō/ in toe, roe, pole, etc. Trudgill also shows (1971) that older speakers preserve the distinction between maid and made, and that even younger speakers can do this in imitating the older dialect. There can be no doubt that different English dialects will require different underlying representations, and that a pan-dialectal grammar would necessarily have many sub-inputs as well as sub-rules.

The historical reflex of long open o in caught, hawk, etc., may very well have been a diphthong /aw/ with a lax nucleus. But there is no synchronic justification for deriving our current vowels from such a diphthong, since all current phonetic forms in this word class seem to show a peripheral or tense nucleus. Thus the Southern dialects which retain the back upglide show phonetic forms such as [ɒ:°], and the various long and ingliding vowels in other dialects all show tense or peripheral nuclei. Our input matrix shows only a tense /ā/, and the diphthong that we begin with is accordingly /āw/. The output of the vowel shift rule P7 will generate a diphthong with a non-peripheral nucleus, /aw/, which will remain distinct from /āw/ even before the /āw/ is backed, raised and monophthongized.

All of the diphthongs in our present input matrix have tense nuclei. All but yū are of the form V̄G, a tense nucleus followed by a glide. The vowel shift rule will be constrained so that it does not apply to V̄G, and a prior rule will front the nucleus of yū to a central position so that it too is exempted from the vowel shift which will apply only to front or back vowels.

The first steps in generating the phonetic outputs of modern dialects will be a series of three conversion rules: these will first elaborate the binary dimension of backness by converting [-back] to [+front]. The position which is [-back, -front] is then [+central]. This [+central] feature already appears in the underlying representation of /r/, opposing it to the [-central] lateral /l/; [+central] will be needed for [ə] which differs from [r] only in being [-consonantal] instead of [+consonantal] (at least in most American dialects). The [+central] feature will also be needed for other central vowels such as [ɨ] and [ʉ]. Furthermore, the central position of [a] becomes a crucial element in the highness conversion rule as we convert the abstract set of orthogonal binary dimensions into a facsimile of the curved triangular phonological space in which vowel shifts take place.

(P1) Backness conversion

$$[-\text{back}] \rightarrow [+\text{front}]$$

(P2) Centralization

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

There then applies a redundancy rule which fills in the obvious fact that central vowels are neither back nor front.

$$(R_1) \ [+\text{central}] \rightarrow \begin{bmatrix} -\text{back} \\ -\text{front} \end{bmatrix}$$

We have now converted backness into a three-way distinction comparable to the three-way resolution of height into [±high] and [±low]. Although this does not make optimal use of two features, it is a useful device when the two extreme members are to be opposed to the central one; and given the more limited use made of the front-back dimension as compared to the high-low dimension, it serves as an appropriate framework for the rules to follow. The high-low dimension cannot be adequately handled by this machinery, however, and the next step is to elaborate it into a five-member linear scale.

The first step in such a system is to establish a reference point of maximum height for the vowel system, which of course is the target point of the upgliding vowels. Semi-vowels are included in the dimension of height by rule $P3_o$ which states that all non-consonantal segments are (no more than) 4 high. We then have P3 which progressively lowers the height of all vowels according to the features associated with them. P3 is an abbreviation for four rules which apply once to each vowel if the given environment is present.

($P3_o$) [-cons] → [4high]

(P3) Highness conversion

$$[z\text{high}] \rightarrow [z\text{-1 high}] \;/\; \left\{ \begin{array}{l} \overline{[+\text{voc}]} \\ [-\text{high}] \\ [+\text{low}] \\ [+\text{cen}] \end{array} \right\}$$

Rule P3 thus creates from a miscellaneous collection of four features the following series:

y,w	4high
i,u	3high
e,o	2high
æ,ɔ	1high
a	0high

The low central vowel /a/ is thus the lowest vowel of this triangular system. P3 applies of course to lax as well as tense vowels. No mid-central vowels have been created yet, since vowel reduction has not applied, nor has /r/ been vocalized. (The underlying representation of bird is still /brd/.)

The third conversion rule follows naturally from the findings of Chapter 3 and 4 above: tenseness is represented by peripherality.

(P4) Tenseness conversion

$$[\alpha\,\text{tense}] \rightarrow [\alpha\,\text{peri}] \;/\; \left[\frac{\qquad}{-\text{cons}}\right]$$

This of course applies to vowels and glides and not to tense consonants. The upgliding semivowels y,h are redundantly tense; they aim at (or begin from) a peripheral position. On the other hand, the ingliding semivowel /h/ is lax and glides to a central position. For the other vowels, 3high and below, Rule P4 creates two sets, located in the peripheral and non-peripheral positions of phonological space.

Before the high vowels are diphthongized, we will need a rule which converts the nucleus of yū to a central position, yielding a yʉ̄ form which is close to the phonetic output in many current dialects. The central position of the yʉ̄ nucleus will exempt it from the three following rules: the first diphthongization, laxing of diphthongal nuclei, and the vowel shift. Chomsky and Halle (1968) exempt the reflex of this vowel from the vowel shift by deriving it from a back unrounded vowel ɨ̄, and limiting the shift to those vowels which agree in backing and rounding. But the same end can be achieved by less artificial means, following the historically realistic path of fronting ū after y. There is some doubt as to what form this vowel took in the centuries following the borrowing of the French u. Modern dialects vary in showing an onset /i/, /y/, or none at all, but the second part of the vowel shows a second formant which is consistently higher than that for /uw/ in too and moo. Furthermore the fronter nucleus is also found in all other words with /y/ onsets such as you, youth, Yule, etc., which stem from a variety of Middle English sources. By fronting yū to a central position rather than a front [ü], we avoid the artifice of having to reverse the movement at a later time and recreate the central position characteristic of most dialects. For the many dialects which have phonetic [ü] here we will of course need a further fronting. The fronting of yū to yʉ and then yü follows Principle III. Once the high back vowels begin to be fronted without falling and remain in a peripheral position at the upper limit of phonological space, we can see the possibility of Pattern 3 instead of Pattern 1. Thus the fronting of yū may form the nucleus of the Pattern 3 movement developing in such dialects as London, Norwich, Philadelphia, the Outer Banks, Atlanta, and Texas.

But in the earliest stage of these movements as expressed in these early rules, the fronting of yū to yü is an isolated feature.

(P5$_0$) Fronting of yū

$$[+\text{back}] \rightarrow [+\text{central}] \;/\; \begin{bmatrix}\text{4high}\\ +\text{back}\end{bmatrix} \begin{bmatrix}\overline{\text{3high}}\\ +\text{tense}\end{bmatrix}$$

Rule P5 now diphthongizes high tense i and u. This rule will recur in slightly different form as a second diphthongization after the vowel shift. The linear notation now allows us to specify the glides quite simply as [4high].

(P5) First diphthongization

$$\emptyset \rightarrow \begin{bmatrix}\text{4high}\\ \alpha\,\text{back}\end{bmatrix} \;/\; \begin{bmatrix}\text{3high}\\ +\text{peri}\\ \alpha\,\text{back}\end{bmatrix} \_\_\_\_$$

Since yū is not [αback], that is, neither [+back] nor [-back], it is not affected by P5. Though yū does glide toward the back, this is an automatic consequence of the movement from the glide target to the nucleus. Some linguists have phonemicized you as /yuw/, but in the dialects we have studied, there is no evidence that the nucleus is moving towards a high back target. If we find such a case, it would mean that P5$_0$ follows P5.

We are now in a position to state quite simply the general rule for laxing of diphthongal nuclei. Like many of the rules to be presented here, it will recur in the ordered series, following the principle noted above that more economy is to be achieved by using the same tool twice rather than using two different tools once.

(P6) Laxing of diphthongal nuclei

$$[\text{2+z high}] \rightarrow [\text{peri}] \;/\; \_\_\_\_ \; [+\text{peri}]$$

The notation "2+z high" indicates vowels of height 2 or greater. (We follow the convention here as elsewhere that z may be null.) The effect of P6 is to register the slight centralization of nuclei before a peripheral element. Since only vowels or semi-vowels are peripheral, and a vowel cannot be followed by a vowel, this must be a peripheral glide--that is, y or w.[24] The only upgliding diphthongs in the system at this point are īy, ūw, and ɔ̄y (and for some dialects, æ̅y and ɔ̄w). Since the rule does not apply to 1high vowels like ɔ̄y, the only diphthongs affected are īy and ūw.

The synchronic reflex of the Great Vowel Shift can now be stated in a form comparable to the ongoing vowel shifts studied above which we attempted to capture in the general rule (18) on page 150 above.

(P7) Vowel shift

$$[z\text{high}] \rightarrow [z{+}\alpha x \text{ high}] \;/\; \begin{bmatrix} \overline{\alpha\text{peri}} \\ -\text{cen} \\ +\text{str} \end{bmatrix} \quad \begin{Bmatrix} [\alpha\text{cons}] \\ [+\text{cen}] \\ \emptyset \end{Bmatrix}$$

Condition: $0 \leqslant z{+}\alpha x \leqslant 3$

In our earlier statement, the chain shift rules simply indicated that there was a general rotation of vowels in a certain direction. For this completed shift, we can assign the correct output for each vowel.

Since _z_ appears on both sides of the arrow, the chain shift rule cannot eliminate any distinctions. If two vowels are separated by one degree of height before the rule applies, they will be separated by one degree after. Thus if there are two vowels which are [+peri] with values of [3high] and [2high], both the input and output of the rule will show them as differing by [1high].

Rules of the type of P7 apply simultaneously to all vowels which satisfy the conditions of the environment. For an α-rule, this takes place in two stages: first to all those which are [+peri], and then to all those which are [-peri]. The [+peri] vowels must be followed by a [+cons] feature, by a [+central] vowel or consonant, or by zero. This excludes a [+peri] nucleus followed by a peripheral glide _y_ or _w_, and thus eliminates ɔ̄y (and ɔ̄w) from the vowel shift. A [-peri] vowel can be followed only by a [-cons] segment, since such (short) vowels do not occur before /r/ or a [+central] vowel, or before pause. Thus the rule applies to stressed vowels of the following four cases:

a. [+peri] nucleus before [+cons]:	beet /bēt/; name /nām/ road /rɔ̄d/
b. [+peri] nucleus before [-cons, +cen]:	Noah /nɔ̄a/; yeah /yāa/ idea /iydēa/
c. [+peri] nucleus before pause:	we /wē/; toe /tɔ̄/
d. [-peri] nucleus before [-cons]:	die /diy/; now /nuw/ bite /biyt/; out /uwt/

P7 does not apply to vowels which are neither back nor front--that is, the [+central] vowels ā and ū. Since we require the [±central] feature for other purposes we obviate the need to refer to the category of [α back, α round] in specifying the application of the vowel shift.

P7 is not a variable rule like (18), but a categorical rule; as such it goes to completion. This happens in two stages: first applying to all [+peri] vowels, in cases (a-c), and then to all [-peri] vowels of case (d). The limiting conditions on the shift are shown in the condition that z+x must not exceed 3 or be less than 0. The conventions for chain shift rules are that the output quantity is maximized for the first application when α = +, and minimized for the second application when α = -. For the Vowel Shift rule P7, the first operation will take place as follows:

	α	z	x	z+x
ē	+	2	1	3
ǣ	+	1	1	2
ō	+	2	1	3
ɔ̄	+	1	1	2

For the second operation with α = -, we have the following maximal result[25]

	α	z	x	z-x
iy	-	3	3	0
uw	-	3	3	0

Another unordered redundancy rule will automatically unround /uw/ as it descends to low position:

(R2) [0high] → [-round]

A second diphthongization now operates upon the new peripheral vowels, similar to P5, but applying to [2high] as well as [2high] vowels. There are [1high] peripheral vowels at this stage, so the original peripheral ā in <u>pa</u>, <u>father</u>, etc,, may be simply excluded by substituting [-central] for the [3high] of P5.

The following rule, P9, is simply a re-application of P6.

(P8) Second diphthongization (=P5 generalized)

$$\emptyset \rightarrow \begin{bmatrix} \text{4high} \\ \alpha\,\text{back} \end{bmatrix} \;/\; \begin{bmatrix} \text{-cen} \\ \text{+peri} \\ \alpha\,\text{back} \end{bmatrix} \;\_\_\_\_$$

(P9) Laxing of diphthongal nuclei (=P6)

We then have the normal vowel reduction rule, which is the last rule in the sequence of SPE (Chomsky and Halle 1968: 245).[26]

(P10) Vowel reduction

$$\begin{bmatrix} \text{-stress} \\ \text{-voc} \\ \text{-cons} \\ \text{-peri} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+central} \\ \text{2high} \end{bmatrix}$$

P10 concludes the first section of the phonological rules, dealing with those processes which are more or less completed and uniform for most dialects. There are many exceptions to this generalization, even in the dialects we have studied here. In many positions, P8 and P9 have not applied to many vowels in many positions in the Northern cities, and of course in northern England, Scotland and Ireland to an even lesser extent. P7 has not been applied to the high back vowel in a number of Scottish dialects, and where it is still variable it ranges between [1high] and [2high]. The lowering of the non-peripheral front nucleus from /iy/ to /ay/ is also incomplete in many areas, and for such dialects, it will be necessary to show the [-peri] section of P7 with variable constraints. Bailey 1970 gives a detailed account of such incomplete stages for this part of the rule in the north of England, and also suggests that the centralization of /ay/ and /aw/ in Martha's Vineyard be seen as a constraint on the original vowel shift rule rather than a reverse movement. But we have already observed that P7 is a categorical rather than a variable rule, and if we want to limit it in this way it will be necessary to differentiate the categorical behavior of P7 with tense nuclei from its variable behavior with lax ones.

Conventions for combining categorical with variable components of a rule have already been established in the form of the * notation. Thus we might write for one stage in the Martha's Vineyard development:

$$(P7_{MV}) \quad [z\text{high}] \rightarrow \langle z{+}\alpha x \text{ high}\rangle \;/\; {*}\langle \alpha\text{peri}\rangle \begin{bmatrix} -\text{cen} \\ +\text{str} \end{bmatrix} \left\{ \begin{array}{l} \langle \alpha\,\text{cons}\rangle \left\langle \begin{array}{c} -\text{tens} \\ \# \end{array} \right\rangle \\ [+\text{cen}] \\ \emptyset \end{array} \right\}$$

Condition: $0 \leqslant z+\alpha x \leqslant 3$

In this notation, the * symbol indicates that the rule goes to completion if α is present, i.e., if $\alpha = +$. (We need not repeat the * for the other instances of α.) In the reverse case, when $\alpha = -$, the rule is variable as indicated by the angled brackets around the output of the rule. In the case that $\alpha = -$, and the element following the vowel is [-cons], i.e., a glide /y/ or /w/, then there are two variable constraints following the rule: the lowering of the nucleus of /ay/ and /aw/ is favored by a following lax (voiced) consonant, or a following inflectional or word boundary. Thus the least lowering is found in right and out, the most in side and sigh, loud and allow. This rule has the advantage of integrating the vowel shift rule P7 into current sound changes; but the details of current developments may be difficult to insert into the abstract vowel shift rule in their full complexity. (See Labov 1972 for spectrographic data on the Martha's Vineyard developments originally reported in Labov 1963.)

In any case, it will be necessary to constrain the [-peri] section of P7 in regard to /ū/, since the rule does not apply in any dialect before labial consonants. It is also suggested by Stockwell (1966) that the rule should be prevented from applying when /y/ or /w/ precedes /ū/. Not only do we have you, youth and Yule, but we also have woo, wound and swoon. The later constraint is not quite as general, however, since the preterit of wind is shifted to /aw/. The force of the /y/ constraint is already accounted for by P5, above, and the cases of woo, wound and swoon might well be shown with an underlying /ō/. The rule cannot be generalized to show that any semi-vowel inhibits P7 since /h/ permits the rule. When the /y/ is present in Houston, we have no vowel shift, as in Houston, Texas; when it disappears, as in Houston Street of New York City, we get /hawstən/.

With these exceptions, the application of rules P1-P10 gives us the starting point from which most current sound changes begin, and also the model on which the later rules are based.[27] Thus P1-10 generate the /iy, ey, ay, uw, ow, aw, etc./ of our charts. At this stage there are very few tense or peripheral vowels left in the system; the next three sub-sections of the rule system generate new peripheral nuclei which turn out to be the ingliding /oh/ and /æh/, /ihr/, /ih/, etc. It is a notable fact that these new tense vowels are all ingliding instead of monophthongs: the existence of the upgliding diphthongs seems to condition this development (see Chapter 5). It is possible that the distinction between monophthongs and upgliding diphthongs is too small to be maintained reliably for mid and especially high vowels. Thus the distinction between [i:] and [ɩj] may not support two major phonemic categories. But there is no problem in the differentiation of /iy/ vs. /ih/ in the form of [ɩj] ~ [i:ə]. The opposition is then tense→lax vs. lax→tense diphthongs, which may be seen quite clearly in the New York City opposition of /ow/ and /oh/ as [ʌ^{o}] vs. [o:ə].

To generate these new tense vowels, we first have rules for the development of new low back tense nuclei, then the front set, and then the vocalization of /r/ and renewed tensing before schwa. We will first present the rule sequences for New York City and then for other dialects discussed above.

4.7.1. Formation of new tense vowels. The modern class of "long open o" vowels in caught, law, talk, all, wash, etc., was formed by a miscellaneous set of processes and it seems quite unlikely that all of the various sub-sets can be reconstructed from a synchronic viewpoint. Nevertheless, we will present a rule which can be seen as operating in a pan-dialectal grammar that would include most English and Southern states dialects as well as the Northern states, Midland, etc.

There are basically five historical sources for long open o: (1) a diphthong /aw/ in caught, walk, all, etc.; (2) short ŏ in off, cloth, lost, etc.; (3) short ŏ before /r/ in or, cord, etc.; (4) short ă under the influence of a preceding /w/ and following /r/ in war, warn, etc.; and (5) short ŏ before back nasals in song, wrong, etc. These are all lax vowels, and are not affected by the vowel shift rule P7, but the following rules create from them a new low tense vowel to replace the /ɔ̄/ in boat, tone, etc., which rose to [2high] under P7.

Historically, the nucleus of /aw/ was short, but it is best entered into our matrix with a tense nucleus /āw/. In many Southern dialects, we have a current form [ɒ:^{o}] with a peripheral, low-back nucleus and a back upglide. Otherwise, we have some form of a long or ingliding vowel with a peripheral back nucleus, [ɔ:], [Ω:^{ə}], [o:^{ə}], etc.

The nucleus of the current diphthong might well be shown as tense, then. There is no other reason to posit a lax /a/ in our input matrix, and this vowel is accordingly shown as [+tense] only.

The first step in the monophthongization of /aw/ is therefore a backing and raising of the peripheral nucleus to generate the Southern forms.

($P11_0$) Backing of /āw/

$$[0\text{high}] \rightarrow \begin{bmatrix} +\text{back} \\ 1\text{high} \\ +\text{round} \end{bmatrix} \; / \; \begin{bmatrix} \overline{} \\ +\text{peri} \end{bmatrix} \; \begin{bmatrix} 4\text{high} \\ +\text{back} \end{bmatrix}$$

The nucleus is rounded as it is backed and raised. This rounding is not as distinctive at [1high] as it is at [2high], but it is regularly recorded in phonetic transcriptions of Southern dialects (see Kurath and McDavid, 1961, Map 23). The next step is the monophthongization of the vowel by the loss of the glide, a rule which operates in most of the dialects we have studied.

(P11) Monophthongization of /āw/

$$[4\text{high}] \rightarrow \emptyset \; / \; \begin{bmatrix} 1\text{high} \\ +\text{back} \\ +\text{peri} \end{bmatrix} \; \underline{}$$

We can now consider the various other sources of the complex modern class of long open /ɔ̄/. There is no single rule that can be written for this process, since modern dialects differ drastically in the lexical composition of this phoneme. British dialects generally preserve short ŏ intact; in the United States, Eastern New England and some coastal Southern dialects such as Charleston do the same. But most American dialects show various shifts of short ŏ words into the /ɔ̄/ class, with different assignment of phonetic subclasses as well as considerable lexical variation. American dialectology has been very much concerned with the distribution of such words as <u>tomorrow</u>, <u>borrow</u>, <u>sorrow</u>, <u>coral</u>, <u>moral</u>, <u>hog</u>, <u>log</u>, <u>frog</u>, <u>gone</u>, <u>on</u>, <u>song</u>, <u>wrong</u>, <u>wash</u>, <u>watch</u>, <u>cough</u>, <u>broth</u>, etc. Since there is so much lexical variation, it is quite unlikely that any given speaker utilizes a rule to generate the class of long open /ɔ̄/; it is more likely that he assigns dictionary entries to individual words as /ɔ/ or /ɔ̄/. Nevertheless, the process is of considerable interest to us since the phonetic environments which govern this assignment are strikingly parallel to those which appear in the tensing rule for short ă in Chapter 3 (see rule (4), page 48).

Following voiceless fricatives and nasals are the primary conditioning factors in the tensing of ŏ, along with following /r/ (which does not appear after /æ/). As Ferguson has noted (1968), these are the same general classes that govern the broad /ā/ class of <u>pass</u>, <u>bath</u>, <u>aunt</u>, etc. We have observed that the effect of vocalized /r/ is to create tense nuclei, since /ahr/ participates in a chain shift with the other back tense and ingliding vowels in New York City and elsewhere; and is generally associated strongly with the broad /a/ class. It is not surprising then to find that voiceless fricatives, nasals and vocalized liquids are the primary conditioning factors in the formation of the /ɔ̄/ class. The nasal which has the strongest effect on /ɔ/ is /ŋ/ rather than the front nasals /m,n/; this is quite natural since we have seen that /ŋ/ produces a lower F2 on a preceding /æ/; similarly, we find that the effect of liquids is strong in the development of tense (peripheral) back vowels, but weak in the front, since their general effect is to lower second formant position. This produces less peripheral vowels in front and peripheral vowels in the back. The effect of a following /l/ has been registered here as the result of a development of a /w/ glide in <u>talk</u>, <u>all</u>, etc.; but it is also possible that /l/ has a direct effect in lengthening and tensing the vowel.

A rule for generating the /ɔ̄/ class will be a tensing rule parallel to rule (4) of Chapter 3. The rule of Tenseness Conversion P4 has already operated to change the feature [+tense] to [+peripheral]; but P12 will re-introduce the [+tense] feature rather than convert /ɔ/ directly to [+peripheral]. This is a rule of lexical assignment which shows the same kind of lexical diffusion and grammatical conditioning that we find in P4; it also operates at a much more abstract level than the phonetic rules which govern the degree of peripherality. Abstract rules such as the tensing rule are typically organized in terms of binary features; e.g. [±anterior] rather than the continuous features of height or peripherality. The particular form of short ŏ tensing which we will show here is that which operates in New York City.

($P12_{NYC}$) Tensing of short ŏ

$$\begin{bmatrix}\text{+back}\\ \text{lhigh}\end{bmatrix} \rightarrow [\text{+tense}] \;/\; \underline{\qquad} \left\{\begin{array}{ll} \begin{bmatrix}\text{+anc}\\ \text{+cont}\\ \text{+tense}\\ (\text{+cor})_i\end{bmatrix} & (C_0\ \#)_i \\ \begin{bmatrix}\text{+nas}\\ \text{-ant}\end{bmatrix} & \begin{bmatrix}\text{-voc}\\ \text{-tense}\end{bmatrix} \\ [\text{+cen}]\ \ (\#(\#)) & \left\{\begin{array}{c} C \\ \emptyset \end{array}\right\} \end{array}\right\}$$

The first part of P12 applies to short ŏ before anterior continuants, that is, the voiceless fricatives--/f, θ, s/ but not /ʃ/. Words such as off, often, coffee, cloth, moth, toss are affected. But if the voiceless fricative is coronal, e.g., /s/ and /θ/, the rule applies only in monosyllabic morphemes. Short ŏ remains lax in roster, hostile, gossip, phosphate, etc.[28] This is a dubious rule at best, considering the amount of lexical variation which we find, and it is doubtful if we are justified in setting up underlying forms with /ɔ/ in these words. There are only a few alternations which can be found: Pentecost vs. Pentecostal is one of the rare examples. But on the other hand, New Yorkers do become familiar with the short ŏ class through exposure to a number of other dialects which do not apply P12 (neighboring eastern New England, for example) or those that apply it to a wider or narrower range of words. P12 establishes complementary distribution between /ɔ̄/ and /ɔ/ in a number of environments and may therefore be seen as a forerunner of the ultimate collapse of the two classes in eastern New England, western Pennsylvania and the West.

As noted above, the first part of P12 does not apply to short ŏ before the [-anterior] voiceless fricative /ʃ/, so that we have phonetic [ɑ] in gosh, slosh, posh, galoshes, etc. But there is no basic vocabulary with short ŏ before /ʃ/; these are all relatively new formations, affective words, etc., and are comparable to exceptions to the application of P12 to short ŏ before /θ/; such as Goth and Gothic. Rule P12 applies regularly to more frequent words that are learned earlier in life, but less reliably to learned and marginal words, borrowings, proper names, shortenings, etc. This applies with even more force to the second part of P12, involving the velar nasal.

The second environment shows /ɔ/ tensed before the velar nasal /ŋ/ followed by a voiced obstruent (which must be a stop), so that we have a tense vowel in all the common words: long, wrong, song, and strong. But in New York City, short /ɔ/ remains in the less common thong, ping-pong, King Kong, bong and bongo.[29]

The third part of P12 is a very general rule which establishes tense /ɔ̄/ before /r/. In all our spectrographic studies to date, we find that the nucleus of back vowels before /r/ is further back (e.g., with lower F2) than most other back vowels. In P12 this vowel is established as tense: the second tenseness conversion will make it more peripheral than other vowels. The effects of these rules will remain even when /r/ is vocalized and the vowel is apparently indistinguishable from the inglide of Noah, law, etc.

It is commonly observed that initial /w/ affects /a/, moving it to the back so that war and warning are pronounced with the same vowel as or and ornament. It is not clear whether there is any synchronic justification in the dialects we are considering for retaining warn in the dictionary with /a/. In New York City, there is no contrast between /ɔr/ and /or/; the two fall together in high position as the variable (oh), and words spelled war- join them. In dialects where /ɔr/ and /or/ are distinct, the war- words fall together with /ɔr/. In dialects such as Southwestern Utah where /ar/ and /ɔr/ are reversed, we find war- words associated with /ɔr/ (see Chapter 7). We therefore do not enter into P12 the effect of w- on the rule, since this change of lexical assignment seems to be completed. For wa- words with other following consonants, the influence of w- seems to be variable in New York City. Thus we have a tense vowel in water, but a lax one in wash and walrus, where neighboring communities in northern New Jersey show a tense vowel in all three. This kind of lexical variability cannot be registered in the kind of variable rules we have been considering here.

There are thus a number of lexical additions to P12: not only water, but also gone, dog, etc., in contrast with wattle, on, hog, etc. These tense exceptions are best entered into the dictionary with underlying /āw/. P11 will then apply to them instead of P12; after P11 and P12 apply, we have /ɔ̄/ in talk, all, caught, off, loss, cloth, wrong, song, or, for, cord, four, hoarse, war, warning, etc. This forms one of the largest word classes in the New York City system.[30]

We can now enter a rule which unrounds the remaining short ŏ words, which are still /ɔ/ as indicated in the input matrix, to [ɑ]. As indicated above, this rule applies to most American dialects except for eastern New England and some coastal Southern areas. In some parts of England, it applies variably. The [ɔ ~ ɑ] opposition has been studied as a sociolinguistic variable by Trudgill in Norwich (1971, 1972).

(P13) Unrounding of short ŏ

$$[\text{1high, +back, -peri}] \rightarrow [\text{0high}]$$

A generalization of the redundancy rule R2 will automatically unround the new [0high] element and make it central.

(R2') $[\text{0high}] \rightarrow [\text{-round, +central}]$

There is no converse of this rule (R2'); if a [0high] element becomes [1high] it does not automatically become [+back] or [+round]; on the contrary, it is common for a [0high] element to become centralized directly to [ɒ] at [1high] or [ə] at [2high]. We therefore have to specify rounding and backing with raising from [0high] as we did with $P11_o$.

For some dialects, we would want to use P13 to bring about the last stage of the lowering of /uw/ by the vowel shift rule P7. But for New York City, this treatment would lose the obvious symmetry which gives us the nucleus [a] for both the new /ay/ and the new /aw/. For a number of the dialects we have studied, P7 is completed even when the original /ɔ/ remains rounded and does not descend to [ɑ]. There are also cases where the reflex of M. E. ū does not descend all the way to /aw/, but stops at /ɔw/. There is no conflict here with the raising of /āw/ to /ɔ̄w/, since this follows the peripheral track, and the lowering of original /uw/ to /ɔw/ takes place along the non-peripheral path.

The creation of the new tense vowel in the front--/æh/--is now accomplished by the tensing rule first presented as (4) of Chapter 3, and given here in the notation of rule P3.

($P14_{NYC}$) Tensing of short ǎ

$$[1\text{high}] \rightarrow [+\text{tense}] \;/\; \begin{bmatrix} \overline{} \\ -\text{W} \\ +\text{front} \end{bmatrix} \left\{ \begin{matrix} \begin{bmatrix} +\text{nas} \\ +\text{ant} \end{bmatrix} \\ \\ \begin{bmatrix} \alpha\,\text{cont} \\ \alpha\,\text{tense} \end{bmatrix} \end{matrix} \right\} \left\{ \begin{matrix} \# \\ [-\text{son}] \end{matrix} \right\}$$

The many exceptions and irregularities in this ongoing process noted in Chapter 3 seem to give added justification for our writing the first part of P12. There is an obvious central core or regularity here, along with the many variable and irregular aspects of the rule, and it is clear that we should attempt to capture this central core in a phonological rule. We are now ready to apply the second tenseness conversion and the adjustment to peripherality which were developed in Chapter 3. The question may arise again as to why this should be necessary: given the success of the feature [+peripheral] in controlling and predicting the direction of the vowel shift rule P7, etc., why should it be necessary to re-introduce tenseness in rules P11-P14?

While it would be simpler to generate all the rules of this section with the feature [+peri], we will require the more abstract feature of [+tense] to account for the clear separation of the two classes created by rule P14. After peripherality is limited by following velars, preceding liquids, etc., we find that there is considerable overlap in the peripherality of the tense and lax classes in bag vs. back, etc. For example, in Figure 3-1 we see that the nucleus of asked is considerably less peripheral than back. In Figure 3-3, the nuclei of bad and chance are further away from the outer envelope of the vowel system than the two cases of lax /æ/ before [ŋk] and [ks] at the bottom of the vowel system. Once the raising rule has effected a clear separation between (æh) and /æ/, there is no problem in the relatively central position of words like grab and brag. But in the early stages, when (æh) and /æ/ occupy a continuous range of phonological space, as in Figs. 1 and 2, it appears that peripherality alone cannot distinguish tense and lax classes. The following peripherality rule P15 would separate the two, but the peripherality limitation rule P16 would recombine them. It may be true that the various subclasses are still relatively peripheral and less peripheral: that is, flag is more peripheral than flak. But the two classes may also be distinguished by length, formant contour, etc., in ways that remain to be determined. At present we only know for sure that peripherality limitation does not lead to confusion of the tense and lax classes which afterwards separate under the raising rule, itself controlled by peripherality. We conclude therefore that the abstract feature [+tense] is still required to express the stability of this separation of the classes of bad, ask, dance, from bat, castle, and hammer in New York City. The same argument may apply to the back vowels when the conditioning of this class is investigated in more detail, and we therefore write P11, P12 and P14 as tensing rules to be followed by the second tenseness conversion P15. The use of P4 here again as P15 suggests that it is a redundancy rule which applies at all times. But the cautions expressed elsewhere about the limitations of P4 hold here. We have not yet created any stressed mid-central vowels in the system, but when we do, P4 would have to be modified. It is therefore economical to use P4 again as it is.

($P15_o$) Second tenseness conversion = P4

We must next differentiate among the peripherality rules as in Chapter 3. Rather than set up a separate rule for increase of peripherality before nasals and limitation before velars, etc., we can best establish that [+peripheral] is maximal, and that the various allophones are differentiated by a limitation rule. Before we can limit peripherality, it is of course necessary to convert the ± binary notation into a numerical form. Rule $P16_0$ effects this by converting [+peri] to [1peri] for the [1high] vowels. These are the only peripheral vowels in the system at this time.

($P16_0$) Peripherality conversion

$$[+\text{peri}] \rightarrow [1\text{peri}] \ / \ \begin{bmatrix} \overline{} \\ 1\text{high} \end{bmatrix}$$

The unit value of peripherality is then decreased systematically by the various constraints discussed in Chapter 3.

($P16_{NYC}$) Peripherality limitation

$$\begin{bmatrix} +\text{peri} \\ +\text{front} \end{bmatrix} \rightarrow \langle 1\text{-x peri} \rangle \ / \ \langle\langle +\text{cons} \rangle +\text{voc} \rangle \ \begin{matrix} \overline{\langle -\text{z str} \rangle} \\ [+\text{syl}] \end{matrix} \left\langle \begin{matrix} -\text{nas} \\ -\text{ant} \\ +\text{voc} \end{matrix} \right\rangle \left\langle \begin{matrix} +\text{voc} \\ +\text{cons} \end{matrix} \right\rangle$$

Condition: $0 \leqslant x \leqslant 1$

The differentiation of tense (æh) by P16 is an unusually detailed variable rule, the result of our spectrographic studies in Chapter 3. Parallel conditioning may exist in the back vowels but we do not have sufficient data. But the same rule may certainly operate to raise both of the new tense vowels.

($P17_{NYC}$) Raising of new tense vowels

$$[+\text{tense}] \rightarrow \langle y\text{high} \rangle \ / \ \overline{\langle \text{z peri} \rangle}$$

Condition: $1 \leqslant y \leqslant 3$

Thus, in both back and front, the tense vowels are variably raised, and the raising is proportional to their peripheral status. P17 is neutral to the question as to whether change is discrete or gradual. If we take height as a discrete series of steps, then it may be only two steps: 1 moving to 2, and 2 moving to 3. But if our evidence shows that height must be further subdivided, we can show a tense vowel moving from 1 high to 1.5 high, or from 1 high to 1.1 high. The use of such fractions would imply that the degree of raising is a function of time and peripherality

$$y = f(t,z)$$

But our sociolinguistic studies show that it is also a function of social class, ethnic group, style and sex (Weinreich Labov and Herzog 1968; Labov 1965). For Jewish working-class speakers, there is a variable constraint of

<+back> which favors P17; for Italian working-class speakers, it is <-back>. Rule P17 will also shift its input probability as well as the value of y as time progresses. In this general form P17 describes a process which takes place over several generations. Other rules may intervene, be re-ordered, or be deleted in the interim. As we pointed out in Chapter 3, the definition of height shifts during this period, so that for some speakers the dimension of <yhigh> concerns a decrease in F1 only, and for others it is defined as 2(F2)-F1. As y reaches [2high], the issue becomes critical as to whether (æh) merges with (ehr).

4.7.2. *Formation of new ingliding vowels*. The first rule of this series, the vocalization of /r/ may have several possible orders in relation to P14-18. The overall view shows that it is ordered after the rules which form new tense vowels, since vocalized Vhr words do not necessarily merge with these when they rise.

At this point, we must insert the very general rule that governs the development of inglides for the rising tense vowels.

(P18) $$\emptyset \rightarrow \begin{bmatrix}+\text{cen}\\ 2\text{high}\end{bmatrix} \;/\; \begin{bmatrix}+\text{peri}\\ 1+\text{high}\end{bmatrix} \;\underline{\qquad\quad}$$

Some important historical implications for P18 were indicated in 3.8. Inglides develop primarily in the course of the raising of mid vowels to high vowels. These inglides may or may not be identical with the [ə] from vowel reduction or *r*-vocalization, to be discussed in the next section.

($P19_{NYC}$) Vocalization of /r/ in New York City

$$[+\text{cen}] \rightarrow \langle -\text{cons} \rangle \;/\; \underline{\qquad\quad} \left\langle \begin{matrix} \begin{Bmatrix} C \\ \emptyset \end{Bmatrix} \\ \#\#V \end{matrix} \right\rangle$$

This Vhr then seems to merge with Vh from Va, so that *yeah* rhymes with *where* and *idea* with *fear*.[31] The crucial question is whether or not these front ingliding vowels have peripheral or non-peripheral nuclei. If the regular effect of /r/ is to lower F2, then P12 would also operate on the front vowels to make them non-peripheral while it made the back vowels peripheral. In general, *r*-pronouncing dialects show less peripheral vowels for front Vhr. But once the consonantal constriction is gone, we may have a rule like P20 operating.

