9   Investigating Chain Shifts and Mergers

MATTHEW J. GORDON

For students of language change, the most challenging questions begin with *why*. Why did pattern A change to pattern B? Why did the change happen when it did? Why did the change occur in one variety and not in others? Trying to explain language change has occupied generations of diachronically minded linguists and remains the most important task facing the field today. One perspective on this issue focuses on the basic roles in communication and weighs the relative needs of speakers with those of hearers. Such an approach is reflected in Martinet's view that "Linguistic evolution may be regarded as governed by the permanent conflict between man's communicative needs and his tendency to reduce to a minimum his mental and physical activity" (1964: 167). This functionalist approach to language change is by no means shared by all, perhaps not even by most, linguists (see, e.g., Lass 1978). Nevertheless, it does provide essential groundwork for the subject matter of this chapter, MERGERS and CHAIN SHIFTS, and offers insight into why these two types of sound change are discussed together.

1   Chain Shifts and Mergers as Alternatives

Chain shifts and mergers can be seen as alternative outcomes of a change situation. Both involve the encroachment of one phoneme into the phonological space of another. If the second phoneme changes so that the distinction between the two is maintained, then the result is a chain shift. If, however, the second phoneme does not change, the distinction is lost, and a merger occurs. From a functionalist perspective, the former case illustrates the power of "communicative needs," and the latter the power of "articulatory and mental inertia" (Martinet 1964: 169).

Long the domain of historical linguists, chain shifts and mergers have more recently drawn increasing attention from variationist sociolinguists. Particularly

influential in this area (as in many others) has been the work of William Labov (see, e.g., Labov et al. 1972, Labov 1994). The variationist approach pioneered by Labov rejects the traditional belief that linguistic changes can only be observed after the fact. Indeed, decades of research into this paradigm have shown the value of studying language change in progress, and the benefits of this approach are perhaps nowhere more evident than in the re-examination of traditional concepts like chain shifts and mergers.

Some of the most intriguing questions posed by mergers and chain shifts relate to the underlying mechanisms and motivations that drive them, and such issues are the subject of ongoing debate in the field. The discussion here attempts to remain more or less neutral on these issues and focuses on empirical matters. I describe various approaches and suggest several methodologies for investigating such changes. I look first at mergers and explore some of the complications involved in the crucial notion of losing phonological contrasts. Then I turn to chain shifting and discuss how the fundamental elements of this process can be identified. Most of the variationist research on mergers and chain shifts has dealt with vocalic changes, and the discussion here reflects this bias in the examples and in some of the procedures described. Still, the core issues will also apply to the study of consonantal changes, and many of the techniques can be utilized with some modification. The ultimate goal here is to paint a picture of this fascinating area of study that will stimulate further research leading the field in new directions.

2   The Study of Mergers

Traditional approaches to sound change have treated merger as an essentially structural phenomenon. Comparing the phonological structure of a language at two points in time, it is observed that a distinction in the earlier structure is lost in the later structure; where there were two sounds, now there is one. Actually, the structural possibilities are much more varied. Several patterns of change involving merger are detailed by Hoenigswald (1960). For our purposes, it will suffice to distinguish cases of "unconditional merger," in which the phonemic contrast is lost in all phonological environments and a single phoneme remains, from cases of "conditioned merger" in which the merger appears only in more limited contexts. In the latter case, separate phonemes are retained in the inventory, but they are no longer contrastive in certain environments. Two changes active in American English today illustrate these types. The contrast between /ɑ/ and /ɔ/ is lost completely in the case of the unconditional "*cot/caught* merger" whereas in the case of the conditioned "*pin/pen* merger*," the distinction between /ɪ/ and /ɛ/ is maintained except preceding nasal consonants (see, e.g., Wolfram and Schilling-Estes 1998).

In discussions of historical phonology, mergers are often represented abstractly as they are in Hoenigswald's (1960) mathematical grid diagrams. This

approach makes clear the connections between different stages in a language's history, but it does not provide any insight into how the transition between the stages progressed, how the changes were actually achieved. This shortcoming is no doubt a consequence of the post hoc perspective on the changes. Evidence of intermediate stages is not always available when dealing with changes that took place centuries or even millennia earlier. Related to this problem is the mechanistic view of the change process that this focus on language system can produce. From this perspective, language change is governed by internal structural factors and the role of speakers is irrelevant.

In contrast to the approach in historical linguistics, variationist work on sound change has tended to focus on active changes in progress. For the study of mergers, this perspective has proven very illuminating. Opening access to the process of change while it is still ongoing has added a new dimension that complements well the traditional approach to mergers. Research on active mergers has aided our understanding of how such changes operate, from both the perspective of the linguistic system and the perspective of the speaker.