(P20) $\begin{bmatrix}-\text{cons}\\+\text{voc}\end{bmatrix} \rightarrow \langle+\text{peri}\rangle$ / ______ [-peri]

The [-peripheral] element which follows another vowel may have three different sources. It may have been a lax unstressed vowel reduced to a schwa by P10; or an inglide which developed by P18; or the result of the vocalization of /r/, P19. At this level of representation, we make abbreviated reference to these long and ingliding vowels as Vh, referring to /ahr/, /ah/, /ohr/, etc., or the variables (oh), etc. The distinction between /ohr/ and /oh/ was originally a way of distinguishing the separate origins of the two word classes; but as Chapter 6 will show, these two classes continue to be distinct through the positions of their nuclei even when they have identical inglides. It will not be necessary to write /ōhr/ to indicate a tense nucleus, since rule P20 insures that all Vh will have peripheral (and so tense) nuclei. However, when we deal with the upgliding diphthongs it will be necessary to distinguish /āy/ from /ay/ and /āw/ from /aw/ according to whether the nucleus lies on a peripheral tra track.

The effect of P20 is to give us a contrast between two kinds of falling diphthongs: tense → lax and lax → tense with opposing but matched phonetic locations of nucleus and glide. Thus we have tense → lax in *law* [o:^{ə}] and lax → tense in *low* [ʌ^{o}], thus opposing /oh/ to /ow/ along this dimension.

P20 is seen as affecting /ihr/ and /ehr/ primarily, but it also operates (redundantly) upon /ohr/. The relation of /uhr/ to /ohr/ and /oh/ is quite similar to the situation of /ehr/ and (æh). For some speakers, /uhr/ remains centralized as both (ohr) and (oh) rise past it; for other speakers /uhr/ becomes peripheral and rises with the mid vowels.

The New York City system also shows a chain shift of /ah/ and /oh/, /ahr/ and /ohr/. Although rule P17 moves /oh/ upward, it may be superseded by the chain shift rule (9) of this chapter, which appears here as P21.

(P21) Pattern 3 chain shift in New York City

$$[y\text{high}] \rightarrow \langle y+z\ \text{high}\rangle \ / \ \begin{bmatrix}\underline{\quad\quad}\\+\text{back}\\+\text{peri}\end{bmatrix}$$

Condition: $1 \leqslant y+z \leqslant 3$

This rule affects four phonemes which now have peripheral nuclei: /ah/ in pa, father, etc.; /ahr/ in car, etc.; /oh/ in law, etc.; /ohr/ in more, etc. But it will also affect a new /āy/ and a new set of /ah/ drawn from a renewed tensing of short ŏ words which had been unrounded to [ɑ] by P13. All of the rules involved here show some degree of overlap; they are typical of tensing rules in that there is lexical diffusion which leads to idiosyncratic oppositions for some speakers of cod [kɑd] vs. odd [ɒːd], etc. We will therefore need a third set of rules that generate tense nuclei. The first completes the process of the Great Vowel Shift by registering the fact that the nuclei of /ay/ and /aw/ have reached the bottom periphery of the system.

$$\text{(P22)}\quad [\text{0high}] \rightarrow [\text{+peri}] \;/\; \underline{\qquad}\; [\text{4high}]$$

It cannot be stated in this simple way, however, since it does not appear to affect /ay/ before voiceless consonants. To register this fact we have to elaborate (P22) to (P22'):

$$\text{(P22')}\quad [\text{0high}] \rightarrow [\text{+peri}] \;/\; \underline{\qquad}\; \begin{matrix}[\text{4high}] \\ ([\text{+front}])_1\end{matrix} \quad \left(\begin{Bmatrix} \emptyset \\ \begin{bmatrix}\text{+cons} \\ \text{-tens}\end{bmatrix} \end{Bmatrix} \right)_1$$

The cross-referenced parentheses express the fact that if the glide is a front, then we need to limit the application of the rule to final and pre-voiced environments. A second rule affects short ŏ words before voiced consonants. The gradual shift of this class to /ā/ or /ah/ class is discussed in Labov 1966:Ch. XIV. Though we show a categorical rule here, it should be noted that this rule affects lexical items irregularly in a way that cannot be formalized here.

$$\text{(P22a)}\quad [\text{0high}] \rightarrow [\text{+peri}] \;/\; \underline{\qquad}\; \begin{bmatrix}\text{+cons} \\ \text{-tense}\end{bmatrix}$$

A second rule now moves those [0high] vowels to the back which are not followed by a back upglide.

$$\text{(P22b)}\quad [\text{0high}] \rightarrow [\text{+back}] \;/\; \begin{bmatrix}\underline{\qquad} \\ \text{+peri}\end{bmatrix}\; [\text{-back}]$$

(This notation presupposes, of course, that we are not using the feature ±back for consonants.) A redundancy rule is needed here to state that any degree of backing or fronting of a [0high] vowel implying [-central] leads to a degree of highness greater than 0.

(R3) [-central] → [yhigh]

Condition: $y > 0$

This increment in height may be slight, less than [1high] if we wish to subdivide height into more than five steps. R3 expresses the basically triangular character of the phonological space we are operating in.

As noted above, the process represented by P22 is more typical of the tensing rules P12 and P14 than the phonetic processes such as P21. It shows considerable lexical diffusion in New York City, for some speakers affecting words like odd but not God, etc. The extension of P22 in time allows it to overlap with P21, which may eventually produce lexical irregularity in the fashion outlined by Wang (1969). Thus it may be appropriate to show the output of P22 as [+tense] rather than [+peripheral], and then re-introduce a third conversion of tenseness to peripherality and peripherality limitation parallel to P15 and P16; or for younger speakers, P22 may be re-ordered so that it precedes P15 and P16, and so these phonetic rules may be generalized to apply to low and back vowels as well as front ones. But we have not yet acquired the detailed knowledge of the peripherality limitations on the low or back vowels which would enable us to express these conditions, and we will not elaborate here the processes by which the low vowels enter into the system.

We will therefore use only the feature [+peripheral] in the discussion of the New York City system to follow. However, there are problems in defining this feature in the back vowels, particularly in regard to (oh). Not only is this variable less peripheral than (ohr), but in younger speakers it can be seen to be moving towards the center of the vowel system. At the same time, it retains the length and impressionistic character that we associate with tenseness: length, overrounding or pursing, and contrasting lax inglide. This development will obviously demand that we modify our automatic conversion of tenseness into peripherality at this level. The problem is symptomatic of the larger class of cases involving tense central vowels. But such modifications will depend upon a more detailed account of the centralizing process and a better understanding of the conditions under which it occurs.

We can also include here the symmetrical fronting of /aw/ in the chain shifting process. We do not have sufficient data to state the constraints on this movement, but it also seems to involve voiced and voiceless classes, and more significantly, the isolation of the allophone before nasals. It is possible that further investigation will allow us to state a symmetrical vowel shift in front, (aw) following (æh), which succeeds P17 just as P21 succeeds it. We would register this by simply removing the [+back] condition on P21.

(P21') Pattern 2 and 3 chain shifts in New York City

$$[y\text{high}] \rightarrow \langle y+z \text{ high}\rangle \;/\; \frac{\qquad}{[+\text{peri}]}$$

Condition: $1 \leqslant y+z \leqslant 3$

It may be helpful to re-analyze here the development of the New York City vowel system as we reconstruct its earlier stages, and show how the complex chain shifting rules were built up. We can represent these as seven stages of a $P23_{NYC}$ rule for later reference.

The first step in this process was a simple raising of the tense /æh/ from low to mid position. Even for the oldest speakers we have studied, this process seems to have been completed.

$(P23_{NYC})$ [1] $[1\text{high}] \rightarrow [2\text{high}] \;/\; [\underline{\quad}, +\text{peri}, +\text{front}]$

This was then generalized to affect the other tense vowel, /oh/, and thus simplified:

[2] $[1\text{high}] \rightarrow [2\text{high}] \;/\; [\underline{\quad}, +\text{peri}]$

The third step was a consequent raising of the mid vowel to high position. As we have seen, this is nowhere completed, and so must remain a variable rule for all speakers.

[3] $[2\text{high}] \rightarrow \langle 3\text{high}\rangle \;/\; [\underline{\quad}, +\text{peri}]$

While it is true that [2] was completed for all speakers, our more detailed examination of the acoustic record shows that there are always some intermediate forms to be found in upper low or lower mid position: vowels before velar nasals, auxiliaries, some results of correction, etc. We may therefore generalize [2] and [3] into the variable rule [4], which will permit us to show the raising of front and back vowels as a continuous process.

[4] $[1\text{high}] \rightarrow \langle y\text{high}\rangle \;/\; [\underline{\quad}, +\text{peri}]$

For most speakers, there is a differentiation of front and back vowels in this process. As Labov 1966 pointed out, this is controlled by membership in Italian or Jewish ethnic groups, giving us an extra-linguistic constraint upon the rule. We will not attempt to formalize here these constraints upon [4] but now enter in the next step, the entrance of the low nucleus into the process. This may be broken down in more detail than in P22 by considering first the /ah/ class.

$$[5] \quad [0\text{high}] \rightarrow [+\text{peri}] \;/\; \left\{ \begin{array}{c} \# \\ \begin{bmatrix} +\text{cons} \\ -\text{tense} \end{bmatrix} \end{array} \right\}$$

We then add to this the new /āy/ class.

$$[6] \quad [0\text{high}] \rightarrow [+\text{peri}] \;/\; \underline{\qquad} \begin{bmatrix} 4\text{high} \\ +\text{front} \end{bmatrix}$$

Before the chain shift rule can be generalized, the results of [5] and [6] must be shifted toward the back:

$$[7] \quad [0\text{high}] \rightarrow [+\text{back}] \;/\; [\underline{\qquad}, +\text{peri}]$$

We can then see the operation of the chain shift rule, including half of the process summed up in [4]:

$$[8] \quad [z\text{high}] \rightarrow \langle z{+}x \text{ high}\rangle \;/\; [\underline{\qquad}, +\text{peri}, +\text{back}]$$

Next we may enter the tensing of the /āw/ nucleus, neglecting any economy to be gained through the complex rule P22':

$$[9] \quad [0\text{high}] \rightarrow [+\text{peri}] \;/\; \underline{\qquad} \begin{bmatrix} 4\text{high} \\ +\text{back} \end{bmatrix}$$

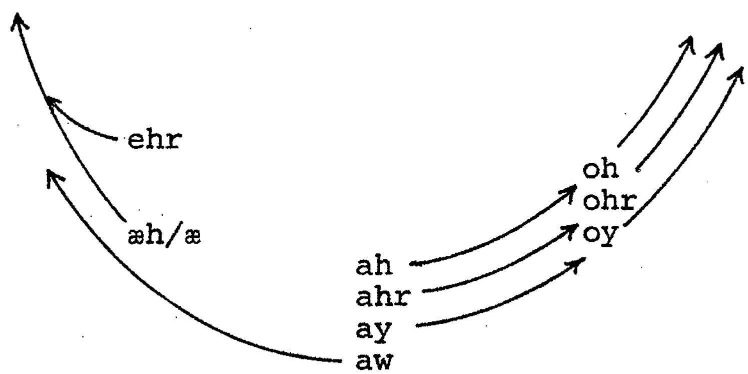
The resulting /āw/ is then fronted, and of course raised to a [yhigh] position:

$$[10] \quad [0\text{high}] \rightarrow [+\text{front}] \;/\; [\underline{\qquad}, +\text{peri}]$$

To generalize the opposing movements of /aw/ and /ay/, we can utilize an [αback] rule, but we have to specify [-central] as well, given the tripartite division of front, central, and back that we are now using:

$$[11] \quad [0\text{high}] \rightarrow \begin{bmatrix} \alpha\text{back} \\ -\text{cen} \end{bmatrix} \;/\; \underline{\qquad} \begin{bmatrix} 4\text{high} \\ -\alpha\text{back} \end{bmatrix}$$

This is a rule of nucleus-glide differentiation which again captures a part of the overall vowel pattern and combines the backing of /āy/ with the backing of /ah/ along with the fronting of /āw/. But it does not include the raising of /oh/ and the raising of /oy/. There is no single rule which can encapsulate all of the interrelations of this system, but rule [8] appears to cover the largest part. It governs the chain shifting of /ah/ and /oh/, and the simultaneous shifting of /ay/ and /oy/ as well. The overall pattern can be summarized graphically as:



4.7.3. Rules for the Northern cities. It will not be necessary to restate the 23 rules just given in order to summarize the situation in the Northern cities discussed at the end of Chapter 3 and the beginning of Chapter 4. P1-11 apply in exactly the same way. Rule P12 is modified differently in various cities, usually extending the first part to a more general and simpler condition for the tensing of short *o*. P13 then applies to unround the remaining short *o*.

The rule for the creation of the new tense front vowel is then much simpler than P14. It must still be a rule, however, for we cannot escape the fact that short *a* is the lax member of tense *a* in the alternations *sane* ~ *sanity*, *acclaim* ~ *acclamation*, etc. There must then be a general rule which converts all short *a* from [-tense] to [+tense]:

(P14n) Tensing of short *a* in the Northern cities.

$$\begin{bmatrix} 1\text{high} \\ +\text{front} \end{bmatrix} \rightarrow [+\text{tense}]$$

The second tenseness conversion P15 then re-applies. The peripherality limitation rule for the Northern cities follows the limitation imposed by (13) of Chapter 3:

(P16n) Peripherality limitation for the Northern cities.

$$\begin{bmatrix} +\text{peri} \\ +\text{front} \end{bmatrix} \rightarrow \langle 1\text{-}x \text{ peri}\rangle / \ \langle\langle +\text{cons}\rangle +\text{voc}\rangle \underset{\langle -z \text{ str}\rangle}{\underline{\qquad\qquad}} \left\langle \begin{matrix} -\text{nas} \\ -\text{ant} \\ -\text{cor} \\ +\text{voc} \end{matrix} \right\rangle \left\langle \begin{matrix} +\text{voc} \\ +\text{cons} \end{matrix} \right\rangle$$

The only changes here over P16 is that ⟨-cor⟩ is added in the following segment. The raising rule P17n will then be the same as (14") of Chapter 3 and P18 follows.

The further development of the Northern cities is then quite different from New York City. Rules P19 and P20 do not apply. Instead of P19, we have an *r*-superposition rule, which converts the entire nucleus to a constricted or retroflex form which holds the vowel in a [-peripheral] position. The Vhr words are then effectively removed from the sub-system we are studying. We then have the Northern chain shift which fronts /o/ and /oh/. First a pair of rules must convert backness to a numerical scale:

(P23$_o$) Backness conversion

$$\begin{bmatrix} +\text{back} \\ +\text{cen} \end{bmatrix} \rightarrow \begin{bmatrix} 2\text{back} \\ 1\text{back} \end{bmatrix}$$

($P23_n$) Pattern 2 Northern chain shift

$$[z\text{back}] \rightarrow \langle z\text{-}y \text{ back}\rangle \;/\; \underset{[1\text{- high}]}{\underline{\qquad\qquad}} \left\langle \begin{array}{l} +\text{cor} \\ -\text{ant} \\ -\text{voc} \\ +\text{tense} \end{array} \right\rangle$$

If /oh/ follows the simple definition of fronting which increases F2, then it may become [-tense]. The further consequences for rule statement are hard to foresee, since we do not know now whether the fronting of /oh/ will continue.

4.7.4. Rules for the Pattern 3 and 4 dialects. In the earlier part of this chapter, it appeared that the same English and American dialects showed Pattern 3 and 4 operating together, in one form or another. We will here restate the rules which govern the London dialect as a base for the following discussion of historical parallels.

Rules P1-10 apply in London working-class speech. But rule P11 does not follow. Instead of monophthongization of /ɔw/, this vowel becomes tense without losing its upglide.

(P11L) Tensing of long open o in London.

$$[1\text{high}] \rightarrow [+\text{tense}] \;/\; \underline{\qquad} \begin{bmatrix} 4\text{high} \\ +\text{back} \end{bmatrix}$$

We then have only one of the three sections of P12 operating. This makes /ɔ/ peripheral before /r/.

(P12L) Tensing of back vowels before /r/.

$$\begin{bmatrix} +\text{back} \\ 1\text{high} \end{bmatrix} \rightarrow [+\text{tense}] \;/\; \underline{\qquad} \; [+\text{cen}] \begin{Bmatrix} C \\ \emptyset \end{Bmatrix}$$

P13 does not apply in London. A very modified form of P14 tensing short a applies--primarily before nasals and a few other most favored environments. The second tenseness conversion applies, and a modified form of peripherality limitation. The general raising rule P17 may not be applicable here, however, since the raising of (æh) seems to be receding rather than advancing for younger London speakers, and the tense back vowels become organized in a different manner. First the vocalization of /r/ P19 applies, and then the tensing rule P20. We then have a new rule, P24, which converts the centering glide to a back upglide for /ɔhr/.

(P24) Upgliding of /ɔhr/ in London

$$[+\text{cen}] \rightarrow \begin{bmatrix} \text{2back} \\ \text{4high} \end{bmatrix} \;/\; \begin{bmatrix} \text{2back} \\ \text{1high} \\ \text{+peri} \end{bmatrix} \;\underline{\qquad}$$

The diphthong /ɔ̄w/ which results from these processes then merges with the /ɔ̄w/ from long open o. This gives us three back upgliding diphthongs: /ūw, ow, ɔ̄w/.

Our earlier discussion of the movements of these three diphthongs led to some relatively complex rules. These rules were the logical result of studying the Pattern 3 shift in isolation from Pattern 4. As we review the data from the Pattern 3 and 4 shifts in other dialects, it appears that they all share the following properties: before upgliding elements /y,w/:

1. Tense or peripheral nuclei rise and/or move forward (Principle I, III).

2. Non-peripheral nuclei fall (Principle II).

Thus all three principles are involved. The complexities of our rules arose when we tried to operate within a binary system of fronting and backing. Thus rules (10) and (11) on page 129 must deal with the fact that /uw/ does not fall while /ow/ does. But we can now register the removal of /uw/ from the back vowels by fronting it to a central position, following the same logic which removed yū from the operation of the vowel shift. First we must note that this /uw/ should be exempted from P9, the second laxing of diphthongal nuclei, by entering in a special rule $P25_o$.

$$(P25_o) \quad [\text{3high}] \rightarrow [+\text{peri}] \;/\; \underline{\qquad} \begin{bmatrix} \text{4high} \\ \text{2back} \end{bmatrix}$$

We can then show the fronting of /ūw/ by a variable rule P25, which like $P25_o$ follows the backness conversion rule $P23_o$.

(P25) Fronting of /ūw/ in London.

$$[z\text{back}] \rightarrow \langle z-x \text{ back}\rangle \;/\; \begin{bmatrix} \overline{} \\ +\text{peri} \\ 3\text{high} \end{bmatrix}$$

We can now account for the raising of /ɔ̄w/ and lowering of /ow/ by a simple chain shift rule.

(P26) Pattern 3 chain shift in London.

$$[y\text{high}] \rightarrow \langle y+\alpha x \text{ high}\rangle \;/\; \begin{bmatrix} \overline{} \\ \alpha\text{peri} \\ 2\text{back} \end{bmatrix} \quad [4\text{high}]$$

Condition: $0 < y+\alpha x < 4$ $\quad 0 \langle\, y+\alpha x \,\langle\, 4$

This rule will progressively raise /ɔ̄w/ and lower /ow/, without affecting the high position of /ūw/. The fronting of /ow/ which we saw in Bob Frost (Fig. 31) and other speakers can be accounted for by a generalization of P25 to include 2high.[32]

In P26, it is not necessary to specify that the following glide is [+back], since /oy/ may be raised at the same time. Furthermore, the glide of /ūw/ may be fronted without affecting its position in the rule. P26 is now very much like P7, the original vowel shift rule, with the exception that the following environment is [4high] instead of [-αperi], and it applies only to [2back] vowels. The first difference is a characteristic shift from Pattern 1 to Pattern 4, brought about by the fact that rule P8 now gives us a base of four upgliding diphthongs instead of four tense monophthongs. If we generalize P26 by removing the [2back] constraint, we have a very general rule which differs from P7 only in the following environment:

(P27) Pattern 4 chain shift in London.

$$[y\text{high}] \rightarrow \langle y+\alpha x \text{ high}\rangle \;/\; \underset{[+\text{peri}]}{\overline{}} \quad [4\text{high}]$$

This rule will now progressively lower /iy/ and /ey/ and raise /āy/ and /ōy/ as Pattern 4 develops, and at the same time raise /ɔ̄w/ and lower /ow/, keeping /ūw/ in high position. If we accept the suggestion put forward several times on the basis of tongue height diagrams that the movement of [u] to [ü] and [i] is a continuation of the raising process, then the continued fronting of /uw/ is governed by P27. There are a number of simple numerical adjustments to our highness conversion rule P3 which would accomplish this, but until we can correlate acoustic and articulatory measurements it will be best to leave this possibility unformalized.

As we examine the other Pattern 4 dialects, it is clear that they all show some degree of lowering of /ow/, though none of the others have a high back upgliding diphthong /ɔ̄w/. We will not attempt to restate the rules for Norwich, the Outer Banks, Atlanta or Central Texas in this report. Each dialect has specific characteristics of its own so that the simplest solution for an individual dialect may lead to rule systems which are superficially quite distinct. We propose as a general problem the construction of pan-dialectal grammars in which the parallel developments of such widely separated dialects are captured in the same mechanism. Rule P27 appears to us one of the most promising candidates for a general rule. Individual dialects differ in the relation of the fronting rule P25 to the vowel shift rule P27, in the number of back vowels and the nature of their glides, and the amount of monophthongization of the [-back] vowels /ūw/ and /āy/. But an overview of the various dialects indicates that they will share the following rules after P10:

P12, 14	Formation of new tense ingliding vowels from short o and a
P17	Raising of tense ingliding vowels
P25	Fronting of /uw/ (and /ow/)
P27	Vowel shift of upgliding diphthongs

4.8 Generalization of the principles to other languages and other periods.

The main body of this report is concerned with the instrumental analysis of change in progress, but it is immediately obvious that the scope of the principles involved is very broad. Our perspective is inevitably deepened and broadened by a consideration of historical records and dialect descriptions, even though these data are lacking some of the dimensions which we have relied on in sections 1-6. In particular, we seldom find reports of relative fronting or backing within the front or back vowels. Since this evidence is crucial to our argument, we must look for indirect evidence to see if the same mechanism operated in the past.

As a consequence, the first contribution of this historical study will be from the present to the past rather than from the past to the present. But the wealth of material and the depth of scholarship in historical linguistics provide a stronger type of confirmation than we can get from studying current changes alone. The mutual interpretation of past and present must eventually reflect an equal contribution from dialectology and philology.

Our present view of chain shifts must necessarily incorporate Martinet's fundamental insights into this phenomenon. In these terms chain shifts preserve a margin of security and reflect a functional economy in the vowel system. We have reviewed the examples cited by Martinet (1955), Haudricourt and Juilland (1949), Ruiperez (1956) and Lüdtke (1954, 1955) and find the principles of 4.1 are fully reflected in them. The internal relations of the vowel system as a whole are seen best in chain shifts. We have located a number of historical cases beyond those which have appeared in earlier discussions of chain shifts; in all of these shifts the basic principles of this chapter are maintained.

It cannot be accidental that our principles I and III seem to apply without exception to chain shifts; where they also apply to isolated movements, it is only on a statistical basis, and there are many counter examples. Thus Sweet's original insights (1888) reflected the principles accurately but not completely.

One of the questions we must face is why Sweet's statements did not have more influence, especially in current-day thinking when many scholars are searching for general principles of change. We ourselves only discovered Sweet's observations as a parallel with our own findings. The answer must lie in the fact that they were stated prematurely with too broad a scope and obvious counter examples could be found by any scholar. In North and West Germanic, we observe a downward shift of long $\bar{e}^1$ [ǣ] to PIE ā. And whereas in Germanic, long ā rose to ō and short ŏ descended to ă, in accordance with Principles I and II, we observe the reverse in Church Slavonic: PIE ŏ,ă appear as ŏ and PIE ō,ā appear as ā. PIE long ō and ē moved downward to merge with ā in Sanskrit. The same lowering of PIE ō can be observed in Old Irish. These and many other cases show that Sweet's original statements could not be considered sound as they stood. It is only when we begin to see the chain shift as a field of inquiry that the principles emerge in their most systematic form. It seems therefore that one general tendency (of long vowels to rise and short vowels to fall) is reinforced by a second tendency (of vowels to preserve margins of security and extend their fields of dispersion). This reinforcement may be thought of as operating in the following manner. The first tendency ensures that most long vowels in a given language will rise, if they move at all, while the second tendency discourages any single vowel from moving in a direction contrary to the predominant movement.

In this final section of Chapter 4, we will review historical evidence on a wide variety of chain shifts to see how general are the principles we have been dealing with, and to see what light they may throw on the interpretation of completed changes. At the same time, we can expect these historical cases to raise new problems for a general theory of chain shifting.

4.8.1. Principles I-III in other languages. In the course of our examination of historical evidence on chain shifting, we have found exemplifications of the three principles in a number of other languages. Before discussing these as patterns, we can give some idea of the extent of confirmation of the principles by listing the cases.

Principle I	Principle II		Principle III
raising of long vowels	(a) lowering of short vowels	(b) lowering of diphthongal nuclei	fronting of back vowels
English	Vegliote	English	Yiddish
German		Yiddish [Central]	Swedish
Yiddish		Yiddish [Western]	Romantsch
Swedish		German	Portugese
Frisian		Swedish	French
French		Romantsch	Lettish
Portugese		Czech	Greek
Swiss French		Lettish	Albanian
Romantsch			Akha
Greek			
Lithuanian			
Old Prussian			
Czech			
Albanian			
Lappish			
Syriac			
Akha			

We have not yet found any counter-examples to Principles I and III for chain shifts as a whole, though there are several cases of individual vowels moving within a chain shift which raise questions. Principle II(b) has no exceptions, although we cannot consider most of the historical evidence strong on this point. Differences between tense and lax, long or short nuclei of diphthongs are rarely indicated on the historical record. Principle II (a) is obviously weak. The Vegliote case does not seem strong enough to warrant the inclusion of II(a) in our general principles, especially since we have only one clear case in our synchronic data. We will therefore revise our second principle to read: In chain shifts, the lax nuclei of upgliding diphthongs fall.

The fact that short vowels are not deeply involved in chain shift processes requires some consideration. One observation that may be relevant is that there are usually more long vowels than short ones; we can then expect that over-crowding will be more common among long vowels. But there are even fewer diphthongs than short vowels, and these are heavily involved with chain shifts. Movements within subsystems are often initiated by diphthongization, the internal differentiation of long vowels, which is not characteristic of short vowels. But on the other hand, one of the basic movements in chain shifting is the upward shift of tense monophthongs without diphthongization. The relative stability of the short vowels is not at all obvious, since it can be observed that they tend to reach their targets less often than long vowels and show more influence of the environment. We might therefore expect them to be less stable. In Chapter 5 we will return to this question, in considering shifts of subsystems.

4.8.2. The history of Pattern 1 in English: the Great Vowel Shift. The most complete exemplification of Pattern 1 is the Great Vowel Shift of Early Modern English. Throughout this report we have referred to the vowel shift rule as it is now embodied in the synchronic analysis of English phonology. As Chomsky and Halle demonstrate, the presence of a set of tensing and laxing rules in English makes it necessary to preserve in some form the underlying Middle English forms of words in order to show the relation between such pairs as divine - divinity, tone - tonic, etc. (1968). Our own version of the vowel shift rule P7 is quite different from that given by C+H and other analyses of the GVS; it also reflects a different orientation towards the problem of reconstructing the historical process itself. Before examining that process, it will be helpful to present the various synchronic treatments of the vowel shift rule.

4.8.2.1. Current synchronic treatments of the Great Vowel Shift. Chomsky and Halle's synchronic version of the Great Vowel Shift involves diphthongization of the tense vowels; reversal of high and mid vowels; reversal of low and mid vowels; rounding adjustment; and gravity adjustment. The vowel shift rule itself is relatively complex (1968:243). Part of its complexity springs from C+H's interest in extracting as much redundancy as possible from the vowel system: one part of the vowel shift operates to capture some of the regularities in vowel ablaut (sing - sang); and another part to lower and unround short u, etc. We will disregard these special extensions of the rule and concentrate upon the central portion:

$$\text{(R1)}\quad \begin{bmatrix}\gamma\text{back}\\ \gamma\text{round}\\ \text{V}\end{bmatrix} \rightarrow \begin{matrix} [-\alpha\text{high}]/ \\ \\ [-\beta\text{low}]/ \end{matrix} \begin{Bmatrix} \begin{bmatrix}\overline{\alpha\text{high}}\\ -\text{low}\end{bmatrix} \\ \begin{bmatrix}\overline{\beta\text{low}}\\ -\text{high}\end{bmatrix}\end{Bmatrix} \quad / \quad \begin{bmatrix}\overline{\phantom{+\text{tense}}}\\ +\text{tense}\\ +\text{stress}\end{bmatrix}$$

The mechanism of this central portion is still relatively complex: each half applies once, the second to the output of the first, and produces two successive flip-flops to move īy to æy. From our point of view, it is obvious that (R1) does not reflect the kind of chain shifts we have studied: (a) tense vowels fall, contrary to Principle I; (b) the process occurs in two discrete stages, contrary to our observations; and (c) the upward and downward movements overlap, which we have never observed. But in assessing (R1), it is first necessary to examine it as an abstract rule which captures certain synchronic facts of English, to be evaluated by internal evaluation measures which develop the simplest formulation within these conventions.

Three linguists have recently re-analyzed this situation and independently arrived at similar solutions which are radically simpler than (R1).

Wang (1968) has shown that the rule can be made considerably simpler by adopting the same kind of feature system for vowel height that he had proposed for tone:

	[high]	[mid]
i	+	-
e	+	+
ɛ	-	+
æ	-	-

With this mechanism, Wang writes a single vowel shift rule which rotates tense ī, ē and ǣ to their correct places.

Wang's rule, in the form most comparable to (R1), will appear as:

$$\text{(R2)}\quad \begin{bmatrix} \gamma\text{back} \\ \gamma\text{round} \\ \text{V} \end{bmatrix} \rightarrow \begin{bmatrix} \beta\text{high} \\ -\alpha\,\text{mid} \end{bmatrix} \Big/ \begin{bmatrix} \alpha\,\overline{\text{high}} \\ \beta\text{mid} \end{bmatrix} \Big/ \begin{bmatrix} \overline{+\text{tense}} \\ +\text{stress} \end{bmatrix}$$

An automatic rule restores the three-level system of height by converting /ε/ to /e/. Krohn (1964) has also criticized the GVS rule of Chomsky and Halle for lack of simplicity. He proposes that we treat /ay/ and /aw/ as [+high, +low]. This solution shares with Wang's the merit of filling out the unrealized fourth possibility in the combination of two ± features, and allows a rule of comparable simplicity. Krohn's rule can be seen to be formally equivalent to Wang's when it is shown in a comparable arrangement:

$$\text{(R3)}\quad \begin{bmatrix} \gamma\text{back} \\ \gamma\text{round} \\ \text{V} \end{bmatrix} \rightarrow \begin{bmatrix} \beta\text{high} \\ -\alpha\,\text{low} \end{bmatrix} \Big/ \begin{bmatrix} \overline{\alpha\,\text{high}} \\ \beta\text{low} \end{bmatrix} \Big/ \begin{bmatrix} \overline{+\text{tense}} \\ +\text{stress} \end{bmatrix}$$

The feature system suggested by Hoard and Sloat (to appear) is structurally parallel to that of Wang: Wang's [±mid] = Hoard and Sloat's [±polar]. Their rule is therefore isomorphic with the Wang and Krohn versions given above, with the addition that u and m markedness notation is introduced. They are therefore able to indicate agreement of backness and rounding with a single symbol, [u round]. Reorganizing their rule into the form of (R2) and (R3), we have

$$\text{(R4)}\quad \begin{bmatrix} \text{u round} \\ \text{V} \end{bmatrix} \rightarrow \begin{bmatrix} -\beta\text{high} \\ \alpha\,\text{polar} \end{bmatrix} \Big/ \begin{bmatrix} \overline{\alpha\,\text{high}} \\ \beta\text{polar} \end{bmatrix} \Big/ \begin{bmatrix} \overline{\text{u tense}} \\ \text{m stress} \end{bmatrix}$$

These three treatments of the Great Vowel Shift all agree in showing that a binary analysis of height can be made more efficient. The C+H system of independent binary features is not truly independent since [+high,+low] is not utilized. Once this combination is filled in by a reinterpretation of the feature system, we get the relatively simple statement of the vowel shift rules, R2-4. Since three analysts independently saw this possibility, we can argue that an internal evaluation criterion will eventually force such a re-analysis. However, rules R2-4 carry us even further away from the principles of vowel shifting which have developed from our observation of current sound changes in progress. For a closer approximation to these data, we can turn to several recent suggestions which analyze the dimension of height as a linear scale.

The phonological system of Foley (1971) includes a treatment of the English vowel shift which is radically different from any of the foregoing. Foley sets up a scale of strength of Germanic vowels (1=ə, 2=a, 3=o, 4=u). He analyzes the long vowels as VV and argues that the presence of the second V causes the first to be increased in strength by one unit--a rule of "facilitative potentiation." When this rule carries a vowel outside of the system, e.g. u strength *5, it re-enters the system at the other end with a value of 1, so huus→həus. The other diphthongs which result from this process are contracted to monophthongs: bloom→bluom→bluum. But if the difference between the strengths of the two vowels is greater than 1, there is no contraction, and həus eventually becomes haus. Foley's system has a radically different terminology from any other, but it can be related to the processes we have observed. He has a strong concern with historical processes: in fact, Foley suggests by analogy with the Germanic raising of tense ingliding vowels (Ch. 3) that English vowels also rose as tense and relatively ingliding vowels. All of our available evidence, however, suggests that Early Modern English long vowels were monophthongs.[33]

Most linguists who work closely with phonetic data find it difficult to accept a binary analysis of vowel height. Ladefoged (1971) has proposed that we treat the GVS as a shift upward of one unit along a linear scale of vowel height; his realistic arguments must be taken into account by anyone dealing with this matter.

The recent treatment of the Vowel Shift by Stampe (1972) is of the greatest interest, since it offers an explanatory theory for the raising and lowering of various nuclei, based on the phonological theory of Miller (1972). Stampe is concerned with a "natural" treatment of the vowel shift movements, based upon the opposing properties of sonority and chromaticity (labiality and palatality). In this analysis, /a/ has the optimal syllabicity and tone-bearing capacity as the most sonorous vowel, while /i/ and /u/ have optimum chromaticity and maximize distinctiveness. Stampe's treatment depends upon the basic principle that "if contextual factors do not interfere, vowels tend to polarize the three cardinal properties." The rules that he presents do not have a form characteristic of chain shifts--there is no mechanism for keeping vowels distinct as they move, and there is no sense in his treatment of the unidirectional character of chain shifts, since there are contrary tendencies to each explanatory value. They are written as variable rules, as for example the raising rule:

$$\text{(R5)} \quad \begin{bmatrix} \text{chr} & !\text{lo} \\ \text{V} & !\text{tns} \end{bmatrix} \rightarrow \text{higher}$$

This notation states that chromatic vowels become higher; the lower and tenser they are, the more susceptible they are to this process. In addition, Stampe shows a diphthongization rule which simultaneously makes the nucleus lax and adds a non-syllabic glide favored in high tense vowels; a lowering rule which is the converse of R5; and a bleaching (centralizing) rule which is favored by low lax vowels:

$$\text{(R6)} \quad \begin{bmatrix} \text{V} & !\text{lo} \\ & !\text{lax} \end{bmatrix} \rightarrow \begin{array}{l} \text{-lab} \\ \text{and/or} \\ \text{-pal} \end{array}$$

It is not possible to apply Stampe's rules with precision, since they are stated as general tendencies, but obviously they reflect the same kind of principles that we find in our studies of the raising of tense and ingliding vowels: that, for example, peripheral (æh) before nasals starts lower and rises faster than any other member of the class.

Stampe's principles lead him to reject C+H's (R1), not on grounds of simplicity but for substantive reasons. In particular, Stampe insists that the nuclei of diphthongs are lax when they move under the GVS, and he criticizes the exchange rules of Chomsky and Halle as an unmotivated manipulation of tense nuclei. In these respects, Stampe agrees with our own analysis, and we will return to his views after we have presented the historical controversy on the interpretation of the vowel shift.

4.8.2.2. The historical process and the controversy over its mechanism. An early view of the vowel shift as a connected series of movements was provided by Jespersen in 1909. In Chapter VIII of his Modern English Grammar (1949) he introduced the term "Great Vowel Shift" and gave the following chart:

$$\begin{array}{ccccc} \text{ai} \leftarrow & \text{i:} & & \text{u:} & \rightarrow \text{au} \\ & \uparrow & & \uparrow & \\ & \text{e:} & & \text{o:} & \\ & \uparrow & & \uparrow & \\ & \text{ɛ:} & & \text{ɔ:} & \\ & \uparrow & & & \\ & \text{a:} & & & \end{array}$$

It is now usual to show the shift in Early Modern English as beginning with ā as a low front vowel [æ:] in name, grave, etc. There is also an [ǣy̆] diphthong from ME ai in day, maid, etc.; there is some disagreement on when this was monophthongized and merged with [æ:],[34] but it was a seventeenth century phenomenon, clearly after the Great Vowel Shift itself. The vowel shift itself was preceded by an earlier OE shift of ā to ō which we might take as the first step in the raising of tense long vowels, and even before that, by the Anglo-Frisian brightening ā → ǣ which was one of the sources of /ɛ:/ above. In addition to the upward movement of the five long vowels noted above, we can then add two more. The new low a: was created by the lengthening of short a in open syllables. Its fronting to [æ:] is then the second example of this movement in the history of English; the tensing and raising of short a studied in Ch. 3 is the third.

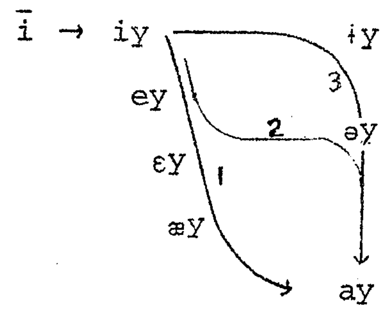
There have been many reviews and explanations of the Great Vowel Shift since it was first identified. These are reviewed by Wolfe (1969), who outlines some of the controversies which we will deal with here; we rely heavily upon her careful review of the issues. We will be primarily concerned with the front vowels, and in particular the mechanisms by which /i:/ descended to its present form [ai]. The "traditional view" held by Luick, Jespersen, Zachrisson, and Chomsky and Halle, is that the development was

M.E. i → iy → ey → əy → ay

That is, the diphthong lowered to mid position, centralized, and then descended to low position. Other scholars (Orton, Ellis) argue for a front vowel all the way, and then backed to [ay]. The third point of view is that centralization took place first:

M.E. i → iy → ɨy → əy → ay

Stockwell presented this view in some detail in 1952, and has since supported it in a number of papers suggesting a revision of the Chomsky-Halle mechanism for the synchronic reflex of the Great Vowel Shift in the interest of greater historical realism (1964). The same view is supported by Dobson (1957) who pointed out that if M.E. ī had descended as a front diphthong to [ei] and [ɛi], it would have crossed the rising diphthong from M.E. ai, rising to [æi] and [ɛi]. Thus die would have merged with day, which did not happen: there was never any tendency for these two vowels to be confused. The options can be diagrammed as follows:



Routes (1) and (2) show the problem of a merger with ME ai. But the difficulty is that route (3), which avoids this problem, does not fit in with the available evidence from orthoepists and grammarians. Wolfe undertook the task of investigating the Stockwell hypothesis (3) from a sympathetic point of view. But after a careful review of four sixteenth century sources (Hart, Bellot, Bullokar, Mulcaster) and thirteen seventeenth century writers, she came to the conclusion that "the orthoepists offer no support whatsoever for the claim that centralization preceded lowering." (1969: 171). She finds that none of the orthoepists before Hodges (1643) identified the nucleus of die, etc., as anything but a front vowel, even though many carefully distinguished the nucleus from the glide; and that after Hodges everyone tended to hear the nucleus as the central vowel of nut, etc.

The issues are then clear-cut but the controversy is unresolved. Dobson and Stockwell agree in arguing for a centralized path (3), and Chomsky and Halle for (2) or (1).[35] The argument about the possible merger of die and day does not carry much weight with them since they believe that discrete changes in the rule system can lead to sudden reversals of the positions of vowels without merger. While we do not find the evidence of Hart and other orthoepists as clear-cut as Chomsky and Halle do, it is necessary to agree with Wolfe that there is no clear evidence in these writings for a central diphthong before the mid-seventeenth century. Our own views of sound change in progress offer little encouragement for the view that such changes are sudden reversals of discrete features. Chapter 7 will examine several apparent cases of reversal in detail: when these are studied closely, they reveal the operation of gradual processes which follow the principles of vowel shifting presented in this chapter.

4.8.2.3. Resolution of the controversy. The resolution of the Great Vowel Shift controversy seems to follow naturally from the spectrographic evidence on the mechanism of parallel vowel shifts now in progress. All of this evidence suggests that after the high vowels were diphthongized, the nuclei fell to low position along a less peripheral path, while the nucleus of M.E. ai rose as a tense vowel along a more peripheral path. Thus in our view of phonological space:

ME i ⟶ i˃y
↘
e˃y
↘
ε˂y   ε˃y
↖   ↘
æ˂y   æ˃y
↖   ↘
a˂y   a˃y
↖
ME ai

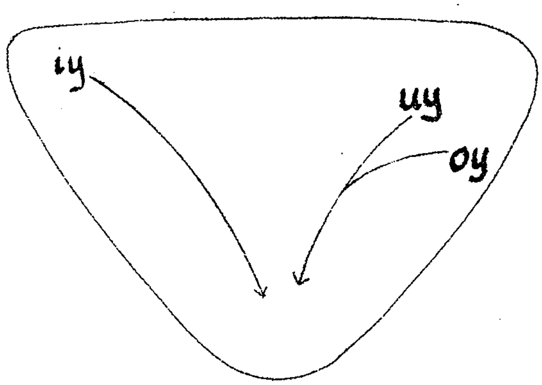
The many cases shown in this chapter have illustrated the two routes followed in the course of chain shifts. In Chapter 6, we will present evidence that two diphthongs (English /ay/ and /ɔ̄y/) can remain side by side, in peripheral and non-peripheral position, for several centuries without merging--even when the speakers of the language hear them as "the same." In Appendix A, "The Uses of the Present to Explain the Past," we show how this must have been the case with <u>bear</u>, <u>tear</u>, <u>pear</u>, <u>wear</u>, and <u>swear</u>. These words originally contained ME short ĕ before <u>r</u>, followed by another vowel. They were lengthened by the rule which operated upon open syllables in early Middle English to something like [ε:]. In the meantime, OE ǣ before <u>r</u> in words like <u>fear</u> (OE fǣr) rose to [ε:], [e:] and finally [i:]. For several hundred years, the lengthened [ε:] managed to remain distinct from these other vowels as they passed. Thus

i:r
↖
e˂:r
↖   ε˃:r (<u>bear</u>)
ε˂:r
↖
æ˂:r (<u>fear</u>)

We can only conclude that the lengthened short ĕ must have remained on a less peripheral path while the rising ǣ moved along a peripheral one, and that this difference in F2 position was sufficient to distinguish the two word classes. Only one word--<u>spear</u> (from OE <u>spĕre</u>)--changed membership. That such regular developments are possible with such fine phonetic distinctions is a tribute to the neogrammarian insight into the regularity of sound change, which can now be appreciated more fully in the light of our current view of phonological space. Instead of seeing <u>tear-tear</u>, <u>fear-bear</u>, <u>sear-pear</u> as an example of lexical irregularity in the history of English, we can now see these distinctions as an example of a much higher regularity (see Appendix A).

Similarly, we can see that the controversy centering on the Great Vowel Shift was based upon an inadequate understanding of the nature of phonological space. The options seen by the participants were: front nucleus or central nucleus; plus or minus low; merger or total distinction. We now see that a vowel may be front but not very front; that it may be low but not very low; that it may be distinct but not very distinct; and all these matters of degree can operate within the basically categorical view of phonological space. Thus the orthoepists could hear the nucleus of ME ī as a front vowel, to be best written *ei*. Our view of phonological space fully justifies this decision. Dobson and Stockwell, who saw that falling /iy/ must be centralized to avoid merger with rising /æ̃y/, are also fully justified in our view.

It is also clear why orthoepists after 1650 heard the nucleus of long ī as central. When the vowel descends far enough, there is very little distance between front and center; the relations between ME ī and ME *ui* or *oi* are now as close as the relations between ME ī and ME *ai* were before. The result of this near identification is another paradox of English history. Just about the time that grammarians stopped identifying this descending diphthong as a front nucleus, speakers began to hear it as the same as another upgliding diphthong with a centralized nucleus. In Appendix A and in Ch. 6 we will deal with this development in greater detail: here we may note that the reported merger of *line* and *loin* was the result of the same kind of approximation in phonological space as the others we have considered.



The view we put forward here is also consistent with the analysis of Hart's dialect by Chomsky and Halle (1968: 25off.259ff). Hart uses *ei* for ME ī and *e* for ME ai and ā. Chomsky and Halle do not believe that the latter two vowels had fallen together, and take e as representing [ēy] when it stands for ME *ai* and [ǣ] when it stands for ME ā. Since *ei* stands for a vowel that is clearly distinct from these, they reasonably interpret it as [ey]. This interpretation of Hart fits in perfectly well with our own view: if we interpret the tense-lax distinction as we normally do to mean peripheral vs. non-peripheral, then the transcription [ey] vs. [ēy] yields the solution we have given above.

It is not however possible for us to agree with all possible interpretations of the Great Vowel Shift. In particular, the mechanism of vowel shift proposed by Chomsky and Halle for Hart's dialect seems unrealistic, especially in view of the fact that these rules were ongoing processes in Hart's time--similar to P27 rather than P7. Chomsky and Halle give the diphthongization rule for high vowels and then a vowel shift rule followed by diphthong laxing:

C+H
(20) VOWEL SHIFT

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

C+H
(21) DIPHTHONG LAXING

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

As a result of this ordering, īy falls to ēy with a tense nucleus, contrary to Principle I. Although Chomsky and Halle give arguments to justify their ordering for almost every other case, they do not give any reason for ordering (21) after (20). If we reverse these two, we then have an exchange of mid tense and lax high nuclei which fit in perfectly with the general principles I and II.

ī	ĭy	ŭw	ū
↑	↓	↓	↑
ē	ĕy	ŏw	ō

At the same time, we have no reason to believe that rule (20) would capture the nature of the ongoing vowel shift which must have prevailed in Hart's time. We might propose instead P7 but with a more limited condition: $2 \leqslant y+\alpha x \leqslant 3$. But in that case, x = 1, and we might as well write

$$(\text{P7}')\quad [y\text{high}] \rightarrow [y+\alpha 1\ \text{high}] \;/\; \begin{bmatrix}\overline{}\\ \alpha\,\text{peri}\\ -\text{cen}\end{bmatrix}$$

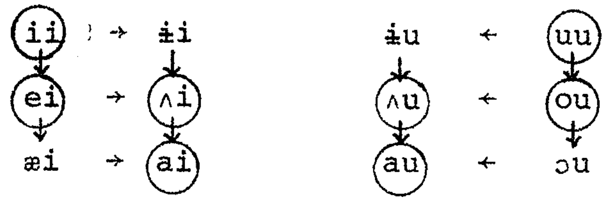
This rule will not only do the work of C+H's (20), but their (22) as well, a vowel raising rule which converts [αback, αround] vowels to [-low]. P7' will have the effects shown below:

	ī	ē	ǣ	ā	ɔ̄	ō	ū	ǣw	ǣy	āw	ɔ̄w	ɔ̄y
DIPHTHONGIZATION	īy						ūw					
DIPHTHONGAL LAXING	ǐy						ǔw					
P7' VOWEL SHIFT	ĕy	ī	ē		ō	ū	ǒw	ēw	ēy		ōw	ōy

The simplicity of P7' is clear; its flexibility should also be evident, as the rule can proceed to a broader scope by replacing [y+α1] with [y+αx]. It is most likely that Hart's situation could be described more exactly by a variable version of P7, since he must have been familiar with and operated within a speech community with a much wider range of vowel forms than his own. In general, we would claim that rules of the form P7 and P27 provide greater simplicity than the vowel shift rules provided by C+H, as well as greater accuracy for describing on-going changes. The structure of P7 is replicated in P27 for current London speakers, reflecting the fact that the same phonetic processes recur. It is possible that some insight into long range drift will be provided by this process of rule replication.

Stampe's suggestions for the motivating principles of the vowel shift deserve closer analysis here. His raising rule (R5) favors tense vowels, but it is controlled primarily by chromaticity: that is, vowels with distinct timbre tend to increase that distinctiveness. Since we have not yet put forward any explanation for Principle I, Stampe's position deserves consideration. But his rule (R5) states only that tense vowels are more susceptible to this process; it seems to fall short of the more precise formulation of Principle I. In his analysis of diphthongization, Stampe offers a clear motivation for the tendency of lax diphthongal nuclei to increase sonority. Since the tense off-glide now carries chromaticity, the nucleus is free to increase its syllabic and tone-bearing properties by becoming more open. This differentiation of function in diphthongs seems to us a useful way of analyzing their properties, especially since we find that the chromaticity of the glide is distinct enough so that the front upgliding vowels usually function in a separate sub-system of their own with no danger of losing contrast with other sub-systems.[36]

Stampe's discrete and rectangular feature system forces him to show the vowel shift as a "zig-zag" movement in which lowering alternates with bleaching:



The circled items are, according to Stampe, "the most widely attested reflexes." He then suggests that the "triangular convergence of these paths reminds us of the typically triangular pattern of systems of simple vowels." It seems clear to us that his principles will take on greater force if they are re-cast within the framework of phonological space presented in this report, a space which is basically triangular, and where a single process of raising and lowering will accomplish the action of his bleaching and lowering rules. It is clear that if he requires two rules to descend, there must also be two rules to ascend: a coloring and raising rules. But there is no reason to posit a zig-zag path for vowel shifts : the gains and losses in sonority and chromaticity seem to be continuous processes within the bounds of a continuous phonological space.

This review of the English Great Vowel Shift suggests that the general principles of chain shifting we have developed here can be captured in a single n-ary rule of the form P7, and that these principles probably operated in Early Modern English. We follow the traditional view in supposing that high vowels were diphthongized first, and fell with front (or back) nuclei as they were identified in the early stages; that at a later point the nuclei were identified as central until they finally fell to low position in most modern dialects. When we state in addition that the tense vowel monophthongs rose along a peripheral track and the diphthongs fell along a non-peripheral track, it can be seen that successive identifications followed naturally from the predicted path of the vowels through phonological space. At the same time, it should be emphasized that the reconstruction of any earlier stage of the language can only be a most plausible interpretation. We are of course lacking the precise acoustic evidence for Early Middle English that we can provide for current-day English changes, and our proposals are therefore intended to throw more light on the problem rather than put an end to it.

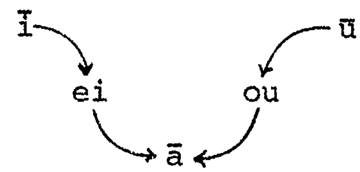
4.8.3. Pattern 1 in other languages. We have not found in any other language a Pattern 1 vowel shift as elaborate as the English Great Vowel Shift. But if we take the symmetry of front and back movements as the basic characteristic of Pattern 1, we can find three parallel subcases in northern Europe. In Common Czech (Kucera 1961) we observe an upward movement of the mid tense vowels with diphthongization and lowering of the high tense vowels.

This dialect contrasts with the standard literary form where the shift did not take place. Urban speakers appear to move freely between both forms, indicating that rules of this sort can be grasped and applied by native speakers. The data on Old Prussian are limited; but evidence of this shift is to be found in the Catechisms: in Catechism II and III, old ē moved to ī while ī moved to ei, but in Catechism I, only the later change is found. In all cases, a conditioned sound change moved ā to ū, while ū shifted to ou or even au. Thus there is some evidence that a rule parallel to our second part of P7 was operating in Old Prussian, maximizing the distance between nucleus and glide. Again, we can isolate in Old Prussian the co-existence of two distinct systems, a more conservative and more innovating vowel system, indicating the presence of an ongoing change (Schmalsteig 1964, 1968).

In these cases we have no evidence that the diphthongal nuclei followed a less peripheral track, and we would make such a conjecture only on the basis of analogy with our current evidence. The same can be said of Middle High German (Priebsch and Collins 1958). Here we have a more elaborate version of Pattern 1, which will be discussed in more detail in Chapter 5, since it involves chain-shifts across subsystems.

In this case, the long mid vowels first rose in Old High German to ingliding vowels, as discussed in Ch. 3; they were then monophthongized in Middle High German. The long high vowels were diphthongized and the nuclei lowered to mid position ei and ou. These diphthongs further lowered to ai and au in modern German; the original diphthongs ei and ou are also lowered to this position, and there is a complete merger in the standard dialect. The merger may have taken place at mid position or at low position after a downward chain shift of ei and ou.

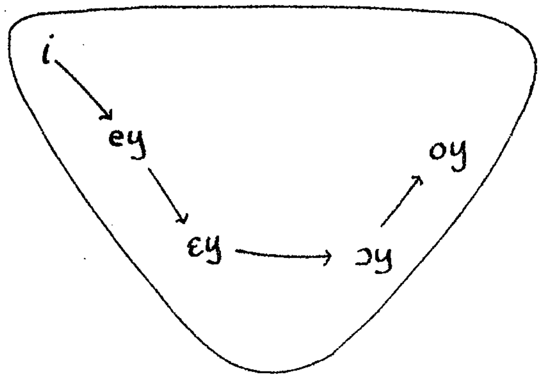
In Western Yiddish, however, there is clear evidence of a downward chain shift which continued further. The original diphthongs ei and ou are now merged as monophthongal ā (Wilkinson 1972). Thus we see a double chain shift across sub-systems:

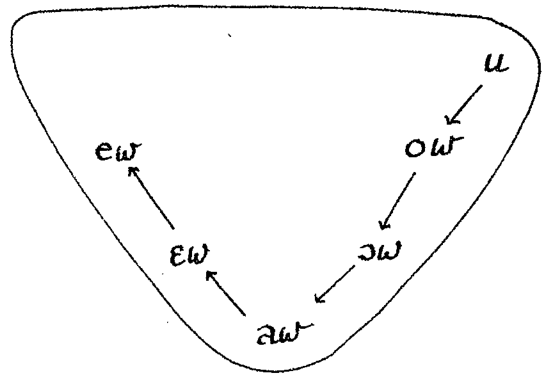


The German development also had a third series: the front rounded vowels which were parallel to the front unrounded ones at each stage. Again, we do not have any strong evidence on the route followed by these diphthongs. The case of the front rounded vowels is challenging from the standpoint of peripherality. As we observe in all current dialects, the front rounded vowels show less extreme F2 positions than the unrounded ones. Would we then find that diphthongs with front rounded nuclei had even less peripheral (centralized) nuclei than the monophthongs? The study of sound change in vowel systems with mixed vowels will be an important step in the further development of our current view.

Proto-Yiddish underwent the same diphthongization of long ī and ū to ai and au (Herzog 1965). But this Middle German system gives us important evidence on the mechanism by which this change took place, reinforcing the parallels between our current observations and these reconstructed movements. In Proto-Yiddish, the old ei and ou remained at mid position, and did not merge with the new diphthongs whose nuclei fell to low position. Thus Northeastern Yiddish /mejn/, 'mean', contrasts with /majn/ 'my'. The first comes from OHG ei, the second from OHG ī. The same movement took place in the back, where ū fell to /aw/ (in Herzog's reconstruction) but ou did not merge with OHG ou. This failure to merge can be accounted for in the back vowels by the fact that ou developed a front glide, ou → oy.[37] But the failure of ī to merge with the older ei in its path to ai as ī moved down to ai would have to be considered inexplicable in the traditional view of phonological space. There is no evidence that these vowels developed "back" or "central" nuclei. But our current findings that falling diphthongs follow less peripheral paths would explain how one ei could pass another without merging. Just as in the case of English day and die discussed above, the two might have co-existed unmerged with peripheral ēi and less peripheral ĕi until the latter continued its descent to ai.

4.8.3.1. Extensions of Pattern 1. Our original version of Pattern 1 in English showed a continuation of the symmetrical developments with the new /ay/ and /aw/ becoming tense and moving upward to /ɔy/ and /æw/ respectively. As we noted above, none of our other examples of Pattern 1 are extensive enough to show a complete parallel. But we do find the path of English Pattern 1 and 1' sketched out in the developments in Romantsch dialects (Grisch 1939, Camenisch 1962), in which a single vowel can be seen shifting from [i] to [ey] to [ɛy] to [ɔy] to [oy]; and a second vowel from [u] to [ow] to [ɔw] to [aw] to [ɛw] to [ew].

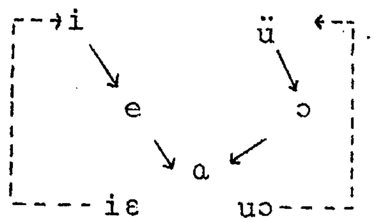




The parallel to Pattern 1' is not complete, since the front vowel does not descend to low position before it moves to the back. It therefore does not become [+peripheral] in our terms. This movement of *ey* back towards *oy* is paralleled by the French developement of Latin *ē* in *mē*, etc., which was diphthongized as *ei* and moved to *oi* before the nucleus rose and it was converted into a rising diphthong [wɛ].

We cannot be sure that no intermediate form *ai* existed in the Romantsch cases, since we are only observing a range of current dialect forms and inferring the existence of a change which was a transition between them. The back vowel does show a low nucleus as an intermediate form [aw]. This situation must raise the general question for further investigation: under what conditions will a front up-gliding diphthong move to the back? If this development should be observed in the course of a chain shift, it would provide a counter-example to Principle III. All the cases noted so far are individual movements of single vowels; but see below under Pattern 4 (4.8.5). The problem is parallel to our present preoccupation with the fronting of /ow/, which moves as a single vowel across the system. In order to solve the problem, it will be necessary to obtain more detailed data on the intermediate forms of such dialects.

4.8.3.2. The lowering of short vowels. When we first formulated the general principles of chain shifting, it appeared natural to oppose the raising of tense or long vowels with the falling of short or lax ones. But in the course of our synchronic studies we have found only one clear example of this phenomenon: /i/→/e/→ in Chicago, with some traces in other Northern cities. In our historical investigations, we have also found only one case: the lowering of short vowels in Vegliote, the extinct Romance language spoken until 1899 on the island of Veglia off the coast of Yugoslavia. This development is especially interesting because it first appears as a counter example to the principle that tense (or unmarked) vowels rise in Romance chain shifts. In "Period Four" (perhaps the fourteenth century) Hadlich shows the following shifts:

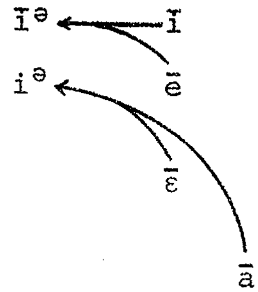


The distinction between long and short vowels had been lost in Vegliote long before this stage. However, if we define the "short or lax" vowels as those which are opposed to a "long or tense" series, then /i, e, ü, ɔ/ would stand in opposition to <u>iε</u> and <u>uɔ</u>. These ingliding diphthongs developed from /ε̄/ and /ɔ̄/ at an early stage. They appear to have developed onglides as rising diphthongs (a model (1) route in the discussion of 3.8). They then shifted to falling diphthongs <u>iε</u> and <u>uɔ</u>, which were then monophthongized to /i/ and /u/. Whatever the actual mechanism of transition may have been, the patterns presented in Ch. 3 argue that the nuclei of these vowels would have been peripheral, and the others less peripheral in contrast. The shift of /i/→/e/→/a/ would therefore be an example of a chain shift downward of lax vowels, along with /ü/→/ɔ/→/a/.[38]

This interpretation of the Vegliote data (which agrees with Hadlich's own view) still must be seen as many steps removed from observable data. Given the scarcity of data on lowering of short vowels we are inclined to reformulate Principle II in terms of the lowering of lax nuclei of upgliding diphthongs only.

4.8.4. <u>Pattern 2 chain shifts</u>. There are almost no historical examples of the Pattern 2 shift that we studied in the Northern cities. This may be because "square" systems which allow shifts of /a/→/æ/→ are relatively uncommon. The basic shape of phonological space is triangular, with a most open vowel at /a/, so that most chain shifts show only upward movements among the low vowels. We can find some parallels to the English situation in the neighboring West Germanic language, Frisian, which shares with English the "Anglo-Frisian brightening" of /ā → ǣ/. West

Frisian breaking (Markey 1972) shows a fronting of /ā/ and a simultaneous upward movement of ē and ε̄ which may be diagrammed as follows:



The parallel with Pattern 2 is close enough to suggest that investigation of West Frisian dialects would reveal parallels to the phonetic conditioning of the Northern cities.

4.8.5. Pattern 3 in the historical record. We have found eight examples of Pattern 3 in historically attested changes. Four of these have been treated by Haudricourt and Juilland (1949): French, Portugese (San Miguel), Swedish and Greek. We have further examined the Swiss French dialects of the Valais, and located in addition Pattern 3 shifts in Yiddish, Albanian, Romantsch, and Akha, a Lolo-Burmese language. The upward chain shift in West Syriac may be considered a truncated case of Pattern 3: although it has not fronting of u→ü, it is an unsymmetrical upward movement of back vowels: /a/→/o/→/u/. A truncated pattern may also be observed in Lithuanian, /a/→/o→uo/.

We are therefore able to say that Pattern 3 is a very general type of chain shift, with ten examples to reinforce Principle I and eight illustrating Principle III.[39]

Haudricourt and Juilland present the Pattern 3 chain shifts as illustrations of the importance of functional relations in vowel systems, arguing that the forward movement of /u→ü/ is always a movement which relieves overcrowding among the back vowels--more specifically, four degrees of height. While four levels of height is a stable situation in the front, the asymmetry of the mouth is such that the creation of four levels in the back will (according to Haudricourt and Juilland) lead to a chain shift. More precisely, four levels of height in the back is a necessary condition for such a chain shift.[40]

We may take the case of Greek as an example of these principles. Proto-Greek distinguished only five vowels, long and short, which formed a relatively stable system. A fourth level of height resulted from the compensatory lengthening of /ĕ/ and /ŏ/ (Ruiperez 1956). These new long vowels were higher than the original long mid vowels, yielding four levels of height:

ī			ū
ē			ō
	ε̄	ɔ̄	
	ā		

One movement which acted to relieve this situation was a fronting of a; but the four levels in the back were maintained by the introduction of a new long ā (Ruiperez 1956). The fronting of /u → ü/ (accompanied by a fronting of the short /u/) was the first movement in a chain shift /ɔ/ → /o/ → /u/ → which permanently reduced levels of height in the back vowels to three.

An equally convincing example is that of the vowel shift of Swedish and East Norwegian (Haugen 1970) which was recognized as early as 1886 by the Norwegian dialectologist Amund B. Larsen (Benediktsson 1970). The first event seems to have been the lengthening of short /a/. This led to the backing of the original long ā to ɔ̄: Benediktsson points out that this is a fairly clear example of a "push chain" rather than a "drag chain." [41] The resulting long vowel system (still preserved in Danish) had four levels of height in the back:

ī	ȳ	ū
ē	ȫ	ō
ǣ		ɔ̄
	ā	

One group of descendants of Old Scandinavian relieved the crowding by diphthongizing /ɔ/ to /ao/. A second group, consisting of Swedish and East Norwegian, carried out a Pattern 3 chain shift /ɔ̄/ → /ō/ → /ū → ü/ (Benediktsson 1970). The Pattern 3 shift did not move /ū/ to a fully fronted position since another mixed vowel, the product of umlauting, already existed; the out-rounded and in-rounded forms thus add one further structural element to the chain shift in that the high front position of the out-rounded vowel acts as a constraint on the position of the in-rounded one (Hammerberg 1970).

We have already discussed in Chapter 3 the Romance diphthongization of tonic free /ɛ,ɔ/ which was one response to the development of four levels of height in Vulgar Latin. The "Second Diphthongization" of tonic free mid closed vowels was referred to above: e,o ei,ou. But these conditioned changes still left four levels of height: at the end of the Gallo-Romance period the remaining o participated in the limited Pattern 3 chain shift /o/→/u→ü/. More extensive Pattern 3 shifts may be observed in particular French dialects (cf. Hauteville in Martinet 1955).

In our own studies of Romance dialects we find a slightly different organization of the Pattern 3 shift. The data collected by Gauchat, Jeanjaquet and Tappolet in the Swiss Valais (1925) shows a shift in the western region in which /ɔ/ rose directly to /u/ without merging with /o/. This /ɔ/ has two sources in the Valais: V.L. checked /ɔ/ and checked and free au. At the same time, V.L. checked /o/ fell to [ɔ]. Thus

Here we have a situation comparable to the Proto-Yiddish case where ei from long i passed old ei in falling to ai; in the Valais the situation is one step more complex since /o/ and /ɔ/ actually reverse positions. If these vowels followed the principles we have observed in current vowel shifts, the matter can be understood without difficulty: /ɔ/ rose as a tense and ingliding vowel along a peripheral path; /o/ fell as a lax vowel along a less peripheral path.[42]

Pattern 3 shifts which show the fronting of [ü] naturally are concentrated in the region of Western Europe where this fronting is an areal phenomenon. In Switzerland, we also find a Pattern 3 shift in Romantsch. Most dialects have merged /ü/ with /i/ but in Engadine they are still distinct (Camenisch 1962). The chain shift /o/ → /u → ü/, identified by Lüdtke (1954/5), is limited as in standard French to the two higher vowels; but in Romantsch this word class is larger than in French since it has not been depleted by diphthongization of the free vowels (Camenisch 1962:129).

The chain shift of Proto-Southern Yiddish is an example of Pattern 3 located in Eastern rather than Western Europe. The shift is again /ō/→/ū→ǖ/, with subsequent unrounding of [ǖ]. The ō which was raised to ū had earlier been raised from ā. Thus: Central Yiddish šīl, 'school' corresponds to NHG Schule, but CY šūl, 'bowl', corresponds to NHG Schale. Thus we have in Proto-Southern-Yiddish only three degrees of height (Herzog 1965). If Herzog's reconstruction of PSY is correct, it is a striking counter-example to the Haudricourt-Juilland theory that Pattern 3 chain shifts are always caused by crowding in the back. Proto-Southern-Yiddish was formed out of Proto-Eastern-Yiddish which clearly had only two long monophthongs in the back, and was in fact missing ā. It seems difficult to avoid the conclusion that crowding in the back favors Pattern 3 but is not in any simple sense the "cause" of this chain shift.

In a more distant branch of Indo-European, we find evidence of a Pattern 3 shift in Albanian. PIE ā is represented by /o/ in Albanian, while PIE ō appears as /e/ and PIE ū as /i/ (Brugmann 1922). Since PIE au is represented by Albanian /a/, it seems clear that there is chain shift involved:

$$\begin{tikzcd} \ddot{u} & & u \arrow[ll] \\ \ddot{o} & & o \arrow[ll] \\ & a \arrow[ur] & \\ & au \arrow[u] & \end{tikzcd}$$

This shift does not involve four levels of height, unless we consider that it was a push chain involving /au/ → /a → ɔ/ as a first stage. The fronting pattern affects both /u/ and /o/ (as in some of our current observations of London, the Outer Banks, etc.). The intermediate stage [ö] is no longer attested, as PIE ō is fronted and unrounded to ē; but there is some evidence of the [ü] remaining.

There are also truncated cases of Pattern 3 which do not show fronting. The Lithuanian development (Senn 1966) shows:

$$\begin{tikzcd} & uo \\ & \bar{o} \arrow[u] \\ \bar{a} \arrow[ur] & \end{tikzcd}$$

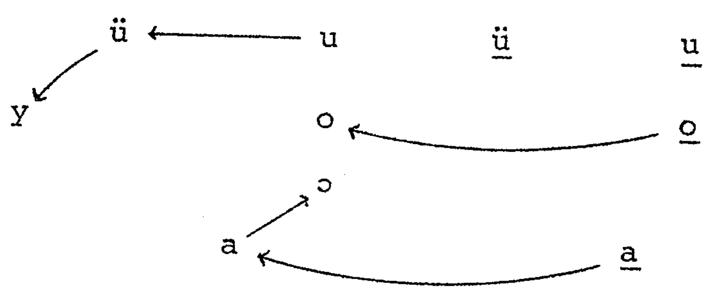
The movement of ō to uo is quite general in Eastern Balto-Slavic, as we have seen in Chapter 3; but while Lettish has only this movement, Lithuanian also has the shifting of ā which gives us evidence of a chain shift.

Outside of Indo-European, we find a similar shift in West Syriac (Nöldeke 1880), /ā/→/ō/→/ū/ with a merger of /ō/ and /ū/ in high position. This is the only example we have found in Semitic languages so far; this is only natural since most Semitic vowel systems have not developed far beyond the three-member system.

The chain shift which is most remote from our Indo-European examples appears in Akha, a Lolo-Burmese language. The Akha are hill tribesmen living in an area overlapping China, Burma, Thailand and Laos. Data on nine dialects have been compared by Bradley (1969) from reports by Lewis, Nisida, Roux and others. Dialect 6, spoken in the central area between Burma and China, is of particular interest here because of the extensive fronting of /u/. There is first of all a classic Pattern 3 shift of back vowels in glottal-tone syllables (proceeding from original checked syllables).

ü ← u
↑
o
↑
ɔ

The new ü in glottal syllables already had a counterpart in open-tone syllables. This vowel developed further to /y/, followed by a fronting of /u/. This left a considerable gap in the back: there was no /u/, /o/ or /ɔ/. Two of the three were supplied by a complex shift: /a/ rose to /ɔ/, while /o/ moved to /o/, losing its glottalization. The place of open-tone /a/ was filled by /a/, which also lost its glottalization.

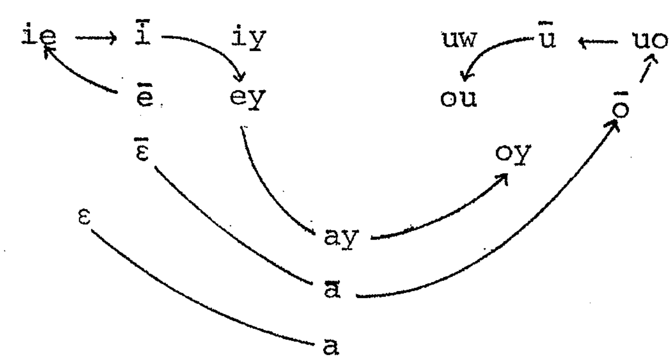


The second shift in open-tone syllables may also be considered Pattern 3, with the additional complication that the full raising of /a/ was forestalled by the entrance of glottal /o/into the open-tone system. The final result is an unbalanced system with /ü/ but no /u/, one of the many counter-examples to the proposed universal that /ü/ always implies /u/ (Sedlak 1969). But if the principles of chain shifting apply to Akha, as they seem to do, we can expect a further raising /ɔ/→/o→u/.

4.8.6. Pattern 4 in other languages. The characteristics which marked the Pattern 4 chain shifts studied above are: (1) they are predominantly movements of the nuclei of upgliding diphthongs and (2) this is an unsymmetrical pattern which lowers in the front and raises in the back. In our historical studies, we find three clear examples of Pattern 4: Central Yiddish, East Lettish, and Lappish, and two truncated cases in Southern Swedish and Romantsch.

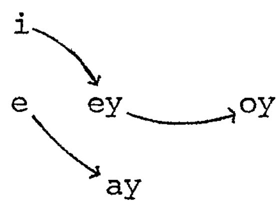
The East Lettish developments combine almost all of the principles of vowel shifting that we have studied so far. As we have seen, Lithuanian and Lettish show a general raising of the tense mid vowels to high ingliding ie and uo. In Endzelin's monumental study of Lettish grammar (1922) we find a wealth of evidence on developments in current dialects. In these dialects, the ingliding vowels are monophthongized to [i:] and [u:]. In the front, the older ī falls to [ei]; older ei moves to [ai]. In some dialects (e.g. Setzen) older ai moves to [oi].[43] The position of old ie is now assumed by ē which now rises as a second tense ingliding vowel. Thus we have the chain shift /e:/→/ie/→/i:/→/ey/→/ay/→. A corresponding upward shift takes place among the back vowels. Here older ō had moved to uo. This uo is monophthongized to [u:] while older ū moves to [ou], parallel to the shift of ī to [ei]. The older ā also shifts, moving up to [o:]. In various dialects this has begun to form a second raising to tense and ingliding position: we note variants such as oā, ōa, oa, ua, uo, ūo in the phonetic record.

There is also a downward shifting among the front vowels. Short ε̆ moves down to [a]. Both short and long ε move down to short and long [e:] and [a]. These downward movements may reflect a single shift of the lower mid nucleus [ε] to [a] in the diphthongs, short vowel and long vowel. If it were not for the upward movements of ā and ō in the back, however, the downward shift of ε̄ would be a counter-example to Principle I. It may be noted that there is also a conditioned upward shift of short a to [ɔ]. After the original raising of ei and ō to ie and uo, we can diagram the further changes as follows:[44]

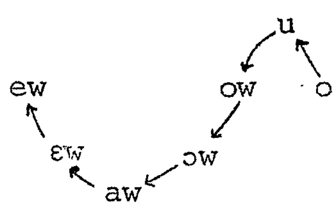


The Romantsch case has already been discussed above as an example of Pattern 1'. However, we must also consider it here under Pattern 4 because in addition to the diphthongization of i and u in Romantsch, there is a parallel development of long close e. As we follow the developments in various communities, we observe that reflexes of VL i and VL o→u appear as [i] and [u] in some dialects (e.g., Surselva, Sutselva) (Grisch 1939). In other communities within the Sotsés region we find these vowels diphthongized to [ey] and [ɔy] and [ɔw] or [aw]. At the same time, the original [e] is diphthongized to [ey], [ɛy] and then to [ay], without any signs of falling together with the reflexes of VL i.