2.1   What does "merged" mean?

The central question at issue in the study of any putative merger is whether a distinction is lost. From a traditional structuralist perspective, the investigation of this question is a fairly straightforward matter. The answer lies in the phonological system of the language and can be determined by examining the distributions of the relevant sounds following the procedures taught in most introductory linguistics classes. When we consider language in its communicative context, however, we find the question is more complicated.

Ordinarily, language users are both speakers and hearers, and it is important to examine both roles in the study of mergers. Losing a distinction between two sounds involves losing the ability to produce it as well as to perceive it. In most cases we expect production and perception to go together. Thus, in a change situation involving merger, conservative speakers will consistently pronounce the sounds differently and will be able to judge which sound is which in the speech of other conservative speakers. Conversely, speakers who have the merger are expected not to show a consistent difference in their pronunciation and not to distinguish the sounds in others' speech. They may be able to learn to hear a distinction, but it is not one to which they normally attend.

Various techniques have been developed to investigate active mergers. Labov (1994: ch. 12) describes two tests designed to examine both the production and perception aspects of a merger. The first is a minimal pair test, which can be used to investigate directly speakers' intuitions about their own pronunciation. The procedure is fairly simple. The investigator compiles a list of potential minimal pairs involving the relevant sounds; that is, items that are minimal pairs for speakers who make a distinction. Pronunciations of the desired

words are elicited from the subjects using a written list, pictures, or some other method. The investigator records these pronunciations, preferably on tape, but possibly in written transcription. Then, after producing each pair of words, the subject is asked whether the words sound the same or different. In this way, the test measures each subject's production of the sounds as well as perception of any contrast and provides for an easy means of comparing these two aspects.

While minimal pair tests can be a convenient means of exploring the status of a merger, some caution is advised in using such tests. This technique is not appropriate for all speech communities nor all speakers. The elicitation part of the task draws maximal attention to the features under investigation and, therefore, produces the speakers' most careful pronunciations. This usage may differ significantly from the patterns of more casual speech. Since we are interested in native speakers' ability to produce and perceive a contrast, this result is appropriate; however, it will be important to compare this usage with speech in less guarded contexts. Evidence of style shifting along such lines can provide important information about the sociolinguistic status of a merger. For example, Labov (1994: 354–5) notes that many New York City speakers consistently distinguish *god* and *guard* in minimal pair tests even though the words are nearly identical in their casual speech due to the /r/-less pronunciation of the latter item. This pattern reflects the stigma associated with /r/-lessness in this speech community.[1] More extreme cases are found in areas like Belfast (Milroy 1992) where the vernacular coexists with the standard dialect, and speakers have access to both codes. In such communities, formal speech events, such as a minimal pair test, condition the use of standard pronunciations, and most speakers resist producing vernacular forms in such situations.

Similar caveats pertain to the perception part of the minimal pair test. This task relies on subjects' metalinguistic judgments. In making these judgments, subjects may rely on more than a simple auditory perception of their own speech. For example, the potential influence of spelling is an obvious concern when dealing with literate subjects. Homophonous forms that are spelled differently may be judged as sounding different because subjects believe orthography reflects pronunciation. To identify influence of this type, it can be helpful to ask subjects who judge words as sounding different for clarification. For example, researching the merger of the voiced and voiceless glides in English, /w/ and /ʍ/, I have found subjects who noted a difference in the pair *witch* and *which*. As they explained, however, the distinction was that *witch* "had more of a 't' in it." Although that study did not measure production, this is likely a case in which spelling led these subjects to believe they had distinctions where none existed. In any event, the follow-up explanation made clear that the subjects did not have the distinction under investigation.

A second test discussed by Labov (1994: 356–7) addresses some of these problems inherent in the minimal pair test. To insure that speakers rely only on the speech signal in making their perceptual judgments, a commutation test can be used. For this test, a speaker suspected of having a merger is

recorded pronouncing several randomized tokens of each word in a relevant minimal pair. The words can be presented in a written list or using picture cards if orthography is likely to influence production or the subject is illiterate. The recording is played back to the speaker, and he/she is asked to identify each word.[2] It is crucial, of course, that during the playback the subject not be able to rely on the original order in which the words were pronounced. The surest way to prevent this is to edit the recording to randomize the tokens again. In the field, it may suffice to begin the playback of the tape at a point unknown to the subject.