This Romantsch development differs from any previous view we have obtained of Pattern 4 because [ey] does not descend to [ay]. Instead, it shifts directly back towards [ɔy] and [oy], giving us:

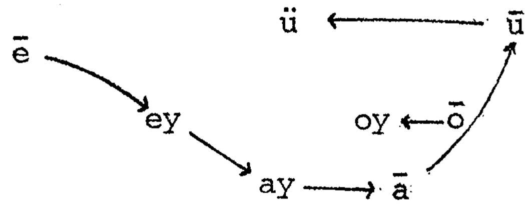


At the same time, the diphthong proceeding from u does descend to [aw] and then rises to [ɛw] and [ew].



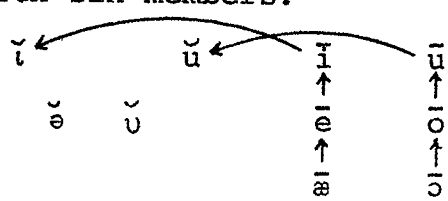
We find a similar shift in Southern Sweden (Swenning 1909, Hedström 1932). In the province of Småland and neighboring regions, the monophthong /e:/ is diphthongized; in some areas it is lowered to [ai] and in others it is raised and appears as [oi]. At the same time, long and short /ä/ is also diphthongized and appears with a low nucleus. Here again, it is the higher diphthong which shifts to the back, while the lower diphthong remains low. The general issue is: under what conditions will we get a chain shift /iy/→/ey/→/ay/→/oy/→ and under what conditions will we observe mid diphthongs shifting directly across the system to the back?

In a number of the Pattern 4 shifts we observe that diphthongs interchange freely with monophthongs. The case of Central Yiddish illustrates this phenomenon within the Pattern 4 paradigm.



We have already studied the developments on the right hand side of this diagram in the discussion of Pattern 3. In Central Yiddish we also have the monophthongization of long close ē in betn to ey; the ey in meyn meanwhile falls to ay, and the ay in mayn is monophthongized to ā which had risen to ō at a much earlier stage.

We can observe a symmetrical Pattern 4 shift outside of Indo-European in the development of Lappish from Proto-Finnic-Lapp. At one stage in the evolution of Lapp, as reconstructed by R. Harms, we have a sub-system of short vowels reduced to two members and a sub-system of long vowels with six members.[45]



The long high vowels are not diphthongized, as in the other Pattern 4 examples we have cited; instead, they are unconditionally shortened to provide a new ĭ and ŭ. The long mid vowels then rise to high position, and the long low vowels rise to mid. At a later stage, a long ā is supplied by loan words.

These five examples of Pattern 4 show us many instances of the basic principles of vowel shifting operating in a variety of languages. Again they confirm that Principle I, the raising of long or tense vowels, operates quite generally in chain shifts. Principle II is strongly reinforced by the many examples of the falling of diphthongal nuclei. Principle III also appears in many of these examples. From these instances we find only one further complication which is not envisaged in our Patterns. In many cases, /ey/ falls to /ay/, becomes tense, and rises as a tense nucleus. But there is an alternate route in which /ey/ moves directly to /oy/. This forms a counter-example to the principle that back vowels move to the front rather than front vowels move to the back in chain shift. Closer examination of the dialect areas in which such shifts occur may throw light on the mechanism of this process; in particular, a study of such sound changes in progress would be particularly rewarding.

CHAPTER V

CHAIN SHIFTS ACROSS SUB-SYSTEMS

In the previous chapter, many of our examples of chain shifting showed movements from one vowel sub-system to another: monophthongization, diphthongization, lengthening and shortening, and shift of syllabicity from falling to rising diphthongs. Yet the main emphasis has been on the movements within the sub-system: Principles I, II and III concern the uni-directional character of raising and lowering, fronting and backing within chain shifts. In this chapter we will examine those movements which carry a vowel from one sub-system to another, and see if there are any general principles of chain shifting which govern the processes.

These shifts of sub-system are crucial matters for an over-all understanding of chain shifts and the economy of vowel systems in general. We see that systems move according to uni-directional principles: but what factors re-distribute the vowels over phonological space and preserve the efficient use of distinctive features? How do systems keep moving and yet remain stable? What prevents Principle I from collapsing all long tense vowels into /i/ and /u/? If we say that chain shifts are rotations which preserve the functional economy of the system, then exits and entrances from a given chain become essential to preserve the economy of the vowel system. Where such exits are closed, we may observe wholesale merger. This leads to the most difficult question of all: what factors allow some languages to show movements across sub-systems which prevent merger while other languages show no such movement and succumb to merger on a large scale?

By <u>sub-system</u>, we mean a set of vowel nuclei or peaks which have the same glides or satellites and the same supersegmental features. Vowels within a sub-system differ only in the three dimensions of fronting, backing or rounding. We have dealt with the following sub-systems of stressed vowels:

short vowels
long monophthongs
ingliding diphthongs
front upgliding diphthongs
back upgliding diphthongs
rising diphthongs

A crucial question is whether the nuclei are tense or lax (or peripheral or non-peripheral). By definition, the short and long vowels are lax and tense respectively, and we usually find that they are non-peripheral and peripheral in acoustic terms. The ingliding vowels we have been dealing with have tense and peripheral nuclei.[1] In the upgliding diphthongs, we may have either tense or lax nuclei, as we have seen. We can therefore subdivide these two classes into tense and lax upgliding sets. For our present purposes we find that back upgliding and front upgliding act in the same way, and we can treat them together. To simplify our notation and diagrams, we will draw all our examples from front vowels, but it will be understood that the same principles apply to back upgliding vowels as well. Finally, we note that the nuclei of rising diphthongs are usually lax. We therefore have the following sub-categories:

			Nucleus	Glide
$\check{V}$	short vowels		lax	
$\bar{V}$	long vowels		tense	
Vh	ingliding diphthongs		tense	lax
Vy	upgliding diphthongs			
	$\check{V}y$	lax	lax	tense
	$\bar{V}y$	tense	tense	tense
yV	rising diphthongs		lax	tense

5.1 Allophonic splits in sub-systems

There are of course many other sub-systems that we might consider: nasal vowels (free and checked), murmured vowels, voiceless vowels, glottalized vowels, etc. But we will consider here only those sub-systems that we have studied in Chapters 3 and 4. To what extent do these sub-systems form a unity? When we say that vowels within a sub-system differ only in position or rounding, we are of course thinking of contrasts in which the larger environment of the syllable or word is the same. To pursue the matter to its ultimate conclusion, each set of minimal pairs would form its own sub-system. In grosser terms, we might sub-divide each sub-system into vowels before voiceless and voiced consonants, etc. But in this study of chain shifts, we will be primarily concerned with unconditioned movements where the phoneme acts as a whole.

At the beginning of this chapter, we saw evidence that (æht) and (oht) co-varied in the Northern cities, as opposed to (æhk), (ok) and (ohk). But we also argued that /æ/ was still acting as a unit. Even where /æ/ is split in New York City between /æ/ and (æh), it could not be entirely dissolved into its separate allophones (æhN), (æhF), (æt), (æk), etc. For if this were so, we might observe a New York City chain shift of (æhN) and (oN), despite the fact that (æt) and (æk) words stayed low, blocking the forward movement of (ot) and (ok). Such a chain shift would bring (oN) forward, overlapping with the /æ/ class. But we observed such a forward chain shift only when /æ/ was tensed and lengthened and raised as a whole in the Northern cities.

We conclude that it is possible to speak of the sub-systems of short vowels or ingliding vowels as units, subject to unconditioned shifts which preserve the distinctions between individual members of the sub-system. When allophonic conditioning reaches its most extreme form, as in the case of words with following liquids, we may be forced to set up separate sub-systems. The assignment of phoneme membership for vowels before -l and -r may then become doubtful. Thus words like beer cannot easily be assigned to /iy/ or /i/ in English, and are usually assigned by dialectologists to a separate /Vhr/ system. The same is true to a lesser extent for vowels before -l. In our spectrographic studies, we do not use words ending in liquids to determine the outer envelope of a vowel distribution: if feel and steal are found to be more central than other /iy/ members, the ellipse that defines the area occupied by this vowel will exclude them. In some cases, we have to treat words ending in nasal consonants in the same way. But with these special reservations, we are still able to speak of the movement of unit vowels within a sub-system, bearing in mind that when a change is in progress, the effects of many conditioning environments become exaggerated.

Throughout this report we have been speaking of "tense or long" vowels as if these two categories were equivalent. It is useful to make this connection, since our historical records usually give us some evidence of length while current studies discriminate the same sets more easily on the basis of formant position--that is, peripherality. But we have noted at many points the limitations of this equivalence. There are languages which show long and short vowels in both tense and lax categories; some dialects of Somali which we have recorded are exceptionally clear in this respect, with two degrees of length for tense (peripheral) and lax (non-peripheral) sets. However, we have no records of chain shifting in such languages; as the scope of our research is enlarged, cases of this kind will become critical.

Figure 5-1 shows the relations of the five sub-systems we are dealing with: V, V̄, Vh, yV and Vy; the last is split into Vy and V̄y. The arrows connecting the triangles show movements between sub-systems; the arrows within the triangles show the directions of chain shifts within the system. Again, the principles we cite here for movement between sub-systems take their clearest form in chain shifts. Only the front vowels are indicated in each vowel triangle, except for the Vy sub-system where all front upgliding vowels are shown. A symmetrical diagram can be drawn for the back vowels and back upgliding diphthongs (see Fig. 5-2).

5.2 Shifts of the short vowels

We have already indicated the minor role in chain shifting played by short vowels--that is, vowels which are opposed by their short or lax position to a set of long or tense vowels. They have relatively few connections with other sub-systems. There are no routes which connect Vy and V̆: short vowels do not spontaneously develop unconditional upglides nor do upgliding diphthongs unconditionally monophthongize to short vowels.[2]

There is also little connection between yV and V̆. Short vowels do not spontaneously develop on-glides, and when yV vowels are monophthongized, the result is usually a long vowel. There are individual cases where the y is absorbed into the preceding consonant, and other alternations between V̆ and yV, but we do not have any cases where these alternations play a role in a chain shift.[3] The routes that we do observe connecting V̆ with members of other systems extend to V̄ and V̄h. The collapse of V̄ and V̆, as in Vulgar Latin, is not, of course, part of a chain shift pattern, since such wholesale merger is the reverse of a chain shift. But several lengthenings of individual vowels have been noted here as forming a chain shift: thus the lengthening of /ă/ in Scandinavian appears at one end of the Pattern 3 chain shift in Swedish and the lengthening of vowels in open syllables in late Old English provides the basis for the Great Vowel Shift. Because so many chain shifts involve the raising of ā, an important part of continuing language change is the lengthening of ă. On the other end of the chain shift, a high vowel is often removed from the system by shortening, setting the stage for an upward chain shift of long vowels. Thus in Harms' reconstruction of Lappish developments, we observe an unconditioned shortening of the high vowels, which in turn led to a general chain shift upward of the mid and low long vowels (see p. 218). The first step in this series of shifts across sub-systems was the reduction of the original short vowel system. Harms shows an original /i, ü, u/ being reduced to a more or less centralized /ə/ and /ʊ/. The other short vowels were tensed and lengthened, so that /ə,ʊ/ were the only members of a "reduced" sub-system at that time. The shortening of the long high vowels which produced the new /i,u/ did not then lead to a merger with the older high short vowels. These vowels had thus followed the general direction of Principle II in lowering (and centralizing) and so initiated the chain shift.[4]

At any point, then, we can see the shortening or lengthening of a vowel as a link in the chain shifting, although the most common phenomenon is the lengthening of /ā/ and the shortening of /ī/ or /ū/. Route (1) in Fig. 5-1 indicates this generalized bi-directional **route.**

The short vowels can also be seen as linked to the tense ingliding vowels by route (2). The example of the Outer Banks and other Southern dialects shows that the short front vowels as a whole can become peripheral and develop inglides. We also find the more specific lengthening of short a in the Northern cities as the initiating element in the chain shift (oh) → (o) → (æh)→ . This raises again the problem of the status of short o in this area. Is it a member of the tense Vh series or is it a simple short vowel? In [0high] position we would not expect to detect an inglide, since this develops only at [2high] or possibly [1high]. Traditionally, this short /o/ class is designated /a/, a member of the set /i/, /e/, /æ/, /ʌ/, /u/. But since /æ/ is now converted to a tense ingliding /æh/, or the variable (æh), and short o moves in response to this element, we may wish to revise our terminology and consider o to be the new /oh/. One consideration to support this point of view is that the descending short /e/ overlaps short o but does not seem to merge with it. A more detailed study of the phonetics of this situation and subjective reactions to the isolated forms will be needed to resolve the question.

5.2a Shifts to and from the long vowels

In our studies of chain shifts, one of the most prominent developments is the conversion of long monophthongs into tense and ingliding vowels. Chapter 3 documented a great many cases and supported the general principle that this diphthongization occurs regularly as mid vowels rise to high vowels. Route (4) in Fig. 5-1 shows this path. One might expect the development of such inglides from high vowels, but we have almost no evidence for a movement from /ī/ to /iə/. The case of West Frisian (Markey 1972) has been cited several times above as a general breaking; but it is conditioned in the case of /ū/ and occurs in only one etymological sub-class of /ī/.

On the other hand, we have many cases of chain shifts embodying a monophthongization of /iə/ to /ī/ and /uə/ to /ū/. In Middle High German we find for example a chain shift across sub-systems:

/iə/ → /ī/ → /ei/

/uə/ → /ū/ → /ou/

/uə/ → /ü → [öü]/

We observe this monophthongization of /iə/ in the high ingliding vowels in East Lettish as part of the intricate chain shift described in 4.8.5. The /iɛ/ of Vegliote was also monophthongized to /i/ in the last stage of development (Hadlich 1965).

Routes (3) and (4) therefore represent a unidirectional pattern similar to Principles I-III. As tense vowels rise from mid to high, they often develop inglides; in high position, the inglide may be lost. The next step in the chain may be route (5) where V̄ is diphthongized to Vy.

The tense or unmarked vowels show enough connections with other sub-systems to justify the central position of V̄ in Fig. 5-1. In fact, all but two of the eight paths shown are connections from an outlying sub-system to V̄. The most intricate connections are with Vy, which is linked by three paths to V̄.

The path most often represented in our data is route (5). The diphthongization of the high vowels is found in English, German, Czech, Old Prussian, Lettish, Romantsch and Southern Swedish. As we see in modern English, it is always possible for us to have a phonetic interchange between [i:] and [ɩj], so that (5) is certainly not irreversible. But we do not find any chain shifts of the type: /iy/→ /i:/→ . Perhaps this is because the elements to the left or right would have to violate Principles I or II, i.e., /ey/→/iy/→ /i:/→/e:/→. In other words, since there are no languages with stable distinctions between /iy/ and /i:/, if we find a new /ɩ:/, we can expect that the highest upgliding diphthong will show a greater differentiation of nucleus and glide than [$\bar{\text{I}}^{\text{i}}$]; that differentiation is irreverisble in the course of a chain shift. The unidirectional character of route (5) is therefore a consequence of Principle II.

We also observe a bi-directional path (6) connecting Vy with V̄. There are a number of cases in our data showing the monophthongization of /ey/ to /ē/. This occurred in the course of the English Great Vowel Shift, though there is disagreement as to the actual height of the mid vowel at the point of merger with the monophthong. Albanian appears to show a shift across sub-systems which involves the monophthongization of /au/ to /a/ and further shifts of /a/, /o/ and /u/ (see p. 214 above). McKenzie (1918) argues that proto IE Lithuanian *ei* must have been monophthongized to [e:] before it rose *to ie* in Lithuanian. On the other hand, we see the diphthongization of the mid vowel /e/ in Romantsch to /ey/ which then descended to /ay/ as part of the chain shift /i/ → /ey/ →. Route (6) is therefore a bi-directional path in the construction of chain shifts.

One of the most important paths in chain shifting to V̄ is (7), representing the monophthongization of /ay/ to /ā/. This is the major output of the Vy part of the chain shift cycle, under Principle II. It joins with route (1) as one of the major inputs to the raising of tense or long vowels. This can be seen most clearly in the Great Vowel Shift. There were two sources for the new front long vowel [ǣ]: the older diphthong /æy/ in *day*, *maid*, etc., and the lengthened and raised /a/ in *name*, *grave*, etc. The Early Modern English monophthongization of /æy/ is quite parallel to the current monophthongization of /ay/ in Southern States English. In both cases, fronting of the nucleus and lengthening of the nucleus is observed. Central Yiddish also shows a monophthongization of /ay/ as part of the Pattern 4 chain shift, in this case replacing the long /ā/ which had been raised to /ū/ by an earlier process.

Paths (7) and (7') are particularly interesting because they represent a fork in the chain-shifting path. While Atlanta and Central Texas follow path (7), London, Norwich, Essex, Philadelphia and the Outer Banks all follow the upward path (7'), raising the nucleus of tense /āy/ in a Pattern 4 shift. The critical point occurs when the descending Vy hits the bottom of the vowel triangle and becomes [±peripheral]. It then becomes tense by definition, and either monophthongizes and fronts by (7) or rises to the back by (7')--in each case rising by Principle I. The fronting is a natural consequence of monophthongization, which often represents an averaging of the positions of nucleus and glide (as when *ai* becomes e). At present we have no clear idea of the factors which determine the choice of one path or the other at this branching.

It is also clear that path (7) is uni-directional. We have no records of an unconditioned diphthongization of /ā/ to /āy/.

5.3 Shift of syllabicity

Once we have explored all of the paths which lead to and from V, we have exhausted the shifts of sub-system which are important in chain shifting. Yet we have not yet considered the yV sub-system. This is plainly connected to the Vh system by path (8), the shift of syllabicity discussed in Chapter 3. There are examples of alternations between Vh and yV, in both directions. In West Frisian, /iə/→/jɩ/; in Vegliote, /jɛ/→/iɛ/. But we cannot say that such alternations play major rôles in chain shifting.[5] Once a rising diphthong has been created, it is quite common for the nucleus to descend to most open position, as in French [wɛ]→[wɑ]. Once this development occurs, the next step if any would be the loss of the on-glide, path (9).

The case of Vegliote indicates that path (8) forms a bi-directional route for chain shifting. Path (8) is more important as an independent sound change. The discussion of Chapter 3 indicated that yV in Romance is derived from Vh as the result of the raising of tense and ingliding vowels. In the literature, there are a number of cases of the sudden appearance of a yV onglide which would otherwise seem quite unmotivated. We take it that these onglides are normally the result of the rise of $\bar{\text{V}}$ to high position, with creation of an inglide by route (4), and a reversal of syllabicity by route (8).

The monophthongization of yV is indicated in the Vegliote data, following path (9) in Fig. 5-1. It may also be possible for /yV/ to monophthongize to a short vowel in contrast with $\bar{\text{V}}$, but we do not have data at present to illustrate this.

As far as we know, there are no connections between yV and Vy.[6] While such a rule might seem a simple case of metathesis, characteristic of abstract reversals of phonological elements, it does not appear in our data.

5.4 Blocked routes

One of the most striking aspects of the shift of subsystems is a negative one. The crucial point in the development of chain shifts is path (5). If we consider the central position of V̄, and the force of Principle I, it is clear that many sound changes will begin to approach /i/. If we add to this the force of Principle III, moving /u/ to /ü/ and /i/, and the uni-directional path (4), converting /iə/ to /ɨ/, the potential pressure on /ī/ can be seen to be very great. The only path which would relieve this pressure is (5): the diphthongization of /ī/. It is therefore strange to find that for several languages, path (5) appears to be blocked.

Greek /i/ has never diphthongized to [iy]. But sound changes have moved other vowels towards /i/ over a long period of time. As a result, we now find in Modern Greek a single phoneme /i/ in which seven earlier phonemes have merged: /i/, /ī/, /u/, /ū/, /ē/, /ei/ and /oi/. No amount of functional pressure seems to have had any effect in preventing this outcome.

In Romance languages, path (5) seems to be blocked. In medieval French we find a wide variety of diphthongs, but /i/ is never diphthongized. The same may be said for Spanish, Italian, and other Romance languages. The sole exception we have found is the Romantsch dialect discussed in Chapter 4, where we can presume Germanic influence is strongest.

On the other hand, Path (5) seems open and readily available for Germanic and Balto-Slavic languages. Once again we are confronted with long-range tendencies in language families which determine the phonological evolution of the language, but we have no explanation for this drift.

5.5 The back vowels

It is not entirely true that the situation of the back vowels is symmetrical with the front vowels. Fig. 5-2 shows the diagram corresponding to Fig. 5-1 for the back vowels. There are two major differences: within V̄ we see a fronting movement as well as raising, and V̆w shows three distinct movements--at three levels of height. All of these fronting movements represent the action of Principle III. This means that part of the output of sound changes in

Fig. 5-2 will feed into Fig. 5-1.

But perhaps the most important difference does not appear on Fig. 5-2. It is the possibility of converting Vw into Vy. There is also an intermediate category of Vü which we encounter in German, in the Outer Banks and elsewhere. If there is a total conversion of a back upgliding set to an upgliding front gliding set of diphthongs it may not form part of a chain shift; yet until we know the outcome of the Outer Banks situation, for example, we cannot know for sure what is the result of this overcrowding of the upgliding front vowels.

5.6 Principles of chain shifting between sub-systems

We can summarize the discussion of this chapter by stating three additional principles of chain shifting.

> Principle IV. <u>In chain shifts, tense or long vowels may develop inglides as they rise from mid to high position</u>.
>
> Principle V. <u>In chain shifts, high ingliding vowels become monophthongs, and high and mid tense monophthongs become upgliding diphthongs</u>.
>
> Principle VI. <u>In chain shifts, maximally open upgliding diphthongs may become tense or long monophthongs</u>.

These are all unidirectional principles. Principle V may be explained by Principles I and II, as noted above, but IV is an empirical finding which does not seem to rest on any previous principle. It reads "may develop" since of course many tense monophthongs continue to rise as monophthongs. Principle VI is also optional but uni-directional.

The number of cases on which these principles are based is smaller than those which support Principles I→III, and it is likely that they will require revision in the future. But it is a promising beginning in the investigation of chain shifts to find this much structure in the first exploration of movements between sub-systems.[7]

CHAPTER 6

FALSE REPORTS OF VOWEL MERGERS

Chapters 3-5 of this report have dealt with chain shifts which alter the positions of vowels in phonological space without changing the number of distinctive units. In this chapter we will consider the converse situation : the possible merger of two vowels as the result of sound change. In particular, we will focus on five cases in which native speakers reported two vowels to be "the same" by minimal pair or commutation tests. These tests are normally considered the most reliable behavioral evidence of merger. Yet in all of these cases, data from connected speech shows that the reports of merger are false, in the sense that the speakers themselves reliably and consistently discriminate the word classes in their own speech production. These findings are not predictable from any previous theory about the factors that control sound change or the relation of perception to production. They throw serious doubt on the reliability of intuitive judgments of "same" or "different" as the sole criterion for determining distinctive differences in sound systems. Applied to the interpretation of historical data, these findings provide the possibility of a fresh approach to several long-standing paradoxes in the development of sound systems.

6.1 *Source* and *sauce* in New York City.

As shown in Chapters 3 and 4, the New York City vowel system is affected by a rule P19 (p. 180), which vocalizes final and pre-consonantal /r/, so that any distinction between *god* and *guard*, *source* and *sauce* must depend upon vowel length or quality. In the case of *god* and *guard*, several different sub-systems have been reported: some speakers distinguish the two by length, as [gɑ·d] vs. [gɑ:d]; some by quality, as [gɑ:d] vs. [gɑ˃:d]; and some show them the same, as either [gɑ˃:d] or [gɒ:d]. But in the case of *source* and *sauce*, it was generally considered that no difference in vowel quality was to be found: they were pronounced the same, both as [sɔ:s], or [soˇ:s] or [sɑ:əs].

This merger involves the class of /ohr/ which includes an earlier merger of /ohr/ and /ɔhr/ in *four* and *for*, *hoarse* and *horse*, etc. The other word class is /oh/, the class of long open *o* words not before /r/, in *caught*, *law*, *sauce*, *talk*, *off*, *lost*, etc., formed by rule P11 and P12 (pp. 173-174). As a result of the merger, we have such homonyms as *source* and *sauce*, *lore* and *law*, *sort* and *sought*, *cork* and *caulk*, etc. Evidence for the merger is to be found in impressionistic transcriptions of speech and word lists, and in minimal pair tests in which the pairs were heard as the same by phoneticians and judged "the same" by the subjects (Labov 1966).

There was no reason to doubt the existence of this merger, which was in fact assumed by all those who wrote about New York City speech.[1] We were therefore surprised when we began to inspect spectrographic charts in our re-study of the sample of New York City speakers (Ch. 3). In case after case, we found that the distribution of /ohr/ and /oh/ were not the same in connected speech. Figures 1-10 show the relations between /ohr/ and /oh/, in the context of the vowel systems as a whole, and Fig. 6-1 assembles the data from these speakers and others. In almost every case, /ohr/ is either higher and/or further back than /oh/: there are no instances of these relations both being reversed.

This was a startling result, since a number of the same informants had reported our minimal pair *source* and *sauce* as "the same." The gross differences in distribution of words could of course be the result of allophonic conditioning, since there are more tokens of /ohr/ words with no following consonant than /oh/: *more*, *four*, *pour* are more common than *maw*, [stressed] *for*, and *paw*. In the /oh/ class, the most common words are checked forms like *caught*, *talk*, etc. The value of minimal pairs or near-minimal pairs becomes clear at this point. Although most informants in New York City pronounce the /r/ in *source* when they read word lists and minimal pairs, there are about one third who preserve the *r*-less pronunciation of the vernacular. When the /r/ is not pronounced, informants regularly say that /ohr/ and /oh/ pairs are "the same." We have not yet found a counter-example where someone clearly heard a difference which was not dependent on the pronunciation of /r/.

The New York City study included a text to show the unreflecting pronunciation of minimal pairs where the two words were placed close together without the contrast being emphasized. In this case, the passage in question read:

> "And what's the source of your information, Joseph?" She used her sweet and sour tone

of voice, like ketchup mixed with tomato sauce.

Fig. 6-2(a) shows the F1 and F2 position of the nucleus of source and sauce as read in this context by Hazel Lapper, 42, of New York City. The two ellipses show the distributions of /ohr/ and /oh/ in connected speech. Source as read here is higher and further back than sauce; the difference in both F1 and F2 is more than 200 Hz, and somewhat greater than the normal difference between source and sauce in speech. While source is above the distribution of /ohr/ words, sauce is below most other /oh/ words.

Figure 6-2(b) shows the position of the nuclei of source and sauce as pronounced in the minimal pair test, again with the background of /ohr/ and /oh/ distribution in connected speech. The F2 difference is maintained, but the F1 position of source is lowered to that of sauce as the informant pronounced them and judged them to be "the same."

Fig. 6-2(c) shows two pronunciations of sauce and one of source by Hazel Lapper in the discussion that followed:

H.L.: (thoughtfully) ...source and sauce... (vehemently) Well when you say the source of your information you don't mean the sauce, tomato sauce...(excitedly) I would know, I would know when someone spoke!

W.L.: But the sound is all I'm interested in. Go ahead [with the rest of the list].

H.L.: (thoughtfully) The sound is the same.

In Fig. 6-2(c) the F2 difference is still maintained: one instance of sauce is 200 Hz fronter than source, the other shows a difference of 400 Hz. The F1 difference is not preserved: it is even reversed in one case. Again, the informant judges the two sounds to be the same as she reflects carefully on her own pronunciation.

We can observe the same treatment of /ohr/ and /oh/ in the speech, reading, and minimal pair test of Lucy Ricata, 57. In Fig. 6-1 we can see that the distribution of /ohr/ and /oh/ speech for Ricata is almost exactly the same as Lapper: the two classes overlap, but /ohr/ is somewhat higher and further back than /oh/. Fig. 6-3(a) shows the general location of /ohr/ and /oh/ for Ricata in the reading texts used in the New York City study. Here /ohr/ is distinctly higher than /oh/; source and sauce shows the same F1 difference as other words in reading. But in Fig. 6-3(b), showing the minimal pair test for Ricata, the difference in F1 disappears. Again the two words are differentiated by F2, reflecting the same difference that we find in connected speech. Lucy Ricata also judges these two sounds to be the same, unless they are differentiated by /r/:

> ...source and sauce...Well of course if you want to say source [so^ɚs]...you know, with the emphasis on the U-R...

The data provided by Lapper and Ricata agree in the three-way relation of connected speech to formal pronunciation to judgments of "same" and "different." In speech, /ohr/ and /oh/ are overlapping but distinct classes, with /ohr/ higher and/or backer than /oh/. In formal reading, the nuclei of source and sauce are distinguished by F1 and/or F2. When the informants are confronted directly with the contrast, the F1 difference disappears, but the F2 distinction remains or is reinforced; at the same time they label the two sounds as "the same" in their considered judgments.

There may of course be other differences between source and sauce not recorded in Figs. 6-1 through 6-3. The glides from r-vocalization may be stronger than the inglide from the rising /oh/, for example. Other formants may distinguish them further. But any additional differences beyond the F1/F2 positions of the nucleus can only reinforce our findings: that two vowels are regularly produced in a different way but judged to be the same by the speakers.

How can we interpret these data? We are of course familiar with the fact that the minimal pair test can be defective when informants try to make a distinction which is not natural to them. The distinction between /hw/ and /w/ in whale and wail is taught in some New York City schools, but no New Yorker in our sample actually made that distinction in natural speech. Similarly, some New York City teachers tried to get students to distinguish utter and udder, and suspend the normal flap formation rule: some informants will do this in minimal pair tests, just as they will distinguish aunt and ant. But these borrowed prestige pronunciations obviously do not reflect the New York City sound system. It is therefore normal for an investigator of lower prestige dialects to be on the alert for distinctions in minimal pair tests which have no basis in spontaneous connected speech.

But to the best of our knowledge, the converse defect of minimal pair tests has never been considered. If an informant insists that two sounds are "the same," it is usually taken as sufficient evidence of a merger. No one has reported before that a distinction which is denied by informants is regularly made in natural speech.

Now however we see that minimal pair tests can be doubly defective. The speaker's intuitive judgments about "same" and "different" may be wrong in either direction. That is not to say that we cannot derive some important information from these judgments. But they are "wrong" in the sense that they do not correspond to the linguistic pattern of every-day speech, and do not reflect the phonological rules employed by the speaker. In one important sense, the judgment of "same" reflects an important linguistic norm that may govern the speaker's behavior in formal situations: her most careful articulation, and her ability to label a difference for (let us say) the problem of correcting spelling mistakes. But all of our research findings indicate that the production of speech in every-day communication is the more systematic aspect of language, which governs the historical development of that system through time. The other cases studied in this chapter and the historical cases cited in Appendix A will give further evidence for this claim. But even in New York City, developments among younger speakers show further differentiation of /oh/ and /ohr/. Instead of the two sounds falling together as one might predict from intuitive judgments, we see as in Fig. 10 a further fronting of /oh/.[2] The continued divergence of /oh/ and /ohr/ in New York City therefore reflects the fact that the two word classes had not in actuality fallen together, and that the sound system seen in spontaneous speech provides a more reliable basis for understanding sound change than intuitive judgments.

What is the cause of the lower F2 position of /ohr/? When we examine the vowel systems of other dialects studied here, in Figs. 11-54 we find the same regular distinction between /ohr/ and /oh/, whether or not the /r/ is pronounced. The vocalization of /r/ seems to have no influence on this differentiation of the nucleus of /ohr/. In r-less dialects of the South, the /ohr/ class has usually risen to high back position, while /ɔhr/ is relatively low, and /oh/ is less peripheral. See for example Henry Gratton, Fig. 46. In the r-pronouncing areas like the Outer Banks, /ohr/ is again high back, and /ɔhr/ lower on the peripheral track; /oh/ may be upper mid or even lower high, but it is regularly found on the less peripheral track; see Jethroe Midgett, Fig. 38, and Monnie O'Neill, Fig. 40. In the Southwest, where /ohr/ and /ɔhr/ have fallen together in high position, /oh/ may also be quite high, but less peripheral: see Norbert Hoolster, Fig. 54. Precisely the same situation is found in London in the speech of Marie Colville, Fig. 30; /ohr~ɔhr/ are merged in peripheral back position, and /oh/ is at the same height but less peripheral, along with short /ɔ/. This is not true for all Londoners; but there are no counter examples and enough evidence in that direction to suggest that even after two hundred years of an r-less pattern, /ohr/ and /oh/ may still be distinct in London. Of course in London the composition of /oh/ does not include lengthened short o words, since rule P12 is basically an American rule, and there is no reason why long open o should merge with the reflexes of au, al, etc. The important point is that the relations between /ohr/ and /oh/ are basically the same in all dialects, whether or not r is pronounced.[3]

Since the F2 position is lowered even in r-less areas like London or New York City, we can only conclude that the phonological system can continue to operate over long periods of time with a rule like P6 even when P19 has removed the consonantal feature which conditions P6. If we were concerned with final /r/, one could easily see that alternations before vowels give enough information to preserve the underlying form of more, four, etc., on which P6 can operate. But in the case of pre-consonantal /r/, there are no alternations; and yet source behaves in essentially the same manner as four.

We conclude that there is considerable inertia to rule systems. As we will see from these and other examples, speakers may continue to make distinctions over many generations which they themselves have difficulty in hearing.

This disjunction between perception and production is of the greatest theoretical interest. Sometimes, as noted above, subjective perception is tied to earlier norms which are outrun by developments in the sound system itself. In other cases, when advancing linguistic variables are heavily stigmatized, speakers will sometimes substitute the prestige norm for their vernacular target, and actually hear themselves saying the former when they are in fact producing the latter (Labov 1966). But there are also cases when norms of perception run ahead of a speaker's phonological system. One such case we will consider briefly in the next sub-section.

6.2 Hock and hawk in central Pennsylvania

One of the most active sound changes taking place in the United States is the unconditioned merger of short o and long open o in hock and hawk, Don and dawn, cot and caught.[4] This merger is expanding outward from three areas: Eastern New England, Western Pennsylvania, and the Far West. In tracing the eastward expansion of the merger in central Pennsylvania, we interviewed Bill Peters, an eighty-year-old man living on a farm in Duncannon, Pennsylvania, north of Harrisburg on the west bank of the Susquehanna River. Bill Peters had been an iron worker and chicken farmer; he was of German background, though never a speaker of Pennsylvania Dutch. Peters is a very confident, forthright and eloquent speaker, and showed no obvious correction in his speech.[5] At the end of the interview, W.L. gave Peters a list of words and some minimal pair tests. He pronounced hock and hawk, Don and dawn, cot and caught as the same.

W.L.: These two words sound the same to you?
B.P.: [hɒk] and...yeah. Mhm, yeah.
W.L.: Are these two the same?
B.P.: Yeah, they do.
W.L.: How do you say these again?
B.P.: [dɒ:n] 'n' [dɒ:n].
W.L.: Are these two the same?
B.P.: [kɒt] and [kɒt].
W.L.: They sound exactly the same?
B.P.: Yes.

Since the minimal pair test was conclusive, W. L. had every reason to believe that the merger had taken place west of the Susquehana River for the oldest generation, and therefore travelled across the river eastward to find the active area of sound change in progress. But in the farming communities across the river, the distinction between short o and long open o seemed quite solid.

A spectrographic analysis of Bill Peters' connected speech showed a firm distinction between low central [ɑ] for short o and mid back, non-peripheral [ɔ] for long open o. There is a wide margin of security between the two phonemes, as shown in Fig. 6-4. The responses to the minimal pair test are shown in the lower right of the vowel triangle in the position of [ɒ]. There is no relation between these responses and Bill Peters' speech; it seems clear that he has adopted some other norm than his own, possibly the system of younger prestige speakers in the area. There is no reason to think that the merger in question has any positive or negative prestige in central Pennsylvania, but if younger educated speakers do have the merger, it is possible that Bill Peters has concluded that this is the "right" way to talk. Without more research in the area, we cannot say exactly what norm is reflected in Peters' minimal pairs. But we can say that it is not his own, and that we were wrong in directing our exploratory interviews by the evidence of these minimal pairs.

One remarkable facet of Peters' responses is that the short o and long open o classes are still distinct, even though they are very close and sound "the same" to him. In each pair, hawk, dawn and caught are more peripheral than hock, Don and cot. The pairs are so close that several fall within our narrowest margin of error of ±25 Hz. But since this same relation is repeated in every case, we cannot ascribe it to chance. Mysteriously enough, Peters can make these two phonemes "the same" and yet keep them apart.

6.3 Fool and full in Albuquerque.

In exploratory interviews in Salt Lake City, we discovered an unreported series of mergers before final -l. In the working-class, Mexican-American western section of the city, younger speakers showed a merger of /uwl/ and /ul/, /iyl/ and /il/, so that fool and full, pool and pull, feel and fill, steal and still were homonyms. For some speakers, there was also a merger of sail and sell (and Sal), and dull and doll as well, so that the total inventory of distinctions before /l/ was greatly reduced. Further explorations suggested that the merger of fool and full was the most general of these, and could be found among younger speakers of many different backgrounds. In the summer of 1971, our transit through the Southwest area (Ch. 4) focused upon this merger as well as the relations of hock and hawk, far and for, and four and for. We proposed a number of possible factors behind this merger which might be confirmed or disconfirmed by our social and geographic distribution.

(1) The influence of Spanish. The merger of fool and full is strongest in the Spanish contact area, and of course Spanish does not distinguish /uwl/~/ul/. But Spanish does not have the /uw/~/u/ contrast in general, and it is not clear why the merger should occur only before /l/. An interview with a large group of Spanish children in El Paso showed that children born in Juarez did have trouble in making the fool-full and feel-fill distinction, but not shooed-should or beat-bit. The Spanish influence does seem to produce merger before -l in preference to other

environments.

(2) The effect of -l in holding back a chain shift. We have observed in the Southwest (as in the South) a Pattern 3 shift which fronts /u/ to [ü] (Ch. 4); there are many dialects where /uw/ does not move forward before -l (in particular, Philadelphia, the Outer Banks). If that is the case in the Southwest, then the /uwl/ sequence may be re-assigned to another phoneme, such as a rising /ul/.

(3) Mergers before -l are following the analogy of mergers before -r. As we examine the most extreme set of mergers in Salt Lake City, it is clear that there is a close parallel between the -r subset and the -l subset. Before final -r we cannot distinguish tense and lax vowels /iy/ and /i/, /uw/ and /u/, /ey/ and /e/, etc. In the case of -r this has resulted from the centralization of the short vowels and their merger into [ɝ]. In general, we can say that in the Vhr sub-system there is less room to make distinctions and so we have a reduced set of vowel contrasts. The lateral liquid -l runs parallel to /r/ but behind it in a great many respects: vocalization, syllabification, and in this case restriction of vowel contrasts.

In pursuing the investigation of these three possibilities in the Southwest, we traced the distribution of the fool-full and feel-fill contrast through a number of communities. We found that as we moved from west to east, the merger of fool-full became weaker, and the merger of feel-fill became stronger. This could not be accounted for by Spanish influence, since Spanish lacks both distinctions. It may be coupled with the fact that as we move eastward, the Southern Pattern 3 shift becomes stronger. As we look more closely, we find that in Central Texas, /uwl/ may be fronted along with /uw/ or move somewhat behind it; it is not retained in full back position as in the Outer Banks or London (see Bud and Wade Stokes, Figs. 51-52). In general, the mechanism of the Pattern 3 shift would seem to work against th merger of /uwl/ and /ul/, moving them farther apart. As far as the effect of /r/ is concerned, it is true that as we move eastward, r-pronunciation becomes weaker and eventually gives way to the r-vocalization rule. But we cannot draw any strong conclusions on the relation between r-pronunciation and the mergers before /l/, since at best the argument is based on the relatively weak grounds of analogy or rule generalization. So far, we have been unable to give strong support to any of these explanations.

Our studies of the on-going merger of fool-full led us to encounter a number of marginal cases where the distinction between these two word classes was quite small. One of these--the case of Dan Jones of Albuquerque--revealed the disjunction between perception and production even more sharply than the New York City case.

We first met Dan Jones in a session with a group of high school students in Albuquerque; their responses to /uwl/ and /ul/ varied considerably. Dan Jones, however, read a list of minimal pairs with fool and full, pool and pull, pronounced them the same and judged them to be the same. We arranged an interview with Dan for that same afternoon, under more favorable conditions for recording casual speech. This interview was a group session with Dan, 16, his girl friend Didi Gibbs, 16, and her brother Hal, 18.

An analysis of Dan's speech pattern in this interview showed the distinction between /uw/ and /u/ in Fig. 6-5(a). (In all sections of Fig. 6-5, the F1/F2 scales are both twice the normal scale, as the distinctions to be studied are quite small). The tense vowel /uw/ is higher and further back than /u/; too and boot are differentiated from shook and good by both F1 and F2. There is also a distinction between /uwl/ and /ul/, but here it is only F2 which distinguishes the vowels. This contrasts sharply with the results of Dan Gibbs' minimal pair test, shown in Fig. 6-5(b). Here /uwl/ and /ul/ in fool-full and pool-pull are quite close and there is no consistent difference of either F1 or F2 between them. The pairs makred A.M. were from the original minimal pair test of the morning; those marked P.M. were read at the end of the afternoon session. There seems to be some F1 distinction, but no regular F2 difference. Bearing in mind that on this enlarged scale the pairs are separated by no more than 50 Hz, we can say that both minimal pair tests indicate merger, but speech suggests a distinction.

In the first cases discussed above, we did not go beyond minimal pair tests--that is, the speaker's intuitive judgment of "same" or "different." We now turned to commutation tests, in which we tested the speakers' ability to produce and perceive the distinction in question. Dan read a list of ten words which randomly alternated FOOL and FULL. Didi and Hal judged them as "double-O" and "double-L." We later submitted the tape of Dan's pronunciation to five judges in New York City, all Easterners. Three were well-trained phoneticians; one was a linguist who did not specialize in phonetics; and one was a sociologist. Hal and Didi Gibbs had a great deal of difficulty in making these judgments, and so did the five Easterners. Table 6-1 shows the results. The non-phonetic linguist interpreted almost all of the words as FOOL, and since her pattern was

TABLE 6-1

RESPONSES TO COMMUTATION TEST OF FOOL AND FULL AS PRONOUNCED BY DAN JONES, ALBUQUERQUE

JUDGES

Hal and Didi Gibbs

		Judgments		
		FOOL	Split	FULL
Text	FOOL	9	-	1
	FULL	2	1	7

Four Easterners

		Judgments				
		4/4 FOOL	3/4 FOOL	2/4 FOOL	3/4 FULL	4/4 FULL
Text	FOOL	7	3	-	-	1
	FULL	1	3	3	1	5

quite skewed from the rest, we show in this table only the four other judges.

It appears that Dan can produce the distinction in general, and that the Gibbs can hear it. One pronunciation of FOOL was heard as LL by everyone, and seems to have been a misfiring. Otherwise, the Gibbs and the Easterners both struggled through to rate all the 00 words as 00. There was more difficulty with FULL: two tokens were heard as FOOL by the Gibbses.

The Easterners also had more difficulty with FULL: as Table 6-1 shows, they agreed in identifying Dan's FULL as an LL word in only 5 out of 13 cases, less than half.[6]

In general, the results of the commutation tests are marginal. The pairs FOOL and FULL as Dan pronounced them are very close; the two judges had to try hard to make decisions and in four of twenty cases they did not succeed in identifying the word as Dan had intended it to be identified. While it is clear that Dan does make some kind of a distinction, one should not over-estimate his performance. After this commutation test, a short test was made with Didi's pronunciation, and another one with W.L. speaking. The responses left no doubt that these productions could be identified with one hundred percent accuracy. Both Didi and Hal made the /uwl~ul/ distinction themselves in careful speech, although the difference is by no means as great as in other dialects. But their close familiarity with Dan's speech did not help them to produce very much better judgments than the outsiders.

We can now turn to the examination of the acoustic properties of the test pattern produced by Dan Jones. Fig. 6-5(c) shows the F1/F2 positions for all the words pronounced by Dan in the several trials of the commutation test.[7] We can quickly see why responses to the commutation test were so hesitant and why some judgments were confused. The obvious fact is that these nuclei are very close; when we consider this is a doubled scale, we can say that they are almost superimposed. At the same time, it is clear that Dan _is_ producing a difference between _fool_ and _full_: seven of the nine cases of FOOL are higher than the eleven cases of FULL; one FOOL is at the same level of height but further back.

The symbols with lines through them indicate those forms which were most difficult to judge correctly. Strangely enough, the single odd instance of FOOL on the far side of the FULL group was not one of these: the judges hear it as _fool_. We have examined this spectrogram for any other feature which would discriminate it from _full_--length, amplitude or formant contours, but we cannot say why it should be heard as *fool*.

The very tight approximation of these forms reflects the impressionistic phonetics of the situation. This is a marginal distinction; but it is a distinction. The acoustic record and subjective reaction both show the marginal character. Let us assume that the small amount of data we have on the use of /uwl/ and /ul/ in speech reflects Dan's actual production of this distinction. The confusion of minimal pairs indicates that on reflection, Dan does not make use of this difference to distinguish word classes. The commutation test is intermediate in style; it shows that if Dan is not thinking about the difference, but only about the pronunciation of the individual words, he more or less makes a very slight difference.

It is also true that Dan can hear the difference between [u·l] and [ʊ.l] and produce it if he is not speaking in his own style. Figure 6-5(d) shows his productions of *fool* and *full*, *pool* and *pull* on the model of W.L.'s pronunciation. If /uwl and /ul/ were actually merged for Dan in the true sense of the term, it is unlikely that he would be able to do this.

We can sum up Dan Jones' treatment of *fool* and *full* as follows:

1. He probably distinguishes /uwl/ and /ul/ in every-day speech by differences in F2.

2. He categorizes these two vowels as "the same" in this context; and on reflection, loses the phonetic difference which he habitually makes.

3. He produces only a very marginal distinction in a commutation test which is only marginally distinguishable by others.

4. He can hear larger differences between /uwl/ and /ul/ and imitate them.

Our present view of the *fool*-*full* merger leads us to think that it is a change in *progress*, though our exploratory studies have not established that fact with certainty. We can expect that such marginal situations will occur whenever a merger is in progress; in the expansion of the *hock*-*hawk* merger we have noted a wide range of intermediate phenomena. In such a situation, many members of the speech community may begin to disregard a distinction in the sense that they no longer rely upon it to distinguish words without other context; the distinctive feature is then suspended. But this decision does not necessarily change the rule system, and it appears that these same speakers may continue to produce the word classes as separate entities.

One might think that such a situation is unstable, and would lead fairly rapidly to a true merger. But this is not necessarily so; the case to be presented in 6.5 suggests that such marginal distinctions can be maintained for many generations and never lead to merger at all. But first we will consider the most dramatic disjunction between production and perception that we have encountered yet, in the speech of two boys from Norwich in Norfolk County, England.

6.4 Too and toe in Norwich.

In our exploration of sound change in England during the summer of 1971, we visited the town of Norwich in addition to the larger cities of London, Glasgow, etc. The social stratification of English in Norwich had been studied in detail by Trudgill (1971), who had found evidence of at least one sound change in progress--the backing of /el/ from [ɛl] to [ʌl]. We obtained rich spectrographic evidence to support Trudgill's findings on the distribution of /el/ through age levels. Evidence on the successive positions of /el/ in three generations of Norwich speakers is shown in Figs. 6-6 (a-d). A more detailed account of this sound change will be presented in a later report, along with data on other Norwich features. We have already presented some data on Pattern 3 and 4 chain shifts in Norwich in Chapter 4 (see Figs. 33-37).

In this section we will consider one aspect of the complex situation in the high back upgliding vowels: in particular, the relations of /uw/ and /ow/. Since Norwich is a small city, we find that it is heavily influenced by the many intersecting dialects of the surrounding Norfolk countryside. We found many combinations of diphthongal and monophthongal /uw/ and /ow/, with close approximation or clear distinction, with one norm or several norms. Reviewing Figs. 33-37, we find the following /uw/ and /ow/ situation:

> 1. James Wicks, 74 (Fig. 33). /uw/ has two norms: front of center and back. /ow/ seems to have two norms also: upper mid back, and fronted but still back of center, for rooms and boots.

2. Les Branson, 42 (Fig. 34). /uw/ is completely fronted to [ü] position except for vowels before -l. /ow/ has two norms: at a mid back peripheral position, and high position, somewhat fronted.

3. Tony Tassie, 16 (Fig.35). /uw/ is fully fronted to [ü] position (more front than some /iy/, except for room, which is found with /ow/ in lower high slightly fronted position.[8]

4. Jean Suffling, 15 (Fig. 37). /uw/ is front, except before - l, in [ü] position and further forward than /i/. /ow/ is in upper mid-position, half-fronted but still back of center.

In these four dialects we observe that /uw/ is always quite front, perhaps moving further in that direction. In all cases, the glide is fronted, moving upward towards [ü]. /ow/ seems to be following behind /uw/ in a chain shift in high position, but gliding towards the back.

The case we will examine in some detail is a fifth speaker, 14-year-old David Branson (Fig. 36). His /uw/ in connected speech shows two norms: one front of center though not as far forward as Tassie or Suffling. The least fronted form in this main distribution is /tuw/ at 1750 Hz, still well to the front of center. In upper mid central position are blue, fruit and true, showing the strong centralizing effect of initial clusters with -r-. There is a second /uw/ norm further back, with high too at 1250 Hz, and school and group gliding to the back from a non-peripheral, lower-high position. These forms all show back upglide, as opposed to the front up-glides of the first set.

David's /ow/ is the most fronted of any set we have seen, possibly indicating a further stage in the chain shift across the high vowels. His /ow/ is located just back of center in high position, at the same level of height as the /uw/ in the front. There is some evidence of other /ow/ norms in back peripheral position with one vowel high and the other in mid position.

Fig. 6-7 shows David's reading of word lists focusing here on /uw/ and /ow/. The nucleus of /uw/ ranges higher and further front than /uw/ in Fig. 36, though there is another group which is not as far forward, about 1800 Hz, in lower high position. Four /uw/ with initial r- are in central position. /ow/ is also further front than in spontaneous speech. One form of go is front of center, another group is in center position, along with the /ruw/ set.[9] Other /ow/ are found in high position but back of center ranging from half-back to a high back (peripheral). /ow/ thus shows a continuous range from half-front to full back, basically in high position.

David was interviewed along with his best friend Keith. David did most of the talking, while Keith said very little. As David was reading the word list, it became apparent that there was a very close approximation between some /uw/ and /ow/ words. W.L. therefore then prepared a commutation test, with ten words randomly alternating too and toe.[10] First David read and Keith tried to guess which was which. Keith simply could not do it; he hesitated, changed his mind, and guessed the wrong item in three out of six cases for toe and two out of four cases for too.[11] David tried in every way to help Keith, pronouncing each word slowly and carefully as he could; at one point he even whispered the answer. Figure 6-8 shows the position of nucleus and glide for the pronunciations of too and toe by David in the commutation test. The nuclei for too are very close to the group of huge,[12] boot, tune, amusing, in Fig. 6-7. None are as front or as high as the forward group in the reading of the word list. The /ow/ nuclei are just back of /uw/ (and a few are slightly lower). They are almost as closely approximated as the nuclei of fool and full in Fig. 6-5. But the glides are all consistently differentiated by direction: /uw/ glides shortly up and slightly forward towards [ü], and /ow/ towards high back [u]. The glide of /uw/ is difficult at first to hear, but the glide of /ow/ is quite pronounced, and reaches a high back target. This distinction seems subtle at first, but after a few moments listening it is possible for an outsider to hear it reliably. After Keith failed the commutation test, David read another list and W.L. guessed the items correctly.

We might then conclude that the two phonemes were merged for Keith, and that his inability to hear the difference was the result of the common observation that speakers cannot hear distinctions not in their system. But when Keith read a list of words, David had no difficulty at all in identifying them. He unhesitatingly named each item T-O-E or T-O-O. The nuclei and glides of Keith's pronunciations are shown in Fig. 6-9. Here the overlap between nuclei is somewhat more than with David, and the glide of /uw/ is even shorter and less fronted. Nevertheless, each member of the /ow/ class is distinctly marked by its back upglide, and David was able to identify each word immediately. Keith could produce the distinction between /uw/ and /ow/ perfectly but he could not perceive it.

It is not merely the mistakes which Keith made which are important here; it is the total confusion and inability he showed in relation to reaction to this particular test. If we examine his errors, we find that they are the words in which the nuclei were closest. Even though the glides were equally distinct in these cases, the differences in glide direction were not helpful to Keith. He was apparently trying to hear a difference in the position of the nucleus, and had not learned to listen to the directions and end-points of the glides. This is all the more unexpected because his own productions are differentiated only by the glides.

Keith then shows us that a speaker can reliably produce a distinction without being able to hear it--or at least be aware that he hears it. In some sense, Keith must have "heard" the distinction when he was learning the language, even if he cannot succeed in turning his attention to it now. At some level of unreflecting perception, he must be monitoring his production. But there is not the least doubt that he now hears /uw/ and /ow/ as "the same" in the sense that linguists use the expression. He has no ability to identify and label these two phonemes on the basis of the regular difference in the sound pattern, a difference which is found regularly in the speech of his best friend as well as his own. This finding represents the maximal failure of the minimal pair. A minimal pair test or a commutation test given to Keith will give grossly misleading results and must be rejected as a means of determining his phonological system.

One possible explanation for this situation may lie in the difference between David's pronunciations of the /uw~ow/ distinction in speech, word lists, and commutation tests. As David focuses more and more sharply on the pronunciation of these sounds, and the contrast between them, the F1/F2 positions of the nuclei come closer and closer together. For example, his <u>go</u> moves forward from an F2 of about 1400 Hz in his speech (Fig. 36) to an F2 of 1750 Hz in Fig. 6-7, his reading of word lists. This is exactly the position maintained by <u>toe</u> in the commutation test, Fig. 6-8. Clearly both Keith and David treat the glide as the "distinctive" feature separating /uw/ and /ow/ and the position of the nucleus as the "redundant" feature. But since the redundant feature of nucleus position is the one used for most other vowel pairs, it is possible that at some point Keith began to utilize this feature to distinguish F1 and F2 instead of the glide. At the same time, the glide direction remained the distinctive feature in his own speech production.

We observe a great variety of /uw~ǫw/ relations for other Norwich speakers of the same age. Another pair of adolescent boys, Steve and Bryan, were sharply differentiated in this respect. Bryan, 14, had mid-back /ow/ and lower high central /uw/. The two classes were separated by a minimum of 500 Hz F2.[13] Steve, 15, showed basically the same system as David, with /ow/ ranging from high center to high back. But he also had some /uw/ back of center, gliding towards the back, and some /ow/ in upper mid back peripheral position.[14]

Steve first pronounced chose in high half-back position. When he repeated it in contrast with choose, it moved to the front, a distance of about 1000 Hz, to the same nucleus position as choose; the two were then differentiated only by their glides. On the other hand, boot and and boat were found together in both high back and mid back position.[15]

Given the great variety of /uw~ow/ relations prevailing in Norwich among members of the same peer groups, it is understandable that the kind of confusion shown by Keith might arise. But no matter what explanation of Keith's behavior we bring forward, we must bear in mind the basic fact that his intuitive judgments and performance on the commutation test did not show us his own linguistic system, or any other system we have found in Norwich. We have not yet located any speakers who show the total merger of /uw/ and /ow/ that would be indicated if we accepted Keith's self-report at its face value.

The failure of the minimal pair and commutation tests is all the more striking in the complex Norwich situation, because it is exactly in such a situation that we might want to rely most upon the tests. If there was no problem in determining "same" or "different" we would not need them. But to understand Norwich we must be sure to investigate the system of contrast prevailing for each individual, and for many words in each word class. It is just when we have most need to determine contrast that tests of perception can be most unreliable. Certainly they give us some valuable information; but if we rely upon them alone, we will be badly deceived.

6.5 Line and loin in Essex.

In the course of our studies of sound change in progress, we have been continually reviewing the implications of our findings for the understanding of completed changes. At the end of Chapters 3 and 4, we reviewed a number of these problems and attempted to apply our current discoveries to the interpretation of various paradoxes and controversies of historical linguistics. At many points, we had occasion to refer in advance to the material presented in this chapter. For example, our interpretation of the mechanism of the English Great Vowel Shift depends upon the possibility of two vowels' being separated by a relatively small difference in F2 position without falling together. In Appendix A we focus on one element in this shift: the apparent merger and later separation of long ā and ea. To illuminate this problem, we consider a parallel case which followed from the later development of the Great Vowel Shift: the apparent merger and re-separation of line and loin, pint and point, etc. This is a crucial case because we have current evidence which bears on it: a dialect in which the merger is said to have continued. In this section we will present our findings on the merger of line and loin in Tillingham, Essex.

The Survey of English Dialects of Orton and Dieth (1970) shows a complete collapse of the /ay/ and /oy/ phoneme in the county of Essex, a finding which agrees with traditional reports that the merger of these two phonemes in the seventeenth and eighteenth century had never been re-dissolved in that area. The field work for the Orton and Dieth survey recorded sounds by impressionistic transcription in a fairly narrow IPA notation as far as height is concerned. As usual, we find very few notations that indicate fronting or backing. Symbols such as [ɔ̈] are occasionally used, which mean (according to the IPA chart) "central vowels." Thus both [ɛ̈] and [ɔ̈] are central. The entire dimension of front to back is therefore recorded by three points on the scale: front [ɛ]; central unrounded [ɛ̈] and rounded [ɔ̈]; and back [ɔ]. The IPA diacritics for "tongue advanced" or "tongue retracted" are not used.

The furthermost east community in Essex, and the most isolated, is Tillingham. It is shown as "13" on Fig. 6-10, which shows the localities studied by the English Survey in Essex and the surrounding areas. In Tillingham, all ME long ī words and all ME ui and oi words are recorded as [ɔɩ]. (These classes will be referred to hereafter as /ay/ and /oy/).

/ay/		/oy/
ivory	tire	poison
light	tires	deadly poison
firelighting	dandelion	very poisonous
fire	scythe	oil
fireshovel	hayknife	boiling
slice	died	boiled
white	lights	groined
whitish	hide	boil
eyes	fight	
blind	dike	
bos-eyed	stile	
eyebrows	iron	
righthanded	fly	
	hive	
height	spider	
knife		

The same basic situation is reported for most of Essex. Great Chesterford at the northwestern corner of the county (No. 1 on Fig. 6-10) is the only town which regularly shows /ay/~/oy/. If we contrast <u>oil</u> (Orton and Dieth V.2.13) and <u>boil</u> (item VI.11.6) with <u>stile</u> (item IV.s.9) we find the following situation:

	distinction		merger
/ay/	[ɑɩ]	[ɔ̈ɩ]	[ɔɩ]
/oy/	[ɔɩ]	[ɔɩ]	[ɔɩ]
Locality	1, 8	6, 7, 12, 15	2, 3, 4, 5, 9, 10, 11, 13, 14

Thus localities 1 and 8 on the east show the standard distinction, but communities 6, 7, 12 and 15 on the north and west show a distinction of fronting and backing. The rest are merged. Throughout all lexical items, we find locality 1 quite stable but as we examine other lexical items we find considerable variation for the others. In other contrasts, like <u>flies</u> and <u>eyes</u> vs. <u>poisonous</u>, we find that Nos. 12 and 15 generally show a fronted [ɔ̈ɩ] for /ay/ and /oy/ while 6 and 7 continue to distinguish /ay/ as fronted from /oy/ as back. Locality 8 varies in this respect. A certain amount of fluctuation in impressionistic transcription is to be expected.[16] But throughout, we find consistent [ɔɩ] for both /ay/ and /oy/ in localities 2, 3, 4, 5 in the northern portion of the county, 14 in the south, and 13--Tillingham--in the extreme east.

We were able to hear a tape recording of one of the Survey subjects who showed the merger of /ay/ and /oy/[17] and we made spectrograms of some vowels. Although there were only a few lexical items, /ay/ did not appear in the same area of phonological space as /oy/: it was slightly to the center. Since /oy/ regularly appears as the most peripheral element in the back vowels, this situation suggested to us the possibility that /oy/ and /ay/ formed a peripheral/non-peripheral pair similar to source and sauce in New York City and the other cases mentioned here. This was a crucial case for the interpretation of historical events, since as noted below, it was generally believed that /ay/ and /oy/ had fallen together in the seventeenth and eighteenth century and afterwards separated.

In the summer of 1971, we therefore made a field trip to Tillingham, No. 13, the most remote and consistent locality reported. We interviewed three informants:

> Jack Cant, 87, a retired farm laborer. He appears to be the brother of one of the Survey informants interviewed in 1961.
>
> Leonard Raven, 70, a retired farm superintendent.
>
> Mrs. Leonard Raven, 69, a former domestic worker and housewife.

All three informants came from Tillingham families. Mrs. Raven had worked in London for a number of years, but Mr. Raven showed the most effect of the standard language and in shifting away from his vernacular forms.

In the interviews, our main concern was with /ay/ and /oy/, and in view of the rarity of /oy/ forms, we attempted to elicit as many words in this class as possible. The interview with the Ravens was a family conversation in their home, with considerable interaction; here we managed to elicit the pairs voice and vice, loin and line before any discussion of language arose. We then asked directly whether loin and line, voice and vice, were the same or different. They were "the same" for Jack Cant and Mrs. Raven, and "different" for Mr. Raven.

Fig. 6-11 shows the vowel system of Jack Cant; it is similar to Norwich and London in many respects. In the Pattern 3 shift, /uw/ has moved to low front position, and /ohr/ to high back position as usual. In the Pattern 4 shift, /ey/ has fallen to low position, and /ay/ has moved to lower mid back position. But /oy/ has not altogether moved up to high position: it is next to /ay/ and overlaps with it in height as expected. But it is also clear that /oy/ and /ay/ are distinct. Jack Cant's /oy/ is higher and/or more peripheral than his /ay/. A few /oy/ forms are very high, but some are lower than the highest /ay/. In those cases, /ay/ is less peripheral than /oy/. The location of the word die is quite similar to the spectrographs of /ay/ which we made from the original Essex recordings: at the same height as /oy/ but more central.

On the right of Figure 6-11 are shown the pronunciations of /ay/ and /oy/ by Jack Cant when he was asked directly about pairs. These minimal pairs are much closer together than /ay/ and /oy/ in natural speech. /oy/ is pronounced lower than the main body of words from spontaneous speech, overlapping the /ay/ area considerably, while most /ay/ words are slightly lower, and a bit less peripheral. One word--point--seems to have been reassigned to the /ay/ category.

Fig. 6-12 shows the /ay/ and /oy/ system of Mrs. Raven, and 6-13 for Mr. Raven. Though she hears line and loin as "the same" and he hears the pair as "different," they have the same system in natural speech as well as the same distribution of individual words. For both husband and wife, /ay/ is lower and/or less peripheral than /oy/. Words ending in -l are more peripheral for both speakers, but the same relations hold for /ayl/ and /oyl/. Though some /ay/ for Mrs. Raven are as high as /oy/, these are clearly less peripheral; and though some /ay/ is as peripheral as /oy/, these are clearly lower. We have no difficulty in drawing a boundary between the two sets. The same relationships hold for Mr. Raven in Fig. 6-13. One /oy/ word appears to have crossed over into the /ay/ class--joined. Otherwise, we can draw a boundary between the two: basically a separation of peripheral and non-peripheral.

Although the whole vowel system is not shown, it should be clear that this difference in peripherality is not equivalent to back vs. central: the /ay/ words are still clearly back vowels, by no means equivalent to a central form [ɔ̈]. In IPA terms, they would be represented by [ɔ˂ ɩ].

Again, we note that for the Ravens, the minimal pairs are closer together than the forms used in connected speech. The situation is similar to Norwich in this respect. We can understand how these small differences may have escaped the dialectologist. Normally, he notes down the pronunciation of isolated words as pronounced in relatively slow style. In such careful pronunciation /ay/ and /oy/ seem to have been approximated, though never brought together. This shift in formal style seems to reflect the intuitive judgment that they are "the same sound" to the informants.

6.5.1. Essex speakers' perception of their own productions. In the summer of 1972, we added a new chapter to the study of line and loin. We returned to Tillingham and met again with the three olders speakers whose vowel systems we had analyzed, bringing with us a commutation test prepared from the connected speech of Jack Cant. The first ten items were a random alternation of his pronunciations of line and loin extracted from his unreflecting, connected speech. Two tokens of loin had nuclei at F1-510, F2-990 and F1-575, F2-975; two tokens of line had nuclei at F1-645, F2-990, and F1-605, F2-1015. The second formant positions were thus quite close, with loin showing slightly lower F2 as usual. The first formants were also close, but with loin showing distinctly lower F1 (that is, occupying a higher position). The second ten items alternated utterances of loin and line made when Jack Cant was reflecting directly on whether or not they were "same" or "different"; loin was at F1-575, F2-1015 and line at F1-685, F2-1005. These positions were typical of the vowel nuclei displayed in Jack Cant's chart given above in Figure 6-11.

None of the three informants was able to pass the commutation test. Jack Cant, who originally rated loin and line as "the same," gradually began to feel that there was a small difference between them. In fact, his comment demonstrates clearly that native speakers naturally contradict Bloomfield's dictum that small differences do not exist: "There's a little difference but sometimes they seem to be both the same." At the same time, Jack Cant was totally unable to identify his own productions of loin and line. His actual score was below chance: that is, he mis-identified line as loin and loin as line 60 per cent of the time. Correct and incorrect identifications ran in blocks, indicating that Jack Cant may have been hearing "same" and "different" with some degree of accuracy without being able to utilize the direction of the difference. In further discussion, he reacted to voice and vice as "the same," and insisted that there was no possible difference between file and foil.

Mrs. Raven had the greatest degree of success in identifying Jack Cant's line and loin, though she had originally reacted to her own pronunciations as "the same." Nevertheless, she mis-identified seven of the twenty cases. The first ten judgments were all correct, though some hesitations and reversals occurred; the mistakes were concentrated in the minimal pair test. Mr. Raven, who originally thought they were different, had much less success in hearing the difference.[18]

Both Mr. and Mrs. Raven came to the opinion that there was a strong difference between line and loin, and their own pronunciations of the two became increasingly differentiated. Mr. Raven, in particular, was able to exaggerate his natural pronunciation in this maximally reflective situation:

> When you try to sound that L-O-I-N [loˇ:ɩn] I think people try to put that o in, more than they would do if they just said [lʌɩn].

Mrs. Raven did not produce such a strong contrast in her own speech, maintaining the slight differentiation shown in Figure 10a, but she insisted that the sound difference was useful in differentiating the two words:

> Loin of lamb, you do go like that, [lɔ^ɩn], loin o' lamb, 'n if you want the [lɔ˂ɩn], the linen line or anything like that, you go like, "Put the linen line, [lɔ˂ɩn, lɔ˂ɩn]," see?

Nevertheless, she was not able to use the differences made by Jack Cant to identify words accurately, contrary to her expectation. As noted above, the contrast from unreflecting speech was easier to hear than the series from the minimal pair test: reactions to the former were much faster, as well as more accurate. This corresponds to the process we have observed in other cases, such as fool--full in Albuquerque: on first reflection in minimal pair tests, the difference made in natural speech tends to disappear or be narrowed as the subject judges the two words to be "the same." This is what Jack Cant does. On further conscious discussion, the difference may be re-established or exaggerated if the subject can consciously imitate other dialects, as Mr. Raven does.

These commutation tests confirm our finding of the asymmetry between production and perception. In these cases, speakers consistently make small differences in natural speech which maintain the identity of word classes, but they cannot accurately label these differences on conscious reflection, either in their own speech or in the speech of their close associates who speak the same dialect. Both minimal pair tests and commutation tests are helpful in identifying this marginal situation, a fact of considerable importance for an understanding of linguistic change. But these tests will give a very faulty view of the underlying forms and phonological rules of the language, if they are not coupled with accurate studies of the actual use of segments in the course of connected, unreflecting speech.

The situation of /ay/ and /oy/ in Essex may help to explain one of the most extraordinary puzzles of English historical phonology. There is a great deal of evidence that /ay/ and /oy/ "fell together" in the late seventeenth and eighteenth centuries.

Appendix A gives a detailed account of the evidence for such a merger. We have many reports that speakers in England did not differentiate between /ay/ and /oy/ words: "thus oil, toil are frequently pronounced exactly like isle, tile" (Kenrick, 1773, quoted in Ellis 1884:1057). But the question then arises, how did /ay/ and /oy/ then re-separate to become distinct phonemes today? The usual reply is that it was the influence of spelling (Jespersen 1949:330). But this is a weak argument in the light of many other examples of merger in current dialects which do not seem to be reversible in a much more literate population--as in the ongoing merger of hock and hawk in the United States. The puzzle presented by line and loin is parallel to an even more difficult case in the history of English phonology: the reported merger and re-separation of meat and mate in 16th century London. Appendix A presents the historical evidence on both of these cases of anomalous reports and brings to bear the evidence of this and preceding chapters to solve the conundrum which they have posed. Our findings on current dialects lead us to infer that these cases of reported merger were similar to the reports we have received on source and sauce, fool and full, two and toe, and that the case of loin and line in Tillingham represents the same kind of false report of merger preserved in a current dialect.

We must infer from our results the strong possibility that /ay/ and /oy/ have remained in close approximation in Tillingham for several hundred years, heard as the same, yet not the same in fact. For some reason, the situation seems to have remained quite stable in Essex. We do not yet know what forces may suddenly initiate a new movement which will separate them further; but this seems to be taking place now among younger Tillingham speakers, as /ay/ becomes progressively more central.

We may further infer that /ay/ and /oy/ may never merge at all in the history of English. Some grammarians heard these two sounds as "the same," and many poets heard them as close enough so that they could be treated as the same. But the rhymes and reports of "the same" may only be the result of the fact that the difference between the two sounds at a certain stage was too small to be relied on to distinguish words; but the phonological system continued to produce a peripheral nucleus for /oy/ and a less peripheral and lower nucleus for /ay/ (basically tense /ōy/ and lax /ay/.

Again, we must conclude that intuitive judgments of "same" or "different" are not necessarily a reliable base on which to build a theory of phonological development.

6.6 Some theoretical implications and directions for further research

The five cases studied here are not the only examples of false reports of merger that we have encountered. In our early work on Martha's Vineyard, we observed similar phenomena with /ohr/ and /ɔhr/; our exploration of the Boston situation has shown a comparable situation with /ehr/ and /ihr/; in the Southwest, we noted parallel cases involving /ɑ/ and /ɔ/. Trudgill has independently noted several other cases in Norwich and elsewhere, including /ehr/ and /ihr/. There is strong evidence for the unreliability of intuitive judgments of "same" and "different."

Nevertheless, this finding has met with more surprise and distress than any other we have presented. At oral presentations of our material, members of the audience have expressed strong reluctance to accept our data. These findings seem to run counter to beliefs that are deeply inculcated by current linguistic training. Yet it is not immediately apparent why this should be so. That speakers of a language can learn to produce a distinction without being aware of it should not be surprising. We all learn a vast amount of such detail as we grow up speaking our own vernacular. In order to be native speakers we must learn many rules of intonation and phonetic realization which characterize our particular dialect. These rules are not automatically retrievable; if we ask other native speakers about some of these small differences, they may not know what we are talking about. For example, people on Martha's Vineyard did not hear any difference between [aɩ], [a^ɩ] and [əɩ], though they regularly made such differences in their speech.[20]

As we examine the standard texts in descriptive linguistics, it is difficult to find detailed discussions of the principles behind minimal pair tests. Most of the discussion is about processing the results. Harris (1951) suggests the use of commutation tests for difficult cases, and points out that if one speaker does no better than chance in identifying the productions of another speaker, then the two forms may be considered to be in free variation. This is the test which Chomsky (1957) takes as one of the few reliable behavioral tests in linguistics.

There seem to be several unstated principles which operate strongly in the field of linguistics but which are not explicitly stated; perhaps because they appear so obvious that they are assumed.

> 1. If a native speaker cannot discriminate between two sounds, then those sounds will be in free variation in his speech.
>
> 2. If two classes of words are consistently separated by a phonetic difference, no matter how small that difference may be, speakers of the language will hear it as an important difference and use it to distinguish those word classes in the course of every-day communication.

We may refer to (1) as the Reliability of Intuitions, and (2), which is the converse of (1), as the Irrelevance of Phonetics. Both have been extremely important in linguistic practice, since they determine the actual behavior of most linguists who are trying to describe a sound system. Reliance on intuitions tells us that minimal pair or rhyme tests will serve as a satisfactory index to a sound system, mapping one-to-one with all significant sound systems. The irrelevance of phonetics has been claimed and demonstrated in the practice of the many linguists who report the significant units of a sound system with a bare minimum of phonetic detail. Principle (2) appears to be reflected in Bloomfield's strong statement in Postulates for the Science of Language (1927):

> Such a thing as a "small difference of sound" does not exist in language.

But it is exactly that which we have located in the five cases studied in this chapter: small differences of sound which are not important to speakers of the language, but which do determine the development of the linguistic system.