The results of a commutation test indicate the strength of a phonemic contrast based on its "primary function" – to convey meaning (Labov 1994: 356). If the words can be identified with 100 percent accuracy, the distinction is clearly maintained. Results closer to random chance (i.e. 50 percent) reveal a merger has occurred. Crucially, the information gained here about the perceived difference between the sounds comes from a simple listening task. As a result, the kind of metalinguistic judgments about whether there "should" be a distinction (based on spelling, sociolinguistic norms, etc.) that are a concern with minimal pair tests seem less likely to play a role here. Nevertheless, the task is still relatively artificial. As Labov (1994: 402) notes, many open questions remain about the connection between the ability to label categories in a commutation or minimal pair test and the process of interpreting actual utterances in context.

In addition to these two tests, a variety of other techniques have been developed for investigating active mergers. For example, Labov (1994: 403–6) discusses the ingenious "coach" test which involves subjects' listening to a narrative that contains a crucial minimal pair. Following the narrative, the subjects are questioned about what happened, and their responses indicate how they interpreted the crucial sequence. The test virtually eliminates the intervention of metalinguistic judgments by making the task a more natural one of semantic interpretation.

A rather different approach is seen in the self-categorization experiment Di Paolo (1988) employed in her study of the contrast between tense and lax vowel pairs (/i ~ ɪ/; /u ~ ʊ/; /e ~ ɛ/) in Utah English. In this test, subjects were asked to categorize words according to the vowel they contained. They did this by writing the words in the appropriate place in a table in which each cell contained sample words illustrating a particular vowel phoneme. This task is useful only in cases of conditioned merger. The merger Di Paolo was investigating only appears before /l/. For this reason, she chose sample words for the table that did not contain this environment and had subjects categorize words that did. An obvious deficiency of written tasks like this test is that they do not provide information about the phonetic quality of the sounds examined. They are best used in conjunction with other techniques as they were by Di Paolo (1988) and Di Paolo and Faber (1990). In fact, given the complexity of the issues involved, a variety of approaches should be explored in any case of suspected merger.

2.2   *When is a merger not a merger?*

As noted above, phonemic contrast involves perception as well as production, though the normal expectation is for these two aspects to pattern together. People who maintain the contrast will consistently produce and perceive it; those who have lost the contrast will do neither. A minimal pair test may find some subjects who identify words as distinct even though their actual pronunciation belies this claim (as can be demonstrated with a commutation test), but such cases can often be explained as evidence of the influence of orthography. Much more challenging to our usual understanding are cases of the opposite pattern: people who consistently distinguish sounds in their production, but do not perceive a contrast between these sounds. In a minimal pair test, such speakers would identify the two words as "the same" despite a regular difference in their pronunciation. The scenario strikes many linguists as impossible. How can someone consistently produce a difference they don't perceive as being there? The proposal has met with substantial resistance from various corners of the linguistics world, as Labov (1994: ch. 12) details. Nevertheless, the evidence for such cases, which are called "near" or "apparent" mergers, continues to accumulate.

  Consider, for example, the case first reported by Labov et al. (1972: 236–42) of Dan Jones. Jones was a teenager from Albuquerque, New Mexico, whom Labov and his colleagues interviewed for their investigation of the reported merger of /ul/ and /ʊl/, the same merger studied by Di Paolo and Faber (1990). In a minimal pair test, Jones labeled *fool* and *full* as well as *pool* and *pull* as the same. A commutation test using Jones' readings of *fool* and *full* and judged by two of his peers showed mixed results: 82.5 percent of the tokens were correctly identified, but the judges struggled with their decisions about which words they were hearing. Acoustic analysis of the tokens from the commutation test was performed to search for some aspect of the speech signal on which the judges might have relied. When analyzing vowels instrumentally, it is common to interpret the frequencies of the first and second formants (F1 and F2) as acoustic correlates of vowel height and backness respectively. The analysis in this case revealed a fairly clear separation of the vowels in acoustic space, specifically a slight difference (in the range of 50 Hz) in terms of F2 (see Labov 1994: 361). In his production, therefore, Jones maintained a distinction between words that he considered to have the same pronunciation. Acoustically the difference is very minor, but crucially it was consistent.

  A similar effect was found with a pair of teenagers, David and Keith, from Norwich, England (Labov et al. 1972: 242–6; Labov 1994: 364–6). For these boys, words like *too* and *toe* have vowels that are very close in acoustic space; i.e. in terms of F1 and F2. However, the vowels involve a consistent difference in terms of the direction of gliding (see Labov 1994: fig. 12.4). Despite this phonetic distinction, Keith was unable to identify reliably David's pronunciation

of *too* and *toe* in a commutation test. Like Dan Jones, then, Keith is an example of someone who produces a distinction that he seems not to hear.