The second principle also asserts that such differences will be used to distinguish words. We have no strong evidence on what in fact happens in the course of every-day communication. But given the cases we have described, it seems extremely unlikely that speakers will rely upon such differences to distinguish words if there is no other context to support them. The unstated assumption here is that the major force which determines the sound system of a language is the need to distinguish words: that if and only if a phonetic difference is used to distinguish words will it be maintained. Presumably, the force which maintains a sound difference is correction: A says a word, B gets the wrong meaning, asks for correction, and thus A learns to say it right.

We have no doubt that such a process operates in language, but that it is the only factor which will maintain a phonemic difference is less than likely. The need to maintain contrast appears clearly in the great number of chain shifts that we have outlined in Chapter 4 and 5; but this need can be clearly overridden on a massive scale--as in the case of modern Greek.

There remains the critical problem: what is the mechanism by which /ay/ and /oy/ have been kept separate over several centuries, if it is not the continual correction of speakers by hearers? To answer this question, we must first begin to analyze more deeply the difference between "hearing" and "labelling."[21] The commutation tests we have carried out have been relatively crude. We did succeed in re-testing one speaker with his own productions, in Tillingham, and we found that he had no greater ability to identify the small difference he made in production than others did. But these tests still deal with the labeling function, rather than discrimination pure and simple. An ABX format should allow us to divorce the labeling function from the capacity to perceive a difference in sound. An ABX test constructed from natural speech is much too easy for a subject to pass: there are always small differences in the length, intonation, etc. of any two words used in natural speech, and the speaker may rely upon these to pass an ABX test rather than the position of the nucleus of the vowel. It may be helpful to test such speakers with synthetic stimuli in order to discover whether any categorical boundary exists between the sounds in question: that is, whether there is any sense in which discrimination within categories is less consistent than discrimination between categories.

We may also consider the possibility of higher level rules which determine the phonetic outputs that we have charted here: for example, an alternation which identifies a given vowel as lax or tense may produce a lower level effect on the peripherality of the vowel. Grammatical alternations may conceivably then determine such output (aided by various analogical extensions of the rules). Further research into the entire set of phonological rules which govern a particular output may throw light on this possibility.

In the title of this chapter we used the term "false report." It should be clear that the report cannot in itself be false. It is only the interpretation which can be in error. When a person fails to identify a given difference correctly, he is giving us information about his sound system. It is our task to interpret this information correctly, and so convert the data into a valid observation. Reports of intuitive judgments are extremely difficult to interpret without data on actual behavior; but behavior cannot be understood completely without this subjective dimension. Our findings indicate that successful research strategies will examine both sides of the question to obtain the maximum insight into the nature of phonological systems.

CHAPTER VII

THE STUDY OF SOUND CHANGE IN PROGRESS: SUMMARY AND FUTURE DIRECTIONS

The preceding chapters presented data on a wide variety of sound shifts in American and British English, and a number of general principles of vowel shifting and merging, based on the instrumental analysis of vowel systems in connected speech. This chapter will briefly summarize these substantive findings, present the methodological principles which proceed from this work, and examine the most important avenues for future investigation.

7.1. The shape of phonological space

Current treatments of sound change generally assume a set of two-valued orthogonal dimensions. Jakobson, Fant and Halle (1952) showed such dimensions or features close to the phonetic level, supported by some acoustic evidence. More abstract proposals for higher level phonological rules (Chomsky and Halle 1968) also include a phonetic level of representation with independent dimensions, perhaps with linear rather than binary dimensions. Our earlier view of the phonological space governing the New York City vowel system showed some difficulty with the three-dimensional binary set, and indicated the possibility of a triangular system for the low vowels for the older age levels, with a low central /ah/ in car, etc. (Labov 1966:XIV). The possibility of spacing vowels along continuous linear dimensions was considered, but the feature system displayed in diagrams was modelled upon the abstractions that are generally used in phonological analysis.

The view of phonological space given in this report is quite different. The two-formant plot shows a triangular space, reasonably close to the acoustic perceptions institutionalized in IPA transcription. In the doubly-linear diagrams presented here, the space appears to be typically convex, with outer envelopes curved outward, yielding the outlines sketched in Figures 5-1, 2, etc. The movements of the long or tense vowels upward appear to follow the contour of the outer envelope. The descent of lax nuclei and short vowels is less tightly constrained, and many follow a straight path from [i] or [u] to [a]. The most important fact about this space is the existence of an inner and outer path for both front and back vowels, indicated by the [±peripheral] dimension. The existence of a lowest point, or most open vowel, is a critical feature for the study of linguistic shifts; if a vowel is front or back of this point, it may then be involved in unidirectional chain shifts which carry it further front or back.[1]

The demonstration of sound change in progress within this phonetic framework shows that these characteristics of the phonetic envelope are important determinants of the course of further sound change, and do not merely reflect the operation of more abstract features. We cannot doubt the existence of abstract factors operating upon such chain shifts as /iy/→/ey/→/ay/→/oy/→; the functional pressure to preserve distinctions which is the fundamental character of such shifts is certainly more abstract than the phonetic parameters. We also presume the existence of articulatory determinants which interact with the acoustic output, and in part explain some of the conditioning factors we have discovered. But the direction of movement and many constraints upon movements seem to be directly correlated with the location of vowels in the phonetic space displayed in the two-formant plots.

7.1.1. <u>Rounding</u>. The fact that our acoustic space shows only two dimensions does not amount to an empirical claim that there is no third dimension corresponding to rounding, or that rounding is not itself an important element in the system. An essential step for further research is to determine the acoustic and perceptual correlates of rounding, and to discover whether such factors function to distinguish words which appear as near-homonyms in the phonetic space displayed in this report.

7.1.2. <u>Other configurations of two-formant space</u>. We have utilized the simplest possible display of the acoustic data in this report: a linear plotting of both the first and second formants. We have done some preliminary explorations of logarithmic displays, and of various weightings and plottings of the third formant. Although none of these efforts have added additional insight into the sound changes we have studied, these possibilities must be examined more carefully in a wider range of sound changes. The possibility of using F2 - F1 differences as a basic parameter will also be explored in future work.

7.2. Two types of "sound change"

The kinds of sound changes we have tracked through this phonetic space appear to be typical of the regular processes which formed the basis of the neo-grammarian view of sound change. At a number of points, we have contrasted these phonetic movements with more abstract rules. The tensing rule which selects members of the short _a_ class is the paradigmatic example of such an abstract rule (number 4 in Chapter 3, p. 48), which utilizes the binary framework of independent phonological features. In this report we have touched only briefly on the characteristics of this tensing rule, which as far as we know is the most complex of phonological conditioning which has been described to date (Trager 1940, Ferguson 1968, Cohen 1970). We have been studying this rule for a number of years in the range of dialects which extend from New York City to Philadelphia, and future reports will deal with its characteristics in considerable detail.

The conditions which govern the fronting of /uw/ and /ow/ also appear to have an abstract, somewhat arbitrary character. In some dialects (Atlanta, Central Texas) all /uw/ is fronted; but in others (London, Philadelphia) there is no trace of fronting before /l/. This points to a rule differentiating the dialects at a higher level. It may be entirely conditioned by differences in the phonetic character of the /l/, but there is no evidence to demonstrate this at present.

If there are at least two radically different types of rules which govern sound change, then we must be particularly cautious not to confuse generalizations about one with statements about the other. It has been argued whether or not there is grammatical conditioning of sound change in general. But the question can be made more precise by distinguishing the two types of rules. Grammatical conditioning cannot be doubted for the tensing of short _a_ (see p. 49, _i_). On the other hand, we see as yet no evidence for grammatical conditioning of the raising rule for (æh), or for the fronting of (uw), or the backing of (el). The same distinction must apply to the issue of lexical diffusion. No one can deny the evidence of lexical diffusion produced by Wang (1969), Chen and Hsieh (1971) and their associates; nor can there be any doubt about the lexical conditioning of the tensing rule for short *a*. But our studies so far do not show clear evidence of lexical conditioning in the fronting, raising or lowering rules studied in Chapters 3 and 4.

The suggestion put forward by Stampe is that we distinguish between abstract *rules* and lower level *processes* (1972). Such a shift in terminology may indeed avoid a great deal of confusion and emphasize the radically different properties of the two types. However, we do not see any profit in maintaining that all rules are obligatory and all processes optional. We find a great deal of optionality in the tensing rule for short *a*. For example, in Philadelphia, there are many options open to individual speakers for such words as *Annie*, *planet*, *badge*, *pal*, etc. The advancing edge of the change shows a wide range of variability, even if the invariant core is obligatory (*far*, *bad*, *man*, etc.) at least within the uncorrected vernacular.

In the sketch of the rule systems put forward in Chapter 4, we might distinguish abstract rules from lower-level processes in the terms outlined above. We show an alternation of such types in our discussion. For example, P14, the tensing of short *a* in 4.7.1. is immediately followed by the peripherality limitation P16 and the raising rule P17 (p. 179). The last two are certainly "processes." We then have the development of inglides (P18) and the vocalization of /r/ (P19) in 4.7.2.; these are abstract binary rules. Whether or not the two types of rules can or should be segregated into different components of the phonology deserves a separate inquiry.

7.3. Detailed phonetic conditioning

Chapter 3 gave an extremely detailed account of the phonetic conditioning of the raising of (æh) (3.3.1). A number of fine-grained effects emerged: the favoring of the rule by nasals and disfavoring of following velars, liquids, preceding liquids and liquid clusters, etc. The tight segregation of the various sub-classes was evident in a number of cases. Although the number of vowels displayed for any one speaker was not great enough to rule out the possibility of chance effects, the same repetition of the same conditioning factor in speaker after speaker made it clear that we were observing regular phonetic effects (Tables 3-4 through 3-8). At the same time, it could not be asserted that every word formed its own word class. Many possible conditioning factors seemed to have little effect. Most preceding consonants did not affect (æh) position significantly. Following /m/ and /n/ seemed to be quite equivalent. The effect of manner of articulation seemed quite variable: viz, the influence of voiced stops vs. voiceless fricatives. Though some speakers showed clear segregation of these classes, it was not always in the same direction (cp. the variability in Labov 1972). On the other hand, point of articulation affected short a more regularly as in the differentiation of following -č, -t, -p, -k (Table 3-8).

Some of these effects appear to have a ready and plausible explanation. Following front nasals will promote raising and fronting of (æh) more than velar nasals; it would seem that the raising of the back of the tongue interferes with the prior raising of the blade. The involvement of the back of the tongue with -k and -g would similarly account for the centralizing effect of following velars (Table 3-7). The involvement of the tongue with liquids would also account for the effect of following -l and -r, though it should be pointed out that this is more variable than any single explanation would predict. Preceding clusters may have more effect than preceding single liquids since it can be shown that in clusters with preceding Kl-, Kr-, etc., the liquid actually forms part of the syllable nucleus from the standpoint of syllable timing.[2]

On the other hand, there is no simple explanation for the clearest effect of all: the peripheral position of words with following front nasals, and the rapid raising of this class in the later stages of the change. This is by far the most powerful and general effect described in Chapter 3, and the most interesting in view of the challenge it poses for explanation (see 7.8 below). We can separate out the raising phenomenon, and attempt to explain it by the argument advanced in Chapter 3: that it is peripherality that favors raising. But we must distinguish between the clear finding that front nasals favor the raising of short a in a wide variety of dialects, and the theoretical construct that would account for this in terms of peripherality. Even if this proposal is correct, it raises two other major questions which are still not explained: why peripheral vowels rise faster, and why in fact they rise at all.[3]

One approach to the solution of such questions is in the application of this fine-grained examination to other changes in progress. One of the most remarkable facts that proceed from our current investigations is that the phonetic differentiation discussed above has not appeared in stable phonemes. It is only in changes in progress that the broad effect of conditioning factors becomes evident, and we can see the mechanism of change at work.[4] We plan to explore in detail the phonetic conditioning of the raising of (oh) and the fronting of (uw). This should throw a great deal of light on the generality of the factors operating on the raising of (æh) and the fronting of (o), and should in turn help us to explain them.

The existence of such detailed phonetic conditioning provides a remarkable confirmation of the neo-grammarian position, once we isolate the type of sound change which their observations relate to. Further confirmation and exploration of such conditioning depends upon providing more quantitative treatment of these phonetic rules.[5] This in turn depends upon upgrading of the input data of our studies, both qualitatively and quantitatively. Several developments in current research techniques are designed to provide such data.

7.3.1. Field methods. Our earliest and most systematic records are of the interviews made in New York City in the survey of the Lower East Side (Labov 1966). Some of these have a large volume of spontaneous speech, but many have less than 45 minutes of interview time with many short answers.[6] Techniques for eliciting spontaneous speech and the vernacular have advanced considerably since then; our most recent exploratory interviews in the Philadelphia periphery involve from 1 1/2 to 2 hours of continuous speech on the part of the subject. More importantly, our current approach to the systematic study of the speech community involves continued access to neighborhoods and groups within the neighborhoods, following and developing the techniques of Labov, Cohen, Robins and Lewis 1968. Furthermore, we are developing methods for eliciting critical and less common lexical items in the course of natural conversation. All of these methods provide us with information on individuals which should provide richer data on detailed phonetic conditioning.

7.3.2. Instrumental methods. The investigations reported here are based upon spectrographic analysis of vowels carried out with the Kay Sonograph. Although the instrument requires less than a minute to examine the first 4,000 Hz of a given 2.4 seconds of speech, the associated problems of location and measurement are relatively time-consuming. An individual's vowel system can be studied through 80-100 measurements of vowel nuclei in approximately two working days. However, the examination of detailed phonetic conditioning, of vowel overlap, of the direction and contour of glides, can multiply by factors of three or four the time required. Current techniques in ongoing research will attack this problem through the use of real-time analysis of the spectrum. It is also expected that the percentage of error will be radically decreased at the same time.

7.3.3. The normalization of vowel systems. A third approach to the development of quantitative studies of changes is through the normalization of vowel systems. If the system of one individual can be transformed so that it can be systematically superimposed upon that of another speaker, and this process extended to the community in general, we would be able to trace change across generations in a single set of measurements. Such techniques would also make it possible to give stronger confirmation of the effects of phonetic conditioning upon sound change even when there are not many cases in a particular class for any given individual. Such development of normalized systems is one of the main directions being explored in current research.

7.4. Principles of chain shifting

Chapters 4 and 5 present a number of general principles governing the chain shifting of vowels. The basic findings concern the uni-directional character of movement within a sub-system: (I) that long or tense vowels rise, (II) that short vowels or lax nuclei fall, and (III) that back vowels move to the front. These principles were first identified by Henry Sweet (1888:19-20) writing about the character of vowel changes in general. But it is only in regard to chain shifting that these principles can be shown to have strong and binding effects. This last fact is particularly interesting since it illustrates how the combination of several variable or probabilistic constraints can lead to a categorical rule. Any given vowel may move up or down, back or front, in response to a number of conditioning factors. There is a factor, unexplained at present, which causes long or tense or peripheral vowels to rise. Martinet has advanced an explanation for the fronting of back vowels: that it is due to the asymmetry of the oral cavity, which allows more distinctions in the front than in the back (1955). If there is a probability of, let us say, .8 that a given tense vowel will rise, we might then calculate that for three vowels to rise we would have a probability of only .8 x .8 x .8, or .51. But such a calculation would assume that the movements of vowels were independent, and nothing is farther from the case. The upward movement of vowels in a chain reinforces the movement of each, leading to a probability of an upward chain shift close to 1. That is, the movements of the vowels are interdependent so that it is the probability of an exception to the rule which declines with the addition of each new element.

Given the seventeen historical cases of Principle I cited in section 4.8.1., we must consider this general principle well founded, especially when we add to it the many cases observed in current dialects. Principle II finds its main support in the lowering of lax diphthongal nuclei. But here we must bear in mind that we do not have independent phonetic evidence for the lax character of the nuclei in the eight historical cases cited. It is the detailed phonetic evidence of London, Norwich, Philadelphia, the Outer Banks, Atlanta and Central Texas which gives the strongest support to this principle, identifying "lax" with [-peripheral] at this level of analysis. On the other hand, the nine cases of Principle III support the generality of this principle as strongly as current observations.

The four or five patterns which we have described in Chapter IV are convenient schema by which we can summarize the coherence of the various principles. The complexity of recent sound changes, in which fronting is combined with the lowering of diphthongal nuclei, shows that Patterns 3 and 4 are not basically independent phenomena. The most important feature of these patterns is that they introduce us to the more general principles of Chapter V, where constraints on shifting between subsystems are set forth in a brief and preliminary way. In the long run, these principles may be the most powerful in explaining the long-range evolution of linguistic systems.

There are many unresolved problems of explanation in considering shifting between sub-systems. In the historical review, no fact stands out as more challenging than the stability of Romance /i/. While Germanic and Balto-Slavic /ī/ can be diphthongized and Lappish /ī/ is shortened, these options have not opened for Romance (or Greek) /i/. The stability of Romance /i/ is one of the many unexplained particulars of linguistic history: in this case, the absence of drift, rather than its presence.

7.5. Mergers and reported mergers

The most unexpected findings of this investigation are the "falsely reported" mergers discussed in Chapter 6. When we first demonstrated that native speakers judged minimal pairs as "the same" though they were in fact different phonetically, many linguists found it difficult to accept these facts, which seemed to violate deeply held convictions.[7] It was always assumed that words would not be heard as "the same" unless they were in fact the same: for how else could differences be maintained if native speakers did not hear them as different?

The six cases presented in Chapter 6 are only a part of the evidence which we have now accumulated on this point. Trudgill has independently found other instances in Norwich [pers. comm.]. The general principle which emerges here cannot be doubted: intuitions about minimal pairs are only a rough guide in establishing phonological systems. Or put in another way, the abstract rule system of the language produces many features of the phonetic output which are not individually controlled or monitored for the direct contrast of meaning. This should not be surprising when we reflect on how completely and unconsciously a person learns his native "accent"--a set of phonetic particulars which may be quite inaudible to himself and others in the process of communicating meaning. The methodological implications of Chapter 6 are strong. We continue to assert that minimal pair tests and commutation tests provide valuable information. But if one were to gather only one kind of data from speakers of a language, it should surely be their spontaneous, unreflecting speech rather than the results of conscious introspection on their part.

Chapters 3 and 4 emphasized the fine-grained control exercised by phonetic factors. On the other hand, the findings of Chapter 6 indicate that a significant part of the sound system must be produced by relatively abstract rules, in the fashion that has been emphasized by Chomsky and Halle (1968). Further evidence for the abstractness of some language changes may be found in our current studies of flip-flops or reversals of the positions of vowels in phonological space. We are investigating two such cases: the reversal of short /i/ and /e/ in Glasgow English, and the reversal of /ahr/ and /ɔhr/ in Southwest Utah. In both cases, there is some evidence that the changes came about by a gradual rotation of one vowel around the other. But this evidence is far from conclusive, and the phonetic evidence of a synchronic reversal is strong and compelling. Our final report on such reversals may argue that sound changes do operate at the discrete, high level required for reversal of distinctive features, unless convincing data for a more gradual process emerges.

7.6. Discreteness and continuity

The question as to the locus of sound change is tightly tied to the question of discreteness vs. continuity. If we think of the changing of a sound pattern as a shift of phonetic realizations, sound change will emerge as a gradual, continuous phenomenon. This is the strongly held view of the neo-grammarians: Paul (1889), Bloomfield (1933) and Hockett (1958); their extreme position is criticized as unrealistic by Weinreich, Labov and Herzog (1968: 109-110). But recent emphasis on the abstract nature of some sound changes has led many linguists to argue the reverse position: that all sound change is a discrete change in discrete rules. Our first studies of sound change showed that there is internal development within rules of a continuous nature (Labov 1963, 1965, 1972) and this report provides massive evidence of sound changes developing within a continuous phonetic space. It is therefore surprising to find a number of extreme statements by recent writers, many applying an unmodified version of generative phonology to historical linguistics, which take a categorical position on this point. The refusal to consider the existence of continuous sound change (Postal 1968: 303, King 1969) or of discrete change (Andersen 1972:12) is the result of a deductive approach to linguistics which is diametrically opposed to the spirit of the present investigation.

We approach the question of discreteness vs. continuity as an empirical issue. There is ample evidence that both types of sound change exist. The question is to find a systematic method for distinguishing in any given case whether we are dealing with a (relatively) discrete or continuous phenomenon, and ultimately to uncover the principles which determine this behavior. The new field techniques and instrumental methods described in sections 7.3.1 and 7.3.2 will be applied to this problem, providing the radical increase in the volume of data needed to resolve such issues.

7.7. The relation of linguistic evidence to linguistic theory

The issues summarized in the preceding sections serve to illustrate a fundamental difference between two kinds of linguistic research. Many of the current writings on sound change and phonological structure strike us as scholastic in character. They accept as given such principles as the discrete nature of sound change, the absence of a contrastive phonemic level, the presence of a particular set of binary distinctive features, the need for a simplicity measure, unique derivations of phonetic realizations from a single underlying form, etc. Theory is seen as a form of manipulation, re-organizing a limited body of data to achieve a simple, attractive or persuasive configuration. This practice follows the model of linguistic theory set forth by Chomsky (1966) who asserts that the theory is always underdetermined by the data. The possibility of gathering new data to resolve the issues posed is often precluded by limiting in advance the kinds of data that will be considered relevant (Chomsky 1965:3). We have given a number of examples of such theoretical activity in our recapitulation of the arguments on the English Great Vowel Shift (4.8.2.1.).

The current investigation takes an entirely different approach to the problems of building linguistic theory. We do not begin with a set of abstract positions and deduce the consequences, though deductions may be made from empirically established principles. This investigation begins from reasonably well established results of phonetic research, such as the fact that the location of the first and second formants can give enough information to discriminate English vowel nuclei; that impressionistic transcriptions basically reflect acoustic information; that the following consonant is the major conditioning factor in differentiating vowel nuclei positions. We recognize some limitations on each of these principles; our empirical investigations provide further confirmation of them and also reveal some additional limitations. In general, we utilize known quantities to discover new known quantities, and attempt to build intersubjective knowledge upon that basis. Our bases are observable, countable and measurable phenomena. We find that intuitions are handy but undependable guides to the formation of hypotheses. The intuitions of other, naive, speakers of a language are acceptable though not necessarily criterial data; the intuitions of the theorist are not acceptable as evidence.

These are principles of scientific method which should hardly need iteration. Some of the reasons why they require re-statement in linguistics are given in Labov 1970. We have benefited from a re-emphasis on the abstract character of linguistic structure, which has led to new knowledge of the complex, hierarchical patterning of rule relations. There has been a healthy reaction against an ideological approach which demanded a purely descriptive approach to the surface data. But we have not profited as much from the claim that the primary data of linguistics is to be confined to the intuition of the native speaker (usually the theorist). Many linguists accepted Chomsky's 1964 argument that the subject matter of linguistics was to be the speaker's introspective judgments:

> ... data of this sort are simply what constitute the subject matter for linguistic theory ... Operational tests, just as explanatory theories, must meet the condition of correspondence to introspective judgments. (1964:939)

The weakness of such data in syntactic inquiry has been realized for some time.[8] In this report, we show that even in phonology, where introspective judgments were thought to be most secure, they are undependable: not only from the theorist, but when elicited from other native speakers as well. If linguistic theory is to rest on sound foundations, radical changes in the mode of inquiry are required.

The proposal which is advanced by this report is that a theory of language can be built upon intersubjective evidence from speech production and comprehension. The positive findings that we present here are based upon production. Further explanations will come in part from studies of comprehension, based upon experiments which reproduce as closely as possible the context of natural, unreflecting speech. Other experiments demand the more controlled conditions of speech synthesis. The fundamental proposal is to utilize observation and experiment as the basic evidence for linguistic theory. Introspection and the formal elicitation of subjects' intuitions about sounds will continue to play a role in the formation of hypotheses, but must relinquish their place as the primary sources of evidence for phonological theory.

7.7.1. The nature of explanation. A further word may be in order in regard to linguistic explanation. Each new discovery necessarily raises new questions of explanation and accounting. There is of course considerable difference of opinion among linguists as to what a valid explanation is. In this report, the feature of peripherality, as defined in a two-formant plot, is advanced as an explanatory principle to account for a number of different facts about the phonetic conditioning of the raising rule. If it is true that the relative peripherality of a phone is directly related to its rate of raising, we have simplified a number of miscellaneous phenomena under a single principle. In that sense, explanation will always involve simplification. This of course raises a further question as to why peripheral vowels rise faster than less peripheral ones, all other conditions being equal.

Within the more deductive types of linguistic writing, we regularly find that the conclusion of individual articles is an explanation rather than a finding. Questions are raised, and answers are found in relatively abstract principles such as a theory of markedness, claims about the ways in which children form grammars, notions about the organization of the mind, etc. Frequently these explanations are re-interpretations of the findings of others. Discoveries which are not explained in this manner are often not considered discoveries at all. However, the principles advanced as explanations are not known quantities, or based upon any independent source of data.

The approach of the present investigation is somewhat different. We present here a number of new findings: some are explained or seem to be explainable within the framework we have provided. Others seem to have no explanation at present. The latter appear to us to be the more important and challenging results of our work. In this report we have not discussed possible explanations for the raising of long and tense vowels in chain shifts, or the effect of following nasal consonants on the raising of tense vowels. There are many inviting avenues for further investigation, but we have at present no plausible evidence to support one possibility rather than another. Speculative publication can be fruitful, if some evidence can be marshalled to stimulate productive research. But too often such hypotheses have been advanced in linguistics as promissory notes for work that we never carried out.

In the mode of work outlined here, it is possible to produce a report which begins with questions and ends with answers. To the extent that these findings relate to previous findings, they will be presented as confirmations, disconfirmations, amplifications, or explanations of them. Thus the work on Martha's Vineyard and New York City produced findings which were reported in a series of reports (Labov 1963; Labov 1966). These were united and compared in several writings about the nature of linguistic change (Labov 1965; Weinreich, Labov and Herzog 1968). Our first report on spectrographic analyses (Labov 1972) confirmed the original findings, corrected some misconceptions about the shape of phonological space, added considerable detail and proposed a more specific mechanism of change through re-weighting of variable constraints on the rules. The present report adds further confirmation, corrects some misconceptions on the shape of phonological space, and develops data on peripherality which added a new dimension to the data previously available. Peripherality is not an abstract principle but rather an independent finding which offers new possibility for explanation which did not exist before instrumental measures were systematically applied to spontaneous speech.

The same point can be made in relation to our finding that native speakers are far more sensitive to vowel height (or F1 position) than they are to peripherality (or at least the F2 component of it). The explanation for this phenomenon may be pursued in another study, no doubt in the physiology of speech. In this report we have focussed upon the important consequences of this finding for linguistic methods and the interpretation of intuitive reports in the historical record.

7.8. The uses of the present to explain the past

The preceding section has presented some ways in which this report presents a new approach to the understanding of sound change taking place at present, and the construction of general linguistic theory. The report also faces towards the past, and the problems of historical explanation. We have systematically applied the uniformitarian principle, hoping to throw light upon some of the more difficult paradoxes of historical linguistics, and to derive added confirmation of our findings on sound change in progress. In so doing, we have also introduced new kinds of data and new arguments to the established methods of historical linguistics; some of these go beyond the limitations set on historical explanation by prominent spokesmen for a structural approach to linguistic change.

At the Ninth International Congress of Linguists in 1962, Kuryłowicz issued a strong statement on the independence of linguistics from other disciplines (1964: 11). He urged that we renounce all support from phonetics, dialect geography, psychology and cultural anthropology. Our reconstructions of the history of language would then rise to a "higher conceptual basis." (1964:30)

This position departs from the older tradition of historical linguistics, which had established deep roots in all of these areas. Kuryłowicz projected into diachronic studies the synchronic tradition of Saussure and Baudouin de Courtenay. Linguistics was to be restricted to abstract operations upon discrete emic units defined by referential contrasts. This restriction was extended to historical matters by Kuryłowicz and Martinet (1955), with many fruitful results. But the exclusion of data has been carried to an even greater extreme point by later writers as noted above. The application to historical questions of abstract syntactic and phonological theories based upon intuitions has not been as fruitful, since we do not have the intuitions of past speakers to call upon. Chomsky and Halle have attempted to utilize the intuitions of orthoepists to support their views of sound change, without relation to any other historical context of other types of data (1968). The writings of Halle (1962), Kiparsky (1968) and King (1969) have attempted to explain historical phenomena by operations with distinctive features, markedness conventions and rule reorderings. But it seems that the most difficult problems of linguistic change remain untouched by such abstract operations and become perhaps even more obscure (cf. Bach and Harms 1970). The long-term drift of particular languages in particular directions is still as inexplicable to us as it was to Sapir (1921), though King feels that it can easily be explained as another case of rule simplification (1969:202).

Our first report on the instrumental analysis of sound change in progress was presented at a symposium where abstract explanatory principles derived from generative phonology were freely applied to historical problems (Stockwell and Macaulay 1972). Our approach offered a sharp contrast in the mode of investigation and argument. In this report, we make a more explicit request for an abrupt change of direction in historical explanation. We have attempted to show that long-standing problems of historical linguistics can be resolved only if we are willing to use general principles drawn from phonetic and sociolinguistic research. We considered the problem of the mechanism of the Great Vowel Shift (4.8.2) and applied to it the logic of patterns we found in parallel shifts taking place today. The problem of how die descended to a low position without merging with day seemed to be resolved. Parallel cases were found in Yiddish (4.8.6) and Romance (4.8.5) where it could be seen that one vowel can pass another without merging if one is on the peripheral path and the other is on the non-peripheral path.

The distinction between these two paths was applied to two other notorious puzzles of the history of English: the reported merger and re-separation of long ā and $\overline{ea}$ in the sixteenth century, and a parallel problem with line and loin in the eighteenth century. Appendix A applies the principles and findings of Chapter 6 to this problem, and appears to yield a clear resolution of the contradictions.

In a broader and simpler sense, the general principles of vowel shifting offer an explanation of the large number of chain shifts we have traced in the historical record (4.8.1, p. 177). The three principles unite a great many particular facts by rule and so simplify them into one. The problem of explaining Principles I, II and III, and uniting them with other, independent observations, remains as the obvious focus for future investigations.

7.8.1. The relations of apparent time and real time. Throughout this report, we have been careful to note that the most systematic findings are based upon those studies where the problem of the relations of apparent time and real time have been resolved. In each of the empirical studies of change in progress, we have made note of the necessity for drawing inferences from distribution across age levels, and the problem of distinguishing age grading from change in real time. In a number of general reviews of the problem, we have discussed how some reference point in real time is necessary to arrive at a conclusive result on this point (Labov 1963, 1965, 1966, to appear; Weinreich, Labov and Herzog 1968). Our soundest bodies of evidence are therefore to be found in areas that have been surveyed by a Linguistic Atlas at least one generation before: Martha's Vineyard and New York City. Next are areas that have been sampled systematically, with good control of class and age distribution (Detroit, Norwich). But we have also drawn upon explorations of communities where we have age distributions for a few families only. In the second cases, we must be cautious not to rule out the possibility that the change is not proceeding as fast as it appears; children may shift to lower forms of short a, for example, as they get older. The parallels with the New York City and Philadelphia cases are helpful in reducing this possibility, but it must be borne in mind. In the third type of data, such as that drawn from the Outer Banks or Central Texas, we are less justified in speaking of change in progress. We may be examining a fairly stable situation in many cases, or even be witnessing the results of a retrograde movement as in Martha's Vineyard. In the case of chain shifts, this latter possibility is extremely unlikely, for the reasons advanced above in 7.4.

We hope to draw upon various sources of data to resolve these issues in future investigations. Philadelphia is the city which will be studied most closely and systematically, and there we have the advantage of Linguistic Atlas studies carried out in the 1930s. Continued observations of other communities such as Buffalo and Rochester should begin to form a solid base for future investigations of the course of change in decades to come.

*   *   *

The basic direction of this report is towards establishing a symmetrical relationship between the studies of the present and the studies of the past. Each chapter has brought these two aspects of linguistic inquiry into contact, with promising results. There is of course a natural relationship between historical linguists and investigators of language in its social context. Both try to approach the state of language as it exists or existed, independent of the observer. Both proceed with conviction that the highly systematic character of language is revealed in its use-- in tape recordings of current speech, or texts which reflect the speech of earlier times. It is hoped that the close association of these two interests will open up new avenues for linguistic investigation and the understanding of linguistic change.

APPENDIX A

TWO PROBLEMATIC MERGERS IN THE HISTORY OF ENGLISH

William Labov and Geoffrey Nunberg

In this Appendix, we will apply some of the findings of the main report to two notorious problems in the history of English: the reported merger of long ā and ēā in the sixteenth century and their re-separation in the seventeenth; and the reported merger of descending long ī and <u>oi</u> in the seventeenth and eighteenth century, and their reported separation in the nineteenth.

Both of these phenomena run counter to the fundamental linguistic principle that true mergers cannot be reversed. A word class such as ēā is the product of a series of historical accidents; and once it has merged its identity with another class, only those words which show grammatical alternations with a third vowel can be identified as different. There is no other way in which native speakers could identify those arbitrary signs which once contained ēā and those which once contained ā in the past. Insight into the past is possible only by comparative reconstruction or internal reconstruction. Only the second is open to native speakers, granting them the capacity to identify underlying forms from grammatical alternations. But such alternations do not exist for the vast majority of English words involved in these mergers. The fundamental reason for separating diachronic and synchronic arguments is that the insight into the past which the historian gains is not open to the native speaker of current dialects.

Given these solid preliminaries, it would seem that students of the history of English are faced with some insoluble contradictions in the case of the two issues just cited. Either the data or the theory must give way. In the following discussion, we hope to show that the contradictions can be resolved, interpreting the data in a more sophisticated way with the help of insight gained from the study of change in progress.

We will first turn our attention to the reported merger of ēā words with long ā and their later separation to merge with long ē. In Section 1, we will draw upon sociolinguistic studies of present-day speech communities to show how such a merger could have been reported in the first place, and why there is so much disagreement about it. In Section 2, we will draw upon spectrographic analyses of sound change in progress to show how the ēā class could be re-separated from one class and joined to another. To do so, we will present fresh data on a second well known and parallel case: the reported merger and later re-separation of *line* and *loin*. In the course of this discussion we will see the fundamental weakness of the minimal pair test and the inadequacy of uncontrolled intuitions and self-report as a basis for describing phonological systems; and the strength of a technique which uses the speech of everyday life as the empirical base for linguistic theory.[1]

1. The merger of *mate* and *meat*: did it occur?

In the history of the English language, there is no issue which is more puzzling than the behavior of the vowel spelt ēā in Early Modern English, derived from Middle English long open ɛ̄. Since the class containing this vowel is spelled fairly consistently with ēā, we will refer to it as the ēā words: *meat*, *mead*, *meal*, etc. The great majority of these words now rhyme with the reflexes of ME long close ē in [i:]: *meet*, *seed*, *feel*, etc. There are five well-known exceptions that still have mid vowels, along with reflexes of ME long ā. Thus *great*, *break*, *yea*, *drain* and *steak* have the same vowel as *made*, *mate*, and *male*. The subclass of ēā words before *r* is split almost down the middle: *fear*, *tear*, *near*, *dear* vs. *bear*, *tear*, *wear*, *pear*, etc. The issue is whether or not the whole class of ēā words was once merged with long ā and if so, how did they separate?

The only thing on which philologists agree is that some time around the end of the sixteenth century all of these word classes showed long mid-front vowels. For theories of language that depend upon the model of a homogeneous speech community, this is a particularly difficult and confused case. It involves many of the features that we are now familiar with in the study of normal, heterogeneous speech communities: widespread systematic variation, asymmetrical word classes, regional dialects, class stratification, and finally the reversal of a reported merger. It is a comfortable situation for those who study language in its social context, but awkward for those who would prefer to ignore that context.

The evidence for and against the merger can be summed up as follows. Quite a large body of evidence from rhymes and puns has been presented by Wyld (1936) and Kökeritz (1953) in arguing for the merger. A number of misspellings are cited by Wyld to show the merger, such as *to spake to her* [C. Stewkley in Verney Mem., iv., 464, 1695, cited in Wyld 1936:211]; *maneing*, "meaning," [Lady Brill Harley 40, 1639]; St. Jeamsis Park [Later Verney Letters, 1:37, 1697]; *to have her bed mead* [Later Verney Letters, 1:75, 1700, these cited by Wyld 1936:401].

The reports of the English grammarians are divided on this question. They give evidence of three possible subsystems:

I	II	III
meet	meet	{meet, meat}
meat	{meat, mate}	
mate		mate

John Hart clearly had subsystem I in 1569, with all three word classes distinct. Mulcaster (1582) and Whythorne (Palmer 1969) agree. But $\overline{ea}$ and $\bar{a}$ are said to be the same or rhyme or are placed in a list of homonyms by Laneham in 1575, Bullokar in 1580, Bellot in 1580 and Delamothe in 1592. They thus indicate the existence of subsystem II above. There was also a subsystem III in which $\overline{ea}$ words have already merged with long $\bar{e}$, as shown for example by rhymes in Shakespeare such as *teach thee*--*beseech thee* [Venus and Adonis 404, 406]; Spenser's *seas*--*these*, *streeme*--*seeme*, etc.; and spellings such as *spyking* [Henry Machyn 1550], *birive* [Harvey Letters 1573, cited by Wyld 1936:209].