The notion of a near merger is intriguing, but it is difficult to assess the significance of this situation on the basis of isolated cases. From Labov's early discussion of near mergers, the phenomenon seems to be almost an idiosyncrasy of a few speakers. Clearly, what is needed are broader community surveys to determine how common near mergers are and what their role in the change process is.

The series of experiments on the (near) merger of /ɛr/ and /ʌr/ (e.g. *ferry ~ furry*) in Philadelphia described by Labov (1994: ch. 14) have helped to address this need. Also important in this regard is the research on the tense/lax vowel distinction in Salt Lake City (Di Paolo 1988, Di Paolo and Faber 1990). As discussed briefly above, Utah (like other areas of the USA) is apparently undergoing a merger of certain tense/lax pairs (/i ~ ɪ/; /u ~ ʊ/; /e ~ ɛ/) in the phonological environment of following /l/. Thus, the *fool ~ full* pattern in Albuquerque is part of a larger trend. The Intermountain Language Survey investigated this trend by sampling the speech of dozens of speakers across three generations (Di Paolo 1988). Results from the self-categorization experiment described earlier suggested a merger was in progress, and impressionistic transcriptions of subjects' pronunciation generally agreed with this interpretation. Both indicators of merger (i.e. how subjects categorize the sounds and their actual production) were found to increase across the generations in the usual pattern of language change in progress (Di Paolo 1988). The phonetic details of this change situation were examined by Di Paolo and Faber (1990) who studied both the formant structure of the vowels (F1 and F2 frequencies) and their phonation patterns. The latter involves differences of voice quality like breathiness or creakiness. They found that, contrary to the suggestions of a merger, speakers maintain a distinction at the phonetic level. Interestingly, the nature of the distinction between tense and lax vowels varied. Many speakers demonstrated differences in formant frequencies like those found in the Albuquerque and Norwich cases, but the acoustic analysis revealed that even when the F1/F2 contrast is lost, speakers avoid complete merger through phonation differences. A perception experiment similar to a commutation test confirmed the persistence of the distinctions. Compared with earlier reports, the Utah studies (Di Paolo 1988, Di Paolo and Faber 1990) offer a broader perspective on the phenomenon of the near merger by considering a wide range of speakers across a large community. The phonetic analysis also makes clear the importance of looking beyond F1 and F2 when investigating reported mergers.

Demonstrating that a near merger can be more widespread in a community lends credence to this notion and expands its explanatory value. One of the most exciting applications of the near-merger concept has been with certain problematic cases in the history of English, such as "the *meat/mate* problem" in Early Modern English (Labov 1994, Milroy and Harris 1980). This case involves the apparent merger of the vowel class of *meat* (Middle English /ɛː/)

with that of *mate* (Middle English /aː/) during the Early Modern period. The difficulty stems from the fact that this merger, it appears, was later undone, and the *meat* class eventually merged with the class of *meet* (Middle English /eː/), a scenario that is deemed impossible by linguists who believe that mergers are irreversible. What, then, should be made of the evidence that suggested the first merger? As Labov (1994) explains, the concept of the near merger offers a solution to this problem if we view the original evidence as reflecting the perception of a merger that had not actually occurred in production. According to this proposal, the distinction between the *meat* and *mate* classes was never lost, and, thus, there is no need to propose a reversal of a merger.

Other approaches to this problem challenge the claim that mergers are irreversible. Scholars such as Wyld (1936) accept the existence of the merger of *meat* and *mate* and have explained the later unmerging as a product of dialect mixing. Explanations of this type often meet with criticism from traditional historical linguists, but variationist work in vernacular speech communities has lent support to this scenario. For example, in their approach to the *meat*/*mate* problem, Milroy and Harris (1980) examine the situation in Hiberno-English, a variety in which the merger was reportedly never undone. Nevertheless, the vernacular variety coexists with more standard varieties, and "speakers appear to have access to two systems here, one in which *meat* merges with *mate* and one in which *meat* merges with *meet*" (Milroy 1992: 157). The *meat* class, thus, maintains a kind of distinctiveness from the other two classes by virtue of its ability to alternate between [eː] and [iː]. In this way, the proposal of an "alternating class" provides a solution to the problem of unmerging suggested by the Early Modern English evidence. The earlier merger of *meat* and *mate* was not reversed, rather the system in which it existed was supplanted by a different one in which the vowels were distinct (Milroy 1992).