In the seventeenth century, we find that grammarians no longer reported subsystems I or II. The great bulk of $\overline{ea}$ words were distinct from $\bar{a}$ for Florio in 1611, Gill in 1621, Wallis in 1688, Price in 1665, Miège in 1680 and Cooper in 1687. By the end of the century, the $\overline{ea}$ words not before $\bar{r}$ had almost all been assigned to the $\bar{e}$ class.

Faced with this evidence, the historians of English give radically different chronology for the raising of these vowels. The traditional view is that the first merger could not have happened, and therefore it did not.

Jespersen (1909), Luick (1921) and Dobson (1968) thus concluded that $\bar{a}$ and $\overline{ea}$ had never merged, on the principle that if they had merged, they could not afterwards have separated, and arranged their chronologies accordingly. Zachrisson was at first of the same opinion (1913) but in later writings he saw that there were some dialects in which the merger had taken place. Wyld (1936) and Kökeritz (1953) also accepted the reports of the grammarians that at least for some dialects, long $\bar{a}$ and $\overline{ea}$ merged. They argued that the first merger was never actually reversed; they see the situation as a replacement of one dialect by another. The subsystem III was a Southeastern importation, arriving with speakers from Kent and Essex, which gradually won out over the older London dialect. The southeast was well advanced in the general upward movement of the long tense vowels; both O. E. $\bar{æ}^1$ and $\bar{æ}^2$, for example, were raised to a tense mid $\bar{e}$ in Kentish, often spelled *ie* as in *gier* and *cliene* (Wyld 1936:41). Newcomers entering London in the sixteenth century from Kent and Essex brought this dialect with them.

Wyld is a leading exponent of the view that social factors play an important role in linguistic change, and he has documented many such cases of regional features becoming sociolinguistic variables in London. His views fit in closely with the scheme put forward by Sturtevant (1947) and with the patterns found in our studies of sound change in Martha's Vineyard and New York City (Labov 1963, 1965).

A linguistic change begins as a local pattern characteristic of a particular social group, often the result of immigration from another region. It becomes generalized throughout the group, and becomes associated with the social values attributed to that group. It spreads to those neighboring populations which take the first group as a reference group in one way or another. The opposition of the two linguistic forms continues and often comes to symbolize an opposition of social values. These values may rise to the level of social consciousness and become *stereotypes*, subject to irregular social correction, or they may remain below that level as unconscious *markers*. Finally, one or the other of the two forms wins out. There follows a long period when the disappearing form is heard as archaic, a symbol of a vanished prestige or stigma, and is used as a source of stereotyped humor until it is extinguished entirely. If the older pronunciation is preserved in place names or fixed forms it is then heard as a meaningless irregularity.

The case of $\overline{ea}$ fits this model quite well. The change must be seen as a relative acceleration of processes that had already been operating, on and off, for more than a thousand years. These are in fact the continued raising of tense vowels in English which follow the general principle that in chain shifts, long or tense vowels rise (Ch. 4). This process was accelerated by the arrival of a large southeastern population in London operating at a more advanced level of the shift. There is strong evidence for the existence of socially marked dialects, in which the two forms are associated with opposing populations. Thus in a well known quotation of 1621, Gill stigmatized the affected or effeminate pronunciation of the Mopsae, who used an "Eastern Dialect," saying kēpn for "capon" instead of kāpn for "capon." Later in the seventeenth century, we follow evidence for the progression of this shift by lexical diffusion in favor of the higher value for $\overline{ea}$ in orthoepists like Cooper (1687). The opposition was still a live one in the eighteenth century: Thomas Tuite reported in 1721 that the English differed in using high or low vowels for many $\overline{ea}$ words, with Londoners leading in the use of high vowels. Today the issue is a dead one; it survives in the well-known irregularities noted above, and in occasional place names like Preakness, New Jersey [preɩknɩs] and Leakey, Texas [lɛɩki]. We cannot doubt the existence of competing $\overline{ea}$ dialects in London.

But Wyld's explanation for the current status of $\overline{ea}$ words is not entirely persuasive; on one obvious point, it cannot stand as it is. Neither the older London system I or the Southeastern system III had the merger. How then did London speakers acquire it?

At this point we can begin to apply principles derived from our sociolinguistic studies of change in progress. In so doing, we necessarily rely upon the uniformitarian principle--that is, the forces which operated to produce the historical record are the same as those which can be seen operating today. Of course we cannot solve historical problems as we can synchronic ones: the phonetic and social data are too fragmentary. But we can provide some plausible interpretations with principles which have full empirical support and so illuminate the past by the present as we do the present by the past.

In these descriptions of change, it should be clear that we do not distinguish on principle between the origin and the propagation of a change. For if we take seriously the view of language as a form of social communication, the language can only be said to change when a new form is transmitted from one speaker to another, and accepted as an arbitrary social convention for conveying meaning. The analogy with biological evolution is clear: for a species can only be said to have changed when a new trait is propagated to future generations.

In studying sound change in progress, we continue the tradition of Louis Gauchat, who showed in 1899 that the assumption of a basic homogeneous speech community had no empirical support, even in the remote village of Charmey in the Suisse Romande (1905). Like Charmey in the nineteenth century, sixteenth century London was a normally heterogeneous community with regular class stratification and style shifting. Within such a community we can locate change in progress by a specific configuration. This is the sociolinguistic pattern shown in Figure A-1: the raising of (oh) in New York City. This is the long open <u>o</u> vowel in <u>caught</u>, <u>off</u>, <u>lost</u>, <u>all</u>, which rose in three generations from low [ɔ] to high [ʊ ᵒ]. In Figure A-1, the vertical axis is the height of the vowel. The horizontal axis is the range of socio-economic class groups. The values for each speech style are connected by solid lines: the highest value of the variable are found in casual speech. The most advanced forms do not appear in the highest or lowest social groups, but in the intermediate Lower Middle Class. This group also shows the strongest correction in more formal styles. In this curvilinear pattern, the sociolinguistic variable is not aligned with the socio-economic hierarchy in any one-to-one fashion. The general principle is that stable sociolinguistic variables will show a linear correlation with social class, so that the highest status group uses the highest degree of a prestige form or the lowest degree of a stigmatized form. But when change begins in an interior group, as it usually does, we see the curvilinear pattern which is associated with change in progress.

Of course it is possible for a change to begin in the highest or lowest social group, but this is not the usual case. A curvilinear social stratification seems to be regularly associated with stratification in <u>apparent time</u>: that is, a regular increase of the variable through the various age levels of the population. When this is correlated with reports from earlier points in real time, it may then appear clear that we are indeed dealing with linguistic change in progress. This correlation was found for (oh) in New York City and the parallel variable (æh). It appears again in the study of Panamanian Spanish by Cedergren (1970). Table A-1 shows the distribution of five sociolinguistic variables in Panamanian Spanish, which may be defined briefly as follows.

(R): the devoicing, fricativization, pharyngealization, and deletion of syllable-final /r/, with values ranging from 1 to 6 in the direction of these processes.

(PARA): the alternation of the full form of the preposition <u>para</u> with <u>pa</u>, with values of 1 and 2 respectively.

(ESTA): alternation of the full form <u>esta</u> with <u>ta</u>, assigned values of 1 and 2 respectively.

(S): the syllable-final alternation of [s], [h], and [Ø], with values of 1, 2 and 3 respectively.

(CH): palatal vs. retroflex and reduced stop onset of /c/, with values of 1 and 2 respectively.

One of these variables, (CH), shows a curvilinear distribution, with a peak in social group II (second highest). The sound change therefore consists of a movement towards the retroflex sound centered in the second highest socio-economic group. Table A-2 shows the age distributions for each socio-economic group. No particular trend appears except for (CH), where it is immediately evident that the younger the speaker, the higher the value of the variable.

A fourth example of this correlation appears in the recent study of Norwich, England, by Trudgill (1971). Figure A-2 shows the pattern of stylistic stratification for the (el) variable in Norwich; the progressive backing of short /e/ before /l/ in <u>help</u>, <u>belt</u>, etc., which moves from [e] to [3] to [ʌ]. The index is constructed as the numerical average (x100) of values: [ɛ] = 1, [3] = 2, [ʌ] = 3. Whereas all other variables in Norwich showed a linear pattern of social stratification, this is curvilinear, with a peak in the upper working class. Note that the groups immediately neighboring to the

TABLE A-1

SOCIAL STRATIFICATION OF FIVE SPANISH VARIABLES IN PANAMA

[from Cedergren 1970]

SOCIAL GROUPS:	I	II	III	IV
(R)	1.62	1.88	2.29	2.29
(PARA)	1.11	1.37	1.39	1.69
(ESTA)	1.26	1.56	1.62	1.71
(S)	2.03	2.24	2.31	2.36
(CH)	1.88	2.24	2.13	2.00

TABLE A-2

DEVELOPMENT OF FIVE SPANISH VARIABLES BY AGE GROUPS

[from Cedergren 1970]

AGE:	11-20	21-30	31-40	41-50	61-70 years
(R)	2.28	1.90	1.95	2.23	1.46
(PARA)	1.31	1.34	1.48	1.33	1.39
(ESTA)	1.64	1.50	1.67	1.57	1.41
(S)	2.34	2.22	2.15	2.18	2.19
(CH)	2.15	2.29	2.05	1.81	1.31

originating group show a marked pattern of stylistic differentiation, though not as steep as the upper working class. The upper middle class is the most remote from the point of origin, and shows no significant trace of this backing. The pattern of Figure A-2 would lead us to predict a wave model of distribution in apparent time, and Figure A-3 shows that this is indeed the case. Trudgill demonstrates that (el) is in an early stage of change in progress. In all styles there is a regular progression upward of (el) values, reaching a maximum in the 10-19 age group. There is some sign of correction in the middle-aged speakers, since their values are a little lower than the oldest speakers, but the sudden upward movement in the younger groups is unmistakeable. We carried out instrumental studies in Norwich to follow up Trudgill's findings, and found clear spectrographic evidence of the move to [3] and [ʌ] in the working-class population.

Following up Trudgill's findings on (el), we carried out parallel exploratory interviews in Norwich to obtain data for analysis. The spectrographic evidence appears in Figures A-4, A-5, and A-6 which show the vowel systems of James Wicks, 74; Les Branson, 42; and Jean Suffling, 15. Here as in previous diagrams of the main report, the two-formant space provides a close analogue of what we hear as the "front-back" and "high-low" dimension. Throughout this and further discussions of the spectrographic record we will be referring to "high," "low," "front" and "back," bearing in mind that we are in actuality referring to formant positions which may match our acoustic impressions but are correlated much less closely with articulatory gestures.

Using this instrumental record, we can follow the progression of (el) in Norwich across generations (i.e., change in apparent time). For James Wicks, in Fig. A-4, half of the (el) tokens are front vowels, while others overlap central /ʌ/. For the middle-aged speaker in Fig. A-5, we see that (el) is totally included in a mid-back /ʌ/; for the youngest speaker in Figure A-6, (el) is in a low-back position, further back and lower than /ʌ/, overlapping and extending beyond the broad /a/ class. This provides strong spectrographic confirmation of the regular progression of the variable through age levels which is reflected in Trudgill's precise articulation scores of Figure A-2.

These convergent patterns indicate that the basic sociolinguistic principle can be relied on to locate change in progress. It is not likely that it will apply to every case we encounter in future research, but it now seems clear that a curvilinear social distribution is a strong indication of a wave pattern in apparent time, and the combined pattern is good evidence that we are viewing the early stages of a change in progress.

There is reason to think that the sixteenth century movements of long ā and e̅a̅ followed a pattern similar to the current sound changes we have been studying. In London, the long ā and e̅a̅ variables were most advanced among speakers from the merchant class, not the highest social class. Hart, who was one of the landed gentry and a court herald, had low ā and lower-mid e̅a̅. Those who testified to the merger of e̅a̅ and long ā were tradesmen's sons, like Bullokar and Laneham. We can see the general outlines of a middle-class pattern opposed to an upper-class pattern. If our present understanding of sociolinguistic patterns is at all applicable, we would not expect to find sharp divisions between the two which would establish them as separate dialects. The predominance of the merchant class in the raising was a matter of more or less.

Within this framework of class differentiation, we must introduce a second principle which is involved in the reported merger. When a set of associated sound changes spreads from one group to another, different elements are advanced more rapidly by different groups. That is, structural relations are not preserved and may even be reversed. Thus in Martha's Vineyard, the centralization of (ay) to [əɩ] was accompanied by the secondary centralization of (aw) to [əʊ] among the Yankees. When the change spread to the Portuguese and Indians, the emphasis was reversed, with (aw) now leading (Labov 1963). In sixteenth-century London, it is clear that the raising of long ā was seen as the primary sociolinguistic variable. We have seen that Gill in 1621 heavily stigmatized the custom of pronouncing ā as a higher-mid vowel. But e̅a̅ was never mentioned.

The merger of long ā and e̅a̅ was then characteristic of Londoners who were influenced by the Southeastern model to accelerate their raising of ā without raising e̅a̅. Eventually, e̅a̅ was raised, but not until a century later was the raising completed.

Those who would try to write a uniform chronology for sixteenth-century London as a homogeneous speech community are bound to encounter contradictions. These are as baffling as those found by linguists trying to write a uniform description of New York City, who ended by describing it as a case of massive "free variation" (Labov 1966, Chapter II). Thus Dobson writes of sixteenth-century London:

> The direction of the changes were mostly convergent, and therefore destructive of the distinctions which an educated language must seek to preserve. (1955)

But our sociolinguistic studies suggest that this convergence is not confusion; it is rather the indirect evidence of the regular style, class and age stratification that must have prevailed in that area of the vowel system. This is the pattern which Weinreich calls "orderly heterogeneity," a normal characteristic of all communities that have been carefully studied (Weinreich, Labov and Herzog 1968).

2. The reversal of irreversible mergers.✓

We must now turn to a deeper problem: if the reported merger of long $\bar{a}$ and $\overline{ea}$ did occur, how was it reversed?

Wyld and Kökeritz suggest that contact with the Southeastern dialect was sufficient. But there is a general principle in dialectology that mergers expand at the expense of distinctions. Large groups of speakers do not re-learn word classes, which are essentially massive sets of historical accidents.

In Halle's 1962 paper on "Phonology in generative grammar" he discussed this merger and reversal on the basis of data supplied by Keyser. He simply explained the reversal as the re-organization of the rules for realizing the same set of underlying forms; $\bar{e}$, $\overline{ea}$ and $\bar{a}$. But how could these three underlying vowels be preserved? There are a limited set of alternations which might identify the $\overline{ea}$ class as opposed to the long $\bar{a}$ class: *break--breakfast*, *clean--cleanliness*, *mean--meant*. If the shortened $\overline{ea}$ forms were distinct from the short ā forms in *sanity*, *tan*, etc., then it would be possible for sixteenth century speakers to distinguish the underlying form of *break* as distinct from *brake* and *breek*. But this strategy would only serve for those few words which showed alternations. It would be of no value in distinguishing *beat* from *bate*, *meat* from *mate*, *feat* from *fate*.

Chomsky and Halle (1968) assign underlying forms to entire classes of long vowels on the basis of alternations shown by some members, though there is considerable disagreement as to whether this should be done (Krohn 1969, Hoard and Sloat to appear). But no mergers are involved: it is simply a case of rotating the sets of long vowels by a phonetic rule to match the underlying forms of sets of short vowels. Limited sets of grammatical alternations have no value in explaining the re-separation of a reported merger. On the contrary, the very existence of *break--breakfast*, and *clean--cleanliness* would motivate the splitting of the original ēā class, with *break*, *clean* and *mean* joining long ē and the others remaining with long ā. Halle does not discuss any of these issues in his 1962 article, which remains as an unmotivated claim for the retention of underlying forms. In SOUND PATTERNS OF ENGLISH (1968), Chomsky and Halle take John Hart as representative of sixteenth-century English.[2] Since Hart shows no merger at all, the problem of ēā is no longer of any concern to them.

The regularity of irregular sound changes. The well-known irregularities of the ēā class may be taken as evidence that the reversal of the merger was not in fact achieved: *great*, *break*, *yea*, *steak* and *drain*, along with *wear*, *swear*, *tear*, *pear* and *bear* might show that speakers were not in fact able to identify the ēā class accurately because of the merger with long ā. These ten forms are then seen as a random residue, testifying to the impossibility of re-separating a merged class. But a re-examination of the historical evidence, along with data from our spectrographic studies of parallel changes now in progress, shows that this impression of irregularity is largely illusory. Let us consider first the five words not before *-r*, which Samuels refers to as "those *enfants terribles* of traditional *Lautlehre*" (1965). With or without a merger with ā, the very existence of these exceptions has posed a difficult challenge for the traditional neogrammarian view of the regularity of sound change.

The form yea can first be set aside as an entirely different phenomenon. It seems to have risen to [yi:] as part of the regular process in the seventeenth century,[3] but afterwards reformed to [ye:] along with nay.

We can understand how a great many place names were left behind, with rare and learned words, since their assignment to a particular word class may be problematical, but these five are common ordinary words, and their irregularity is puzzling. If the shift of ēa words to high position was the product of irregular dialect mixture, why did it work so regularly for all but these five? On the other hand, if sound change is basically regular, why do so many sound changes show residua like these which give comfort to the opponents of the neogrammarian doctrine? The five residual words are too many to fit the model of regular change, and too few to be explained by random mixture.

We cannot hope to resolve the major question posed here by one investigation, but we believe that we can throw some light on the issues by drawing again on our instrumental studies of sound change in progress and some new sociolinguistic principles as well.

First of all, we observe that the irregularity is not so great as it seems. Three of the five words begin with consonants plus r. Of course historical linguists have noted this fact, but they have been quick to discount it because it immediately becomes obvious that a great many words were raised after initial /r/.

> In great and break it is often explained as due to r, which is not probable, seeing that r is followed by [i:] in read, treason, breach, grease, cream, preach, etc.
> (Jespersen 1909 [1949 edition: 338])

To this list we can add ream, real, reap, rear, dream, bream, scream, treat, etc. Jespersen did not let the matter rest there, since the primary task of the historical phonologist is to reduce such irregularities to rules or account for them somehow. He develops intricate arguments by analogy for great, break, and yea. But historical linguists underestimated the subtlety of phonetic conditioning in sound changes such as the raising of $\overline{ea}$. Our work on sound change in progress has steadily increased our respect for the power of phonetic factors to differentiate word classes in the middle stages of a change.

At the beginning of our work on sound change, we found naturally enough that the major influence on English vowels was the following consonant, especially /l/ and /r/, but more recently we have discovered that there are dialects in which initial /r/ has just as strong an influence as final /r/. For example, in Glasgow, we find that the vowel of short /e/ in rest winds up in exactly the same position as short /e/ in person, somewhat lower than the main body of short /e/ words. And in every dialect studied a preceding post-consonantal /r/ has been shown to have a strong effect on the vowel nucleus. In the studies of the tensing and raising of short a reported in Chapter 3, we find that words like grab are lower and more central than stab. This on-going sound change is quite parallel to the original raising of long $\bar{a}$; [mat] having been lengthened in open syllables to [ma:tə] and reduced to [ma:t]. It was then gradually raised to [mæ:t] and [mɛ:t] and [me:t].

This raising of (æh) follows the first of three unidirectional principles of chain shifting of Chapter 4: in chain shifts, tense or long vowels rise. Somewhat to our surprise, examination of this change in progress throughout the Northern tier of cities in the United States--Rochester, Buffalo, Detroit, Chicago--has not yet shown us lexical irregularities. Instead, we see extraordinarily regular phonetic processes. Let us review these processes as they appear in the vowel systems of James Adamo from Detroit and his son Chris in Figures 11 and 12 in the main series above. The father shows short a in a low front position, ranging from lower low to upper low. But the sound change is already in progress: we see the characteristic fine-grained phonetic differentiation which arises when (æh) begins to move upward. The highest and most peripheral vowels are those before front nasal consonants, as we now expect, with the velar nasal in a lower position. (From this point on we will use the expression "velar stop" to indicate "vowels before velar stop"). Voiced stops are lower; voiceless fricatives are lower yet and more central, with /f/ lower than the others; and the voiceless stops are lowest of all. Among the voiceless stops, the palatal /č/ is relatively highest and /k/ is the lowest and well back to a central position.

The effect of preceding and following /l/ can be seen in a subtly graded series of restraints (æh): initial /l/ has some effect in land and last; next, post-vocalic /l/ in Italian and challenge. Returning to the voiced stops, we see that flag is more central than bad with a velar final and preceding post-consonantal /l/. In a word, the relative position of almost every item can be accounted for by phonetic conditioning. This spacing out of phonetic subclasses is characteristic of the intermediate stages of change in progress, like the spacing out of runners in a race; at the beginning they are all bunched together; in the midst of the race, they are strung out according to their individual abilities and speeds; at the finish, they are brought together again.

Figure 12 is a view of (æh) in the system of the thirteen-year-old son, Chris Adamo, where we see even greater phonetic dispersion. The sound change has advanced until the words ending in front nasals are in lower-high position; the rest are in upper and lower-mid position. Voiced stops are just behind the nasals; below them the voiceless fricatives, then the voiceless stops, and one word ending in /kt/ in the lowest position of them all. And most importantly for our analogy with the case of great, break and drain, there is one item ending in a voiced stop well below all the others, in lower mid instead of lower high position: grabbed, showing the effect of the postconsonantal /r/.

The two crucial irregularities in the raising of $\bar{e}\bar{a}$ are great and break, since these are regular reflexes of ME $\bar{\varepsilon}$ from OE $\bar{æ}^2$. Not only are great and break preceded by post-consonantal /r/, but they are followed by voiceless stops so that both initial and following environments disfavor the change--if the EME raising of $\bar{e}\bar{a}$ operated on the same general principles as our twentieth century raisings.[4] Thus we might compare great and break only with words in comparable environments:

not raised:	great	break
raised:	treat	streak creak freak

We now find that the words that were raised all had voiceless initials before the *-r-*, and we have some evidence that voiced clusters, *dr-*, *gr-*, *br-* have the heaviest effect. Here we are perilously close to asserting that every word is indeed its own class, absorbing a complete phonetic determinism which would ultimately betray us. There is a probabilistic character to these events, because as Jespersen notes, we have plenty of evidence that *great* often had [i:] in the eighteenth century.

> Doubtless the pleasure is as great
> In being cheated as to cheat
> --Hudibras

As we have already indicated, the word *yea* followed a special history, as various forms of *yeah* do today; not only because the lower form rhymed with *nay*, but because such discourse particles normally range over five-sixths of the vowel spectrum. Furthermore, there is evidence to show that the low position of *yea* is the result of a later lowering of *yea* and *nay* in the seventeenth century, and that *yea* had risen to [ji] along with other $\overline{ea}$ words. *Drain* may be influenced by the initial *dr-* but shows other irregularities in its history including irregular breaking to $\overline{ea}$ before *-h*, which make it a special case. This leaves *steak* (from ON *steik*) as a true exception which we cannot give any rationale or probabilistic account for. Since this was [e:] in the sixteenth century, it should now have a high vowel.

One might wonder why we should be concerned over the small irregularities in $\overline{ea}$ words when there is apparently massive irregularity in $\overline{ea}$ words ending in *r*: *fear*, *beard*, *dear*, *hear*, *clear*, *near*, *tear*, *year*, with high vowels as against *bear* (vb), *bear* (n), *pear*, *tear*, *wear*, and *swear* with mid vowels. But as Jespersen noted, these five low words all stem from OE short ĕ (*bĕran*, *bĕre*, *pĕru*, *tĕran*, *wĕrian*, *swĕrian*). There seems to be only one exception to the rule for this subclass: *spear* from OE *spĕru*. Thus the irregularity in this class is comparable to the low degree of irregularity in other $\overline{ea}$ words.[5]

Current re-evaluation of speaker reports. With our increased respect for the regularity of the $\overline{ea}$ class, we must ask again, how was the re-separation achieved? We have seen that the presence of the Southeastern dialect may have been the indirect cause of the merger for one group of London speakers who raised ā without raising ēā. But we cannot easily accept the suggestion of Wyld and Kökeritz that these Londoners simply abandoned their old dialect with the merger and adopted the Southeastern pattern with a completely different assignment of the ēā words. There is a great deal of evidence to support the claim that once a merger, always a merger. It is easy enough for someone to lose a distinction, not so easy to gain one. It would mean memorizing a long list of words that are "different" though in terms of their original vernacular system they are "the same." The overwhelming body of evidence from dialect geography shows that mergers expand. In his study of Yiddish in northern Poland, Herzog (1965) puts forward the general principle: whenever an area which makes a distinction is in contact with an area that does not, the second will expand at the expense of the first.

In the United States we find many examples to support Herzog's principle. Mergers are expanding rapidly in the case of /hw-/ vs. /w-/ as in which, witch; /or/ vs. /ɔr/ as in four, for; /-in/ vs. /-en/ in pin, pen; /a/ vs. /ɔ/ as in cot, caught; /æ/ vs. /a/ as in aunt, ant. This is true even when social pressures are strongly supported by spelling as with which vs. witch. There is one contrary movement taking place in all the Eastern r-less areas, where final and preconsonantal r in car, guard, etc. is being restored. Here we normally have the support of regular morphophonemic alternations [kɑ: ~ kɑr##ænd] and vowel quality (e.g. god vs. guard as [gɑd ~ gæ:d] as well as the influence of absolutely regular spelling. These factors are absent in the case of mate ~ meat. Granted that one segment of the population was in contact with another which made the distinction, we would normally expect the merger to expand. We still have no plausible explanation as to how this re-separation was accomplished, especially when we note that the re-assignment of ēā to ē is not reported until the middle of the next century.

We can now throw some light on this question by turning to the results of Chapter 6 on the relation of reported mergers to spectrographic records of connected speech. We discovered there a previously unsuspected possibility: that speakers can report two sounds as "the same" even though they regularly make the distinction in their own natural language. This appeared first in the case of source and sauce in New York City; in the case of fool and full in Albuquerque; in the case of two and toe in Norwich; and other cases discussed in Chapter 6. But the most important case for the present discussion is the example of loin and line in Essex. The reported merger in the town of Tillingham was total and absolute as far as the Linguistic Atlas was concerned, and this in turn reflected on the long-standing reports that /oy/ and /ay/ had merged several centuries ago in this area of England, and remained merged today. The reports of the older inhabitants of Tillingham whom we interviewed were also that these vowels were the same: and in commutation tests they could not reliably distinguish between the two vowels, especially in the loin ~ line context. Nevertheless, the spectrographic records showed that loin and line were quite distinct, with loin higher and/or further back than line. This reported merger becomes especially significant when we consider that it involves a case of re-separation which has been almost as puzzling to historical linguists as great and break.

3. The case of line and loin.

The /oy/ diphthong in modern English comes from a number of sources: (1) Latin au+i, as in joy; (2) Latin short ŏ+i, as in oil; (3) Lat. long ō+i or short ŭ+i, as in point, join, toil, voice; (4) Late French oi from earlier ei, as in loyal; and (5) other obscure sources, as in boy and toy. The traditional view of Sweet is that (3) was kept distinct from the rest as /uy/ until the mid-seventeenth century, when the nucleus [u] unrounded and fell to [ʌ] along with short /u/, producing a merger with the descending ME ī at [ʌy]. But the confusion of /ay/ and /oy/ seems to have begun considerably earlier than this lowering of /u/. The first signs of merger with ME ī appear in fifteenth century misspellings. Kökeritz points out a number of rhymes in Shakespeare as well as inverted spellings: smoil for 'smile' and imply for 'employ' (1953:216). Moreover, early merger of /ay/ and /oy/ was not confined to the /uy/ class at all. The assignment of an "open" or "closed" vowel to these words showed that the /oy~uy/ distinction was confused in the sixteenth century. Hart for example shows coin and voice, both /uy/ words, with an open /o/ nucleus, but join with /u/; and boy, which is an /oy/ word, appears with a /u/ nucleus in his account.[6] The assignments to /uy/ and /oy/ by other orthoepists show many such examples in the sixteenth and early seventeenth centuries (Nunberg 1972).

The first signs of merger with ME long ī words appear in fifteenth century misspellings; the general tendency appears in the late seventeenth century when Coles (1674) identifies line and loin, bile and boil, isle and oil, including both ui and oi types, and a wide variety of words are shown as merged by other phoneticians of the period. Free variation appears in the rhymes of Dryden, Butler and Pope. By the end of the eighteenth century, this merger had become a major social stereotype, stigmatized by Rudd (1755), Kenrick (1773) and Nares (1784). Kenrick conceded that some words had been so completely merged that a reversal would now be affected:

> A vicious custom prevails, especially in common conversation, of sinking the first broad sound entirely, or rather of converting both into the sound of i or y; thus oil, toil are frequently pronounced exactly like isle, tile. This is a fault which the poets are inexcusable for promoting by making such words rhime to each other. And yet there are some words so written, which by long use, have almost lost their true sound. Such are boil, join, and many others, which it would now appear affectation to pronounce otherwise than bile, jine.
> (quoted in Ellis 1884:1057)

Jespersen and many others were convinced that the re-separation of /oy/ and /ay/ was accomplished under the pressure of spelling pronunciation.

> The disappearance of ai for oi in polite society is no doubt due to the influence of spelling. (1949:330)

This argument is put forward because it is the only conceivable one, but it is not convincing. The general problems raised for ēa hold here as well. If spelling could reverse the merger of /ay/ and /oy/ in the nineteenth century, it could reverse the merger of /ɑ/ and /ɔ/ in the twentieth. But our observations of speakers who learned English with this merger in their vernacular system find it almost impossible to reverse, even under pressure from teachers and peers who regularly make the distinction. The stigmatization of h-dropping has had no success in changing working-class speech throughout the south of England. The irreversibility of mergers has not ended with the rise of literacy.

But beyond this, we find that the merger and separation of /ay/ and /oy/ is not confined to polite society: throughout the local vernaculars of England and America /ay/ and /oy/ are distinct. In the south of England /ay/ is often backed and raised to the original position of /oy/ [ɔɩ] but at the same time /oy/ moves upward in a chain shift to high-position [uɩ]. It is hard to explain this clear separation, even under the pressure of a chain shift, by the effect of standard spelling in London speech. Figure 8 shows the vowel system of a working class speaker in the East End of London, taken from our current studies of sound change in progress. This diagram is merely one of many which show that the /ay/ ~ /oy/ distinction is normally preserved without any difficulty. Though /ay/ is raised to a lower mid position, /oy/ is quite distinct with a high back nucleus.

This dialect is the direct inheritor of the "common speech" stigmatized by Kenrick for its merger of /ay/ and /oy/. The same pattern appears in many other dialects that seem to have once shown a merger. How do we account for this situation? The evidence of merger seems clear; the evidence of re-separation seems equally clear; the principle that mergers are irreversible is still in effect. Until recently we would have put it down as one more unsolved mystery of historical linguistics.

We re-considered the /ay/ ~ /oy/ situation in the light of our findings on the unreliability of current reports of merger. We found that the re-separation of /ay/ and /oy/ may not represent the reversal of a true merger: it is quite possible that the two vowels were distinct throughout the seventeenth and eighteenth century, despite contemporary reports that they were the same.

The commutation tests in Tillingham confirmed our finding of the asymmetry between production and perception in the case of <u>line</u> and <u>loin</u>. Speakers consistently made small differences in natural speech which maintain the identity of the word classes, but they could not accurately label these differences on conscious reflection, either in their own speech or in the speech of their close associates who spoke the same dialect.

From these results we inferred the strong possibility that /ay/ and /oy/ have remained in close approximation in Tillingham for several hundred years, heard as the same, yet not the same in fact. They are now re-separating in the speech of younger Tillingham speakers, as /ay/ becomes progressively more central. We may further infer that /ay/ and /oy/ never merged at all in the history of English. The rhymes and reports of "the same" may only be the results of the fact that the differences between the two sounds at a certain stage were too small to be relied on to distinguish words; but the phonological system continued to produce a peripheral nucleus for /oy/ and a less peripheral and lower nucleus for /ay/ (basically tense ōy and lax ăy).

4. The resolution of the ēā problem

We can now apply these findings to the problem of the merger and re-separation of the ēā words. From all that has been said, it follows that we cannot use the reports of orthoepists on "same" or "different" as direct evidence for the existence of a merger. It seems clear that the ability to label a difference is not a determining factor in the evolution of the language. Without instrumental records of the use of language in the past, we must base our conclusions on the actual course of linguistic history.

There is no question that a merger of ēā and long ā was reported in the sixteenth century, and that many speakers heard <u>meat</u> and <u>mate</u> as the same. That does not mean that they were the same. It does mean that they were in close approximation, and could not be relied on--for a time--to distinguish words. The later history of English in the seventeenth century showed that ēā and ā had not merged in the sixteenth. This conclusion seems to resolve effectively the contradictions in which this problem has been embroiled, and we submit our findings to historians of English with the hope that they will find them illuminating.

We can never claim to have resolved an historical issue decisively, as we might do for a synchronic problem; the best that we can do is to develop the most plausible reconstruction of past events, in the light of other past and present data. We suggest that historical linguistics can continue to benefit by drawing upon the rich and inexhaustible store of data to be found in the study of change in progress. The case of $\overline{ea}$ is but one of a great many where subjective reports of past observers need further interpretation; and the problem of merger and re-separation is but one of many unresolved contradictions in the past which can be illuminated by the present.

FOOTNOTES

Notes to Chapter 1

[1]Made available through the courtesy of Roger Shuy and Walt Wolfram of the Center for Applied Linguistics, Washington, D. C. The New York City data includes a total of 210 subjects, and the Detroit data over 700; but the requirements for tracing sound change in progress noted in 2.2 sharply reduce the number of subjects we would analyze in our program.

[2]Whenever there is no longer direct evidence of on-going change, there is a certain danger of making incorrect inferences that the stage we are witnessing is the end-point of the simplest series of changes connecting this with neighboring dialects. We must always be on the lookout for the existence of retrograde movements which would make such a simple explanation illusory (Weinrich 1958).

[3]It is obvious that the sound quality of candid recordings is inadequate for our present purpose; but on other grounds such techniques must be rejected as socially undesirable and self-defeating in the long run.

[4]Convergent data on this issue can be drawn from New York City (Labov 1966), Panamanian Spanish (Cedergren 1970) and Norwich, England (Trudgill 1971).

[5]We also find that certain ongoing changes are most advanced among lower middle-class speakers in the suburban periphery of the cities, especially among females (see 2.1).

[6]The American atlas (Kurath 1939) is a notable exception; for a study which makes good use of the age range of informants, see Avis 1960.

[7]We should not rule out the possibility that there are vowel distinctions which the ear is sensitive to that current spectrographic displays fail to register. There are a number of cases of overlap in our studies

Notes to Chapter 1 continued

which have not been resolved by F1-F2 plots, F3, duration, or formant contours; this is an important topic for future investigation.

[8]These variable rules may eventually be converted into quantitative functions based upon articulatory factors as well as acoustic ones, but such developments necessarily depend upon the further explanation of the regularities we have discovered.

[9]King 1969 finds no difficulty in explaining drift as simply one more example of rule simplification (p. 202). We find very little explanatory force in rule simplification in general, but in this case King's optimism seems particularly unjustified.

Notes to Chapter 2

[1]A good portion of the field work and analysis of the social situation was done by Teresa Labov, to whom we are much indebted.

[2]As one of many instances, W. L. selected an isolated working-class youth in Eastville Park in Bristol, at a time when no one else was to be found. He was lying on the grass listening to a radio. He turned out to be a local boy from a working-class area, but he had never been a member of any local group or hung out with Mods or Rockers in his day. He was then working as a recreation director in a youth center, trying to keep young boys out of trouble. His language reflected his general endorsement of the dominant social values, quite remote from the Bristol vernacular.

[3]In England, pubs offer the best site for natural social interaction of adults, but in most urban areas they are too noisy for good recording.

[4]Several interviews were carried out with lower middle-class families in the English series, and there was a striking contrast in the amount of style shift towards the formal end of the speech spectrum.

Notes for Chapter 2 continued

[5]In England or France, the fact of being an American is still a very positive feature for working-class people.

[6]One was from an old rural type who was convinced that we were missionaries, since he had been approached by Jehovah's Witnesses the day before.

Notes for Chapter 3

[1]See Sweet (1890); Jakobson, Fant & Halle (1963); Jakobson & Halle (1964); Kim (1965); Chomsky & Halle (1968: 324); Pike (1967); Ladefoged (1972).

[2]And along with [r], which differs from [ə] and [ɜ] only by the feature [+consonantal], and is opposed as [+central] to the [-central] laterals.

[3]As we will see, there is a problem of overlap in that the centralizing effect of certain consonants, like gr__ or __g may result in values for F1/F2 identical with lax or [-peripheral] vowels. See below for other reasons why the feature [±peripheral] cannot replace [±tense].

[4]We will encounter examples of centralized monophthongs in Southern dialects (e.g., the Outer Banks) and English dialects (e.g., Received pronunciation) where long and obviously "tense" vowels occupy the same F1/F2 positions that certain lax vowels do but are heard as different. In fact, we will encounter this problem in the final stages of (oh) development in New York City--see especially Figs. 4 and 9. Duration and formant amplitude may resolve many of these cases, but we are not convinced that they do so in every case. We will confront this issue directly in studying Principle III in Chapter 4. The problem is similar to that of identifying the acoustic correlates of rounding (see Chapter 4).

[5]There is some indication that the ingliding vowels have monophthongal equivalents in high position too, but with less peripheral values which contrast with peripheral values of the monophthongs which alternate with upgliding

Notes for Chapter 3 continued

vowels. These monophthongal equivalents of ingliding vowels seem to represent an averaging process which reproduces the acoustic impression of nucleus-glide with a single value. Thus New York City *beer* may be [bi:ə] or [bɨ:] while *be* may be [bi:] or [bɨi]. Although this question has important consequences for both synchronic and diachronic theory, we will not be able to explore it further in this report.

[6]If the glide which the new tense vowels develop is actually a schwa, then these vowels should merge with the small class of original Vh words in which the schwa is derived from an underlying unstressed final *-a*. In our data the only original Vh word which occurs with any frequency is *yeah*. Most interviews have one or two examples where we can contrast this /eh/ with the rising vowel of *bad* or the /ehr/ of where. In *r*-less dialects these two should become identical. But given the conditioning effect of the initial /y/, the data is not strong enough to prove this point. It suggests that for some speakers, *yeah* has fallen in with the class of rising short *a* words, and for others it is squarely within the /ehr/ class.

[7]There may actually be two stages in the *r*-vocalization rule. Even in dialects which are normally considered *r*-less, /r/ functions tactically like a vowel in consonant clusters. Thus native speakers cannot delete *-d* in *card* (though Spanish-Americans do). But they can delete the *-d* in *old*, since *-l-* functions as a consonant here. Since /r/ functions as a consonant in other situations, there must be an early *r*-vocalization rule applying to all dialects, which precedes *-t, d* deletion, and a late *l*-vocalization rule which follows it. It is not at all clear how this is to be formulated.

[8]This rule utilizes the [-tense] feature of schwa rather than [+central] to capture its character as a rule of dissimilation. It is one form of nucleus-glide differentiation which will assume considerable importance in our study. This rule is actually parallel to a higher level rule which tenses the stressed vowel of *Hebraic*, etc. (Chomsky and Halle 1968:241). But it seems clear that we cannot use the same rule for both purposes, since the *Hebraic* rule precedes the Vowel Shift and for reasons to be noted it is simpler to consider that

Notes for Chapter 3 continued

all of the present rules follow the original diphthongization and laxing of diphthongal nuclei.

[9]Whether or not baa falls together with this class is still an open question.

[10]In the New York City study (Labov 1966) the symbol (eh) was used to designate both (æh) and (ehr). But current indications are that these variables rarely become identical.

[11]Previous treatments of short a such as Trager (1940) and Cohen (1970) have discussed it as a single process, relating underlying /æ/ to a phonetic form such as [ɛ:ə]. But there are many reasons for differentiating a selectional (tensing) rule from a raising process, summarized on page 70 below.

[12]Sue Palma showed more correction than most working-class informants, as one might expect from her occupation as a hair-dresser.

[12a]The New York City study also registered two lower degrees of height: 5 for [a] and 6 for [ɑ]. These occur only in hyper-correct speech and as we now know, are not actually lower than [æ].

[12b]The scale also included two points lower than (æh 4). Some speakers corrected to a point equal to New England broad ä (eh-5) or even to the position of /a/ in [ɑ] in got (eh-6). In Table 3-2 there are some values below (æh-40) as a consequence. In Labov 1966, the variable (æh) was designated (eh).

[13]The social stigmatization of (æh) was at that time being registered in the vernacular of the upper middle-class. I have heard some young New York City people with totally corrected low (æh).

[13a]The one exception in previous studies in the United States was the centralization of (ay) and (aw) on Martha's Vineyard (Labov 1963). Trudgill (1971) finds a number of changes in England which show men more advanced than women, although women correct towards the standard more than men as is generally the case. Further investigation is required to state

Notes for Chapter 3 continued

under what conditions men will be ahead of women in the course of a new linguistic change from below (see Labov 1972).

[14]Virginia Hashii interviewed this series of older women; the first and third in our series (see also Fig. 5).

[15]The ordering of the speakers we have used is not strictly by age; there are a few re-orderings to take into account the fact that some speakers are more conservative or advanced on many variables than other speakers. But the order we show here will be preserved for examination of all New York variables.

[15a]Where the peripherality of (æhN) is only partial we will indicate it by superscripting the number of items which are most peripheral out of the total, e.g. $N^{4/5}$ The remaining N will normally be a peripheral vowel also, but separated from the main body by one or two other vowels. Of course the amount of overlap is a function of the number of measurements taken.

[16]Sotnick was profoundly depressed through sickness and on-coming blindness, and his son Joel did most of the talking during the interview. Nasca seemed willing to talk but had less to say: simply a case of an unsuccessful interview.

[17]Nasca also has two Ns: one set high and less peripheral, the other weak words which are high and peripheral.

[18]Many speakers in other cities show high nasals in the course of a rise to mid position. See Fig. 11 for James Adamo from Detroit.

[19]That is not to say that the broad <u>a</u> class is irrelevant to the raising of (æh). Ferguson (1968) has observed that front nasals and front voiceless fricatives are the main conditioning classes for the raising of Philadelphia (æh) and for the broad <u>ä</u> class. (It may also be noted that nasals and voiceless fricatives also tense short <u>o</u> words to become members of the long open <u>o</u> class, e.g. <u>lost</u>, <u>off</u>, <u>song</u>, <u>wrong</u>, etc.) The New York City inclusion of voiced stops in rule (4) actually obscures this fact, which becomes clearer as we move south to Philadelphia. There is no

Notes for Chapter 3 continued

doubt that the same general conditioning factors are at work, and our variable constraints should show this, as well as our ultimate phonetic explanations.

[20]Lehiste has found evidence through studies of timing that the post-consonantal liquids must be considered a part of the nucleus, and therefore exert a much stronger influence on formant position.

[21]See Appendix A. The sw- cluster seems to play a similar role (see Fig. 3-12).

[22]See below for the Northern city treatment of -f which is also variable, but favors low peripheral position more heavily. Since -f is one of the first elements to be tensed by the New York selectional rule (4), this indicates that there is no close match between constraints on raising and the ordering of tensing environments.

[23]Rule (10) applies after rule (8) has established peripherality and the variable constraints which promote it. We must see rule (10) applying to (8) since nasal words are affected by the other constraints we have noted: e.g., chance, answered, etc.

[24]This form of the rule does not account for the fact that /g/ has a stronger effect than /ʃ/. This may be due to an interaction between backness and continuance, or may require setting up a continuum of backness--reflecting the articulatory match between tongue position and vowel formation.

[25]This is one condition which makes it necessary to set up (11) as a separate rule. There is no way to state in a rule favoring peripherality that the rule is disfavored by a liquid and further disfavored by stop plus liquid.

[26]See 4.7 below for rule formulations which can account for continuous phonetic shifts.

Notes to Chapter 3 continued

[27]Eva Sivertsen's study of Cockney speakers (1960) shows no values of /æ/ higher than [ɛ], with no lengthening or fronting indicated in her phonetic transcription as in [stɛndz]. But some of our middle-aged Cockney speakers show no forms higher than this, and it is possible that none of her speakers had high vowels.

[28]The question will naturally arise as to why the data for the less common cases of (æh) could not have been supplied from the reading of word lists. The phenomena we are studying largely disappears in the reading of word lists (see Ch. 2 and section 3.4 below).

[29]The same tendency can be observed in New York City and in northern New Jersey, where there is a strong movement among weak nasal words to move into the tense class (Cohen 1970).

[30]This proportion is clearly a function of the number of cases. As we expand the number of items we will represent the same pattern by a difference in central tendencies.

[31]She is older, more travelled and works as a secretary; Carol Muehe is still in high school and has just recently transferred from the "soshes" to the "greasers." She also shows a clear working-class identification in her fighting style.

[31a]A parallel issue arises when we ask whether there is a universal implicational ordering in the items which enter the selectional rule such as (4). The answer from our current studies in the Philadelphia area again seem to be that there is an ordering which seems to match general articulatory configurations, but it is not general to all short a raising and not without dialect-specific oscillations.

[32]We must be careful not to lay too much stress on interpretations involving that, since it is a weak word and will be less peripheral and lower than lexical items like bat and cat.

Notes for Chapter 3 continued

[33]Note the effect of initial r in holding back rap (and possibly final -r in holding back matter).

[34]This coincides with a tendency noted in New York City: in the advanced stages of a change, the polysyllables can be more extreme than the monosyllables. Compare matter and transfer in Fig. 19 to stand, bath, etc.

[35]For a comparable phenomenon in New York City, see Fig. 7 for Rose Calissi.

[36]That is, even in the New York City rule, (10) should read <+velar> specifying velar place of articulation on a scale of six or seven points. See Ladefoged 1972.

[37]Our major evidence is drawn from an examination of Buffalo speakers; but see the Detroit figures in Chapter 3 as well.

[38]The problem cannot easily be resolved in our data; too much depends on the special position of one word, got, which is raised more than others.

[39]As we will see in Ch. 4, the short vowels /i/ and /e/ cannot be used for this purpose as they are moving downward.

[40]Thus the merger of pin and pen is usually accomplished by a raising of /e/ before /m/ and /n/. But this is true only before front vowels; it is often lowered to [æ] before /ŋ/ by the same speakers.

[41]This is one of a number of illustrations which check Ferguson's suggestion for a universal that all nasal vowels come from VN sequences (Ferguson 1963).

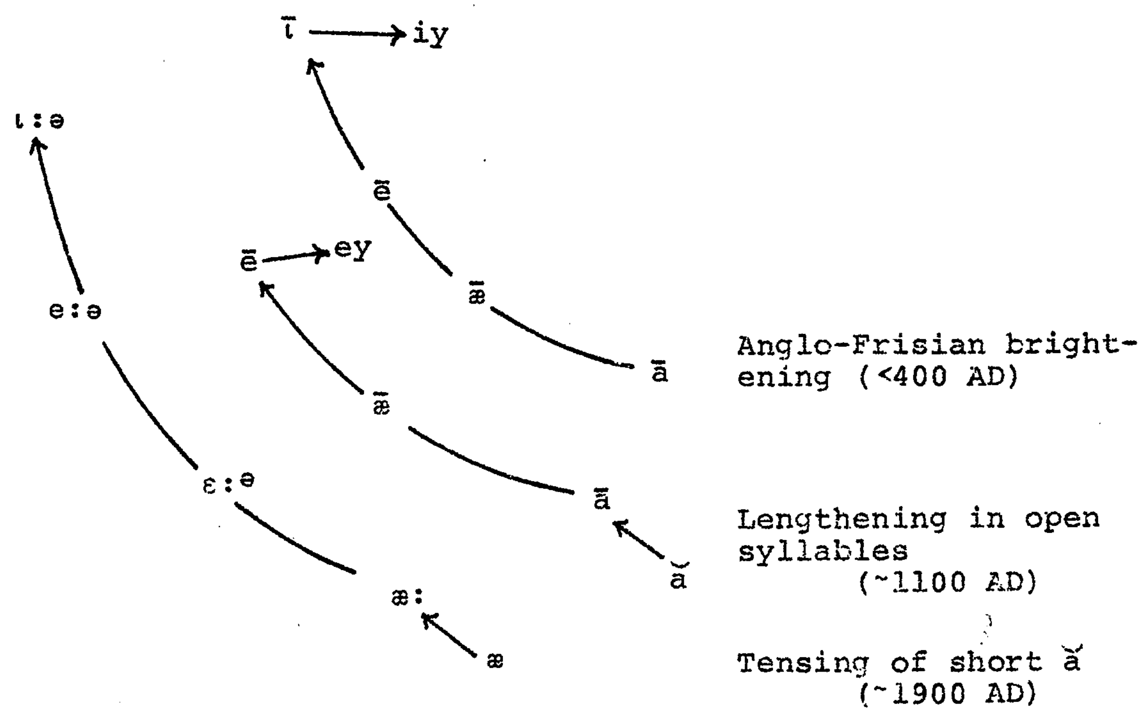
[42]This may not be true for the merger of /ihr/ and /ehr/ which produces permanent confusion in some speakers.

[43]This continued raising in the back is reminiscent of the path of Latin long ē in French which was

Notes for Chapter 3 continued

diphthongized to <u>oi</u> and then apparently rose to [ui] before a switch of nucleus gave [we] and [wɛ]. See Ch. 4.

44 There have been two recurrent raisings of long ā in the front since the Anglo-Frisian brightening: (1) after short a was lengthened in open syllables (in <u>name</u>, etc.) it rose to ē in the Great Vowel Shift; (2) after short a is tensed and lengthened in American English in <u>bad</u>, <u>ask</u>, etc. it is being raised to [e^{ə}] and [ɩ^{ə}]. The first process merged with the English continuation of Anglo-Frisian brightening in the subset of <u>great</u>, <u>bread</u>, etc. (see Appendix A) but in most cases followed behind it as the original long ā → ǣ → ē → ɩ̄. Thus



Notes for Chapter 4

[1]We find that each of these principles was foreshadowed in observations made by Sweet (1888: 19-21) about sound change in general. Although Sweet's principles are only approximations for general tendencies if we consider the movements of any isolated changes in place, they hold with much greater force for chain shifts.

[2]A position which excludes gradual sound change must necessarily reject push chains (King 1969). See Steiner for examples of push chains.

[3]From this point on we will refer to Principles I' and II' as I and II, but with the understanding that it is the peripheral realization of tenseness that we are dealing with.

[4]This discussion is focused on the complex vowel system of English. When we consider below the simpler systems of modern Romance languages, where there is no direct contrast between tense and lax, peripheral and non-peripheral, the general principles must be restated and their predictions re-examined.

[5]The first elements of Pattern 1' are the fronting of the nucleus of (aw) and backing of the /ay/ nucleus from the central position where they terminated their downward movement. This is the "backness adjustment" of Chomsky and Halle (1968:244), particularly clear in Philadelphia (Chomsky's dialect) where the nucleus of /aw/ is [æ]. We find older speakers in many areas who have back /aw/, but everywhere the movement of /aw/ is toward the front and in some areas it has risen to become a higher mid vowel (see below, p.108-109).

[6]An examination of the phonetic alphabet proposed by the spelling reformer Michael Barton shows that the unrounding of short /ɔ/ to merge with /ɑ/ was first being recognized in upper New York State dialects in the early 1800's, in contrast to the Boston dialect where short open /ɔ/ was and still is low back rounded (Labov ms.).

[7]For the co-variation of these opposing movements

Notes for Chapter 4 continued

and their development with apparent time on an impressionistic scale, see Labov 1966:516-7.

[8]This lax position of /ay/ is not part of a chain shift but may be the point to which M. E. ī descended. But see Ch. 6 for the rising of /ay/ in Essex on an inside track.

[9]This is the stereotyped (ay) which leads outsiders to call natives of the Outer Banks "hoi toiders."

[10]The extreme position of (ay) in Nora Herbert's chart is obvious, so that there is no clear indication of the change moving further in this area. But we do not yet have good data from young women in the area; those we did observe showed strong correction. This was evident when W. L. asked a group of high school girls to record a word list. When they came to the card with <u>high</u>, <u>buy</u> ... etc., there was a pause and then a very soft "uh-oh" can be heard on the tape. The list was then read with corrected, standard [aɩ]. A similar process may have operated on (aw) in the past.

[11]The centralization of (ay) and (aw) on Martha's Vineyard thus forms a striking reversal of a general drift in English (Labov 1963). The evidence of the 1933 Atlas showed that there was some [æo] in rural speakers which gave way to [əo] and [ʌo] for younger Vineyarders.

[12]Membership of original short <u>o</u> words varies regionally, and we cannot be sure when we enter a new dialect where words like <u>soft</u> will lie. But the spectrographic placement of the item usually speaks for itself. If there is a close approximation of /oh/ and /o/, it can become difficult, as in Fig. 19.

[13]This phenomenon was first noticed by Benji Wald in December 1970 in the speech of Carol Muehe (Fig. 23) as he was interviewing her in Evergreen Park, Chicago.

[14]See the (el) sound change in Norwich, where the front mid vowel before /l/ moves back until it coinincides with low back /ʌ/.

[15]Stylistic analysis cannot expect to resolve each individual utterance to decide if it was a "careful," "corrected" or "spontaneous" form. The sources of such

correction are probabilistic. They produce a given frequency of corrections, but no sytlistic rule makes predictions about individual utterances. We find that we can "explain" erratic forms in about half the cases by stylistic arguments, but these fail for the other half.

[16]This rounded glide need only be added for /ohr/ words, since the other long open o words already had rounded glides at an earlier stage in their derivation; this is also heard in many U. S. Southern dialects.

[17]David's /aw/ also shows multiple norms: more so than any other phoneme. As in the case of /ow/ and /uw/ it is possible that some of the scattering of targets is due to our ignorance of the Norwich word classes, but much of the variety is due to a combination of social correction and the traditional "dialect mixture."

[18]Throughout the South, /aw/ has reached low position as a result of the completed Great Vowel Shift and is already moving forward towards /æ/, so we will not consider this element further in the discussion of the Pattern 3 shift. Roberts also shows one fronted /uw/ before -l, which seems to reflect his borrowing of an advanced form from younger speakers. The regular effect of -l in backing vowel nuclei makes it unlikely that this would be Roberts' most advanced form from his own vernacular.

[19]From personal observation in city schools and conversation with teachers. The same observation was made to me by Alexander Hull of Duke University about undergraduates from North Carolina. Extreme language learning difficulties of this kind seem to have important implications for linguistic theory. It cannot be the case that Philadelphia and North Carolina speakers are not used to forming vowels in high back position, since /ohr/ holds that position. It would follow that we are dealing with abstract structural questions and not matters of physical muscular control. It may be that a conditioned allophone of this type does not give the general support needed in the rule system for an identification of French /u/ = English /oh/ before r.

[20]It would therefore be appropriate to speak of the variable (ey) rather than the phoneme /ey/, but since we will not be examining its social or linguistic conditioning we will continue to write /ey/ along with /iy/ and /ay/.

Notes for Chapter 4 continued

[21] Here as in many other cases, the short vowel /o/ can participate in the general raising without being involved directly in a chain shift.

[21a] "Non-peripheral" here indicates any movement away from the outer envelope of the vowel space. The back vowels move steadily forward in many current English dialects instead of following a "non-peripheral" track downward.

[22] Mike Graham's father comes from Central Texas, and we therefore do not use his system to illustrate a difference in generations. It is essentially the same as Jerry Thrasher's.

[23] The alternations which make it desirable to relate [au] to [ʌ] as tense-lax members are before -n, as in profound-profundity, announce-annunciation, etc. Since there is no [u] before nasals, we make such an adjustment without loss of the distinction between /u/ and /ʌ/. Given the existence of pairs such as could-cud, put-putt, and the unpredictability of u~ʌ in many cases, the simplest solution is to take these as underlying forms and allow the vowel shift to apply only to tense vowels.

[24] We might have designated the following element [4high] but the [+peri] notation emphasizes the dissimilatory nature of this rule. In fact, P6 is the first rule of nucleus-glide dissimilation.

[25] This second stage goes to completion for most English dialects, where the nucleus of /ay/ and /aw/ is the lowest vowel of the system, and has become tense by a later rule, or has actually moved beyond this point to become a front or back peripheral vowel. But there are many dialects where the rule has not gone to completion, as in Canada or Tidewater Virginia, where the nuclei of underlying ī and ū are still at [2high] before voiceless consonants, or in Glasgow, where the nucleus of out, about, etc. is still at [1high] or [2high], depending on the social dialect involved ([2high] is posh).

Notes for Chapter 4 continued

[26]Chomsky and Halle write [ə] as the output of the rule and avoid any detailed feature specification, leaving open the question of how the reduced vowel is actualized phonetically. Our [+central, 2high] notation allows a wide range of phonetic forms, and indicates the target of the inglides--the point at which rapid reduced forms are aimed. The influence of consonants is naturally stronger with [ə] than with tense steady-state vowels, and prevents it from reaching that target. A detailed vowel reduction rule would of course be variable, showing the target reached as a function of environment and tempo.

[27]From a purely descriptive standpoint. But from an epistemological point of view, rules P1-10 may be constructed on the model of later rules, since the variations the child or the analyst notes in current sound changes show the nature of the machinery which generated past ones.

[28]Boston and foster are exceptions to this rule. When interdental fricatives are intervocalic they are voiced, as in bother, etc., and the rule does not apply.

[29]In some other dialects, all /ɔ/ before /ŋ/ is affected by P12. But in New York City, the rule does not apply to /ŋk/ sequences as honk, conk, conquer, etc.

[30]In other dialects, a large part of this class remains as /or/, continuing the older distinctions between hoarse and horse, four and for, pork and storm as /or/ vs. /ɔr/. But in New York City the collapse is total, with no alternations, and it is impossible for native speakers to reconstruct this distinction. The same is true for Philadelphians, Londoners, and other Midland areas, as well as large portions of the North and South which are losing this distinction.

[31]For some indications as to why this is a problem, see Ch. 3. It is interesting to note that Kurath and McDavid 1961 showed the inglide of tense vowels as a small superscript schwa and the result of r- vocalization as a large schwa with an off-glide sign. Our studies of the possible merger of source and sauce (Ch. 6) have concentrated on the position of the nucleus: the nature of the offglide remains to be investigated empirically.

Notes for Chapter 4 continued

[32]The generalized form of (P25) would then affect [+peri] vowels to make them less than [2back]. In so doing, it would make /ow/ [-peri], but not /uw/. At that point, these two vowels are commonly defined as [2- back,+round], and continued fronting would be governed by those features.

[33]Stockwell has suggested that they were in fact upgliding diphthongs (1964).

[34]Jespersen takes the opposite view, that the merger of <u>aii</u> and <u>ale</u> was the result of diphthongization of <u>ale</u> (1949:326).

[35]Kökeritz (1953) takes the position that both (1) and (3) were followed by distinct dialects, but not (2).

[36]For this reason, the exceptional problem in the Outer Banks is of the greatest interest (4.).

[37]According to Herzog, both nucleus and glide may have been fronted, ou→øy, which involves interesting parallels with the fronting of French tonic free closed o. The mechanism of this movement may be the same as that we observe in our studies of Norwich and the Outer Banks above.

[38] The movement of /ü/ to /ɔ/ may also be seen as a counter-example to Principle III, which should be investigated further with reference to the original phonetic records.

[39]We are not taking the Swiss French dialects of the Valais as separate cases, but the great varieties of chain shifts involved here add greatly to our understanding of these principles.

[40]The chain shift which we observe in Norwich occurs in the presence of a diphthong /ɔw/ which is not generally found elsewhere in English dialects. Thus the Pattern 3 shift /ow/ → /uw/ → may be said to act in response to the four levels of height in the back, and has the effect of reducing these levels to three, and this fits in well with the proposition put forward by Haudricourt and Juilland.

Notes for Chapter 4 continued

41 The argument over the existence of "push chains" has recently taken on new life through the contention of some generative linguists that all chain shifts must be drag chains, depending on their insistence that sound change is discrete rule change (King 1969).

42 In the areas of the Valais where tonic free /o/ was fronted, we observe some evidence of a simultaneous partial fronting of the checked /o/, contrary to the situation of standard French where only the free vowel was fronted. Gauchat et al. show some intermediately fronted forms in the Center and West Valais for the checked /o/. This suggests that the tendency to front checked /o/ may have been present throughout the Valais, even in the East where no fronting was recorded: it must be remembered that the phoneticians reported only back, front and half-fronted positions.

43 In Setzen, however, it should be noted that ei does not fall all the way to the position of ai, but remains at an intermediate position [ɛi]. The shift to [oi] is quite general in other dialects near Setzen, and it is not entirely clear that it is connected to the lowering of ei.

44 The overall view of East Lettish chain shifting that is shown here is represented in all but one feature by the dialect of Aahof: the movement of /ay/ → /oy/. Setzen does have this part of the shift, but is not listed explicitly among the towns which have carried out some of the other changes. The East Lettish developments thus include the raising of tense vowels, development of ingliding high vowels, monophthongization, development of upgliding diphthongs and the falling of diphthongal nuclei.

45 We are deeply indebted to Robert Harms for providing us with his most recent view of this development [pers. comm.]. In his reconstruction, there is no original low ā; short ă has been lengthened and raised to ō at a stage previous to the one shown above.

Notes for Chapter Five

[1]That is not to say that some ingliding vowels may not have lax nuclei. But tensing rules operate to move [ɩə] to [ɩ< ə] or [iᵛə], so that most ingliding vowels develop tense nuclei.

[2]Bearing in mind that "short vowels" mean a set opposed to long vowels: the normal result of monophthongization is a long member, when such a contrast can be made. If there is only one series, it will appear in Fig. 5-1 in the $\breve{V}$ triangle.

[3]For example, in Dravidian languages, y-onglides appear and disappear before front vowels and w-glides before back vowels, but we do not see such free variation playing a role in sound change.

[4]We recognize Proto-Lappish as another instance of chain shifts downward of short vowels, but because only one short vowel movement in front and back was involved, and because it is a reconstruction of an unattested form, we do not take this as strong evidence for Principle II(a).

[5]In the case of Vegliote, however, the ingliding /iɛ/ is monophthongized to /i/, so we have a chain shift utilizing both paths (8) and (4), /jɛ/ /iɛ/ /i/ /e/ /a/.

[6]One might take Schürr's argument for the development of the Romance inglides from yVy structures (Ch. 3) as an argument for some kind of metathesis rule, but we have no evidence for any general process.

[7]It has been pointed out to us by Henry Kahane [pers. comm.] that chain shifts across sub-systems may also involve the disappearance of a vowel. The systematic elision of a vowel may then be seen as one way of preventing merger and consequent homonymy, and at the same time relieving structural pressure within a vowel system. We may then conceive of a "zero" sub-system and begin to explore the routes which connect it with other sub-systems. We must also recognize of course a system of reduced vowels in unstressed position; such reduction is normally produced by conditioned sound changes. We have been dealing only with unconditioned changes of stressed vowels, but the larger picture of shifts between sub-systems must certainly include a reduced sub-system as well as zero itself.

Notes for Chapter 6

[1]The merger was actually assumed rather than reported in Hubbell 1950:83; Wetmore 1959; Kurath & McDavid 1961.

[2]Our original impressionistic judgment was that raised (oh) in New York City was somewhat centralized and tense with pursuing rather than rounding of the lips. Hubbell (1950) and others described this sound as "retracted," the term normally used for British /oh/, which seemed to us quite in the wrong direction. Our first examination of spectrographic charts did seem to show this retraction, contradicting our impressionistic judgments, but we did not then distinguish (oh) from (ohr). When this distinction was made, the basis for the original impressions of the fronting of (oh) in lost, off, etc., became clear.

[3]This entire discussion raises again the problem of the classification of long open o in terms of the peripheral-non-peripheral category. In most English dialects it is more peripheral than /ɔ/, and in American dialects certainly more peripheral than /ʌ/; but it is not as peripheral as /ohr/. We can conclude that the dimension of peripherality is as complex in the back as it appears for front vowels, as reflected in rule P16.

[4]This report will deal with only one aspect of our studies of the large-scale merger. In future reports, we will deal with the social differentiation of hock and hawk in Phoenix, Arizona; the over-all national distribution of the feature as mapped through the speech of telephone operators; and the rapid expansion from the Northeast.

[5]Though Peters did take note of the formal influence of the interview situation in a number of ways. When asked if there ever would be a time when color wouldn't make any difference, he said, "I won't answer that...because I can't answer it right. But I'll say this...I know there are some good Negro people...I'd be a liar if I said there weren't."

[6]The Gibbs did not usually rate the word independently,

Notes for Chapter 6 continued

or even give two opinions in many cases. Their lack of disagreement is therefore not to be compared to the Easterns' disagreements, which were based on independent judgments. The Gibbs' individual agreement with Dan's intentions was therefore about the same proportion of the cases as the individual Eastern judges.

[7]The test involved a number of stops and starts because the judges took considerable time to decide and overlapped Dan's reading at a number of points.

[8]The fact that room appears in the /ow/ area for both Wicks and Tassy, and a third speaker, indicates that there has been lexical reassignment. There seems to be a general collapse of /uw/ and /ow/ after r-.

[9]It is striking that this set of /row/ should coincide with /ruw/. If the effect of initial r- was a predictable allophonic conditioning, we would expect /row/ to be back relatively to other /ow/ words. But /ruw/ and /row/ have the same nuclei and since both sets glide to the back, there seems to be a merger here.

[10]Trudgill comments that it would have been better to take too, since two shows some odd distributions in Norwich. But the force of the commutation test for our present purposes is unaffected: it would hold for any two pair of words that are in close approximation.

[11]Actually, Keith's performance was a little better than chance, because he had a second try at some cases, so his scores were three out of seven mistakes and two out of seven mistakes for toe and two respectively.

[12]Pronounced [hu·ʝ] in Norwich.

[13]Though Bryan must also have been familiar with the other system. One word jumped over to the nucleus position of /uw/, retaining its back glide; curiously enough, it was toe. The word room appears in /ow/ position, but as we have seen, this is now a member of the /ow/ class in Norwich.

[14]Steve was the only boy who we interviewed who attended the local academic grammar school; he was energetically directed towards a path of upward mobility. He

Notes for Chapter 6 continued

therefore have been influenced by school pronunciation more than the others.

[15]As we noted in Ch. 4, all of these speakers have another back upgliding phoneme, /ɔw/, in upper low or lower mid position, discretely separated from /ow/.

[16]Personal isoglosses between field workers can not have been responsible for these differences, since the divisions just mentioned do not correspond to the allocation of communities to field workers: 1 and 5 were done by Ellis, 7 and 15 by Barry, 11 and 12 by Wright, and the rest by Berntsen.

[17]We are indebted to Howard Berntsen for drawing our attention to this problem and making the tape recordings available to us.

[18]This difference between the Ravens may be entirely due to hearing problems. Mr. Raven is acknowledged to be hard of hearing, while his wife has no difficulty at all. Of course, hearing problems are not likely to be responsible for the general phenomenon we have been studying here, since most of the eight cases of inability to hear small differences have been with young adolescent subjects.

[19]This may be due to the labial on-glide of boy which is frequently noted.

[20]More exactly, linguistic variables may show social distribution without stylistic variation, particularly in the early stages of change. Such indicators do not rise to the same level of social awareness as with markers and stereotypes, and it is not easy to make native speakers aware of them.

[21]We are indebted to Leigh Lisker for his thoughtful comments on this issue.

Notes to Chapter 7

[1]The history of English shows some dramatic shifts of direction in this respect. OE ā moved to the back, so that stān, bāt → stǭn, bǭt [stɔ:n, bɔ:t]. Next the LOE lengthening in open syllables created a new ā which in EModE moved to the front, so that nāme, grāve → nę̄m, gręv [nɛ:m, grɛ:v]. The new lengthening and raising of short a discussed in Chapter 3 occurs after the short /a/ has moved to [æ]. The next step in the alternation is therefore the backing and raising of the long ā in father, car, etc., as in New York City and Philadelphia, so that once again ā → ō [ɔ:], or in the notation used in Chapter 3, (ah) → (oh). The case of Northern cities' short ŏ is a different type. Here the short open ŏ moves downward and forward to become tense [a:], and then moves upward as a tense vowel behind the old short ă, now [ɛ:ə]. The long open ō shifts forward, but not, in most cases, to the low peripheral position, but across the vowel system as a less peripheral vowel.

[2]We are indebted to Ilse Lehiste for calling to our attention the significance of these timing phenomena in explaining the greater effect of postconsonantal liquids as opposed to initial liquids. For experimental data see Lehiste 1972.

[3]Note that the tendency of vowels to rise before nasal consonants is contrary to the general, though not universal, tendency for free nasal vowels to fall.

[4]For the emergence of phonetic conditioning in the course of change, and its simplification towards the end of that change, see the analysis of the centralization of (ay) and (aw) on Martha's Vineyard (Labov 1963, 1965, 1972).

[5]The quantitative analysis of variation is now being advanced by the application of probability models to variable rules (Cedergren and Sankoff, to appear). At present, the program for estimating the contribution of each conditioning factor to the rule is written for binary choices--the probability of application or non-application of the rule. One direction of our current research program is the development of this model for rules which have continuous outputs, such as P17.

Notes for Chapter 7 continued

[6]One reason for the limitations on the volume of speech is that the interview forms were not entirely freed from the lexical model of traditional dialect geography. At the beginning of the interview, ten or fifteen minutes were spent in eliciting information on characteristic New York City words, which involved relatively long questions and short answers. Lexical questions of this type are rarely included in current interview schedules.

[7]The first report on this phenomenon was given at the Linguistic Society of America annual meeting in San Francisco (Labov and Wald 1969). In this presentation, the main focus was on the principles of vowel shifting, and the case of source and sauce in New York City was the only case of false reports of merger which was discussed.

[8]The first published report of the unreliability of intuitions was presented by Hill in 1961. Very few published, but many informal experiments conducted in classrooms and elsewhere have led to the general understanding that there was little agreement on intuitive responses to tests of grammaticality. Recent systematic experiments are reported in papers given at the Linguistic Society of America in 1972 by N. J. Spencer (1972) and Labov (to appear).

Notes to Appendix A

[1]This appendix corresponds to sections 1 and 2 of "The uses of the present to explain the past" delivered by W. Labov at the XIth International Congress of Linguists at Bologna in August, 1972. The present version has benefited from a number of critical and insightful comments of C.-J. Bailey.

[2]The Chomsky-Halle approach to the history of English appears to be the realization of Chomsky's approach to synchronic linguistics: that we are concerned only with the study of the ideal speaker-listener and that all social variation ("data-flux") is to be disregarded. Thus Hart, Cooper, Wallis, etc. are taken as exemplars of the language in this sense, and history is written as a series of successive models. The Saussurian Paradox can then be exploited in historical as well as in synchronic linguistics.

Notes for Appendix A continued

[3]Nay is itself irregular. It is derived from OF ei, and should have risen to long ē as well as yea. The fact that these vowels are both lowered indicates sociolinguistic processes affecting words of affirmation and disaffirmation, in which the vernacular favors more open forms. Compare the variant forms of yes as [jeə, jɛə, jɩə] and French oui as [wɛ, wæ].

[4]We must be particularly cautious about interpretations involving /r/, since it is possible that Early Middle English speakers used a tongue-tip /r/, flapped or trilled, especially in post-consonantal position, and this may have less influence on neighboring vowels. We are exploring this question with English speakers who use such an /r/; but as noted above, the Scots patterns seem to show essentially the same relative influence.

[5]The position of these lengthened short ě words poses an astonishing problem for historical linguistics, and it is remarkable that Jespersen accepted so easily the idea that their origin in short ě explained their continued separation. The lengthening in open syllables of běre, pěru, etc. took place at least three centuries before long ǣ rose to the ɛ̄ position. Therefore at the time of the lengthening, fear, beard, etc. were lower than bear, pear, etc. How did it then happen that the ǣr words moved from this lower position to a higher position than the lengthened short ě words without merging with them, giving us [fɩ:ər, bɩ:ərd] as against [bɛ:ər, pɛ:ər]? It is clear that the other ǣ words moved gradually up to the [ɛ:] position, and were then raised to [i]. This problem is parallel to several other examples from past changes, such as the fact that Germanic long ī fell to [ai] without merging with ei in Yiddish and several other dialects. Even more striking is the central puzzle of the Great Vowel Shift of English: that long ī fell to [ai] without merging with M. E. ai as it rose to [ei]. The solution is indicated in the view of phonological space provided by our current studies of sound change in progress, in which both front and back vowels are clearly divided into peripheral and non-peripheral

Notes for Appendix A continued

areas. The continued raising of long vowels takes place along the peripheral track, and vowels with less peripheral nuclei can remain quite distinct without being involved in this raising. It is reasonable to assume that lengthened short ĕ remained in a less peripheral position throughout Middle English, similar to the treatment of <u>where</u>, <u>bear</u>, etc. by some New York City speakers today. This view is supported by recent observations of Nunberg of the rhyme patterns in Chaucer; it appears that ĕr words are not rhymed with words from OE ǣr.

[6]This may be due to the labial on-glide of <u>boy</u> which is frequently noted.

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