The contrasting solutions to the *meat*/*mate* problem outlined by Labov (1994) and Milroy (1992) help focus our attention on fundamental issues of interpretation. The near merger concept was developed to account for an unexpected result from a minimal pair test: subjects who produce a distinction they do not perceive. Much of the literature on near mergers has been concerned with establishing the existence of such cases and identifying the phonetic differences involved. An important consequence of this research for the study of mergers (both real and apparent) is an expanded understanding of perception, which now must be seen as including a subconscious dimension. Speakers appear to be able somehow to hear subtle phonetic differences well enough to reproduce them but without enough conscious attention to know that they are actually hearing them.[3] Substantial empirical questions about this scenario remain, but if we assume that it is possible, we must ask how it comes about. What leads speakers to contradict their perception by their production?

In addressing this question, it can be helpful to recall Milroy's (1992) description of the Hiberno-English situation. Those speakers have access to two

phonological systems, and presumably also have the ability to choose between them. If the analogy to the *meat/mate* problem in Early Modern English is correct, then historically such a choice was made, discarding the system in which *meat* was merged with *mate* for one in which *meat* was merged (or was free to merge later) with *meet*. Describing this process in terms of "choices" may seem to place too much faith in speakers' decision-making abilities, but the process of choosing need not involve any conscious determination. Essentially what is involved in this situation, as with all linguistic changes, are speakers effecting and responding to a shift in sociolinguistic norms.

Applying this idea to the case of a near merger, we might treat it as a situation in which speakers accept an incoming norm in stages. They first accept the idea that two sounds should be merged, and only later does their production catch up and actually reflect that belief. Labov offers some support for this idea in his description of the "Bill Peters effect" (1994: 363–4, Labov et al. 1972: 235–6), a phenomenon named for an older, rural man from central Pennsylvania who had a clear distinction between /ɔ/ and /ɑ/ in his spontaneous speech, but who reduced that distinction in the more formal context of a minimal pair test and identified pairs like *caught ~ cot* and *dawn ~ Don* as sounding the same. Such style shifting can be an important indicator of speakers' norms; suggesting in this case that Peters "had unconsciously adopted the incoming merged norm as a guide in the minimal pair test, but not for speech" (Labov 1994: 363). Considering that Peters was 80 years old when he was interviewed, his case also makes clear that with this two-step acceptance of new norms, the second step may never come; that is, a complete merger in production may never take place. In this way, near mergers need not be seen as transitional situations preceding complete mergers.

These suggestions regarding differential responses to changing norms reinforce a point made earlier about the need to utilize a variety of methods in the study of reported mergers. Minimal pair tests allow access to a subject's relatively conscious sense of the status of a contrast. The consciousness involved may lead to discrepancies. As was discussed in the previous section, factors like spelling may affect subjects' judgments, causing them to claim differences that they do not produce. Conversely, the influence of community norms may cause speakers to deny differences that they do produce. The information provided by such disagreements between perception and production is useful, but researchers must explore these situations with a range of investigative tools to begin to answer some of the many questions they pose.

The central lesson to be taken from this discussion is the need for investigators to be attentive to the complexity inherent in the perception of phonological contrasts. The process of perception involves more than a straightforward interpretation of the speech signal; it is subject to influence of various types. While we are just beginning to appreciate the challenges presented by phenomena like the near merger, their "discovery" nevertheless testifies to the power of variationist approaches to the topic of mergers. Research in this paradigm has expanded our understanding of the issues, even if it has sometimes generated as many questions as it has answered.

3   The Study of Chain Shifting

Variationist approaches have also been fruitfully applied to the study of chain shifting, a process that represents a kind of structural alternative to merger.[4] Like mergers, chain shifts affect two sounds from the same phonological neighborhood, but unlike mergers, chain shifts maintain the distinction between the sounds. It is common to distinguish two main types of chain shifts based on the ordering of the stages involved. Some chains begin as the movement of one sound brings it into the space occupied by another sound which in turn moves so that the distance between the two is maintained. This case is referred to as a "push" chain. The opposite ordering is found in a "drag" chain. In this case, the movement of one sound creates an opening which another sound moves to occupy. With either type, the chain may continue beyond these initial events to involve more sounds.

   The concept of chain shifting has generated substantial debate among historical linguists (see Hock 1991). At the center of the controversy is the teleology implied by the chain shift model, particularly the push chain scenario. For Martinet, chain shifts demonstrated the power of "communicative needs" because they were motivated by "the preservation of useful phonemic opposition" (1952: 126). Critics may question the importance of avoiding merger by pointing to the evidence which indicates that mergers are, in general, much more common than chain shifts. Also troubling for traditional historical linguists is the role that speakers are presumed to play in a functionalist account like Martinet's. Roger Lass, for example, rejects the suggestion that people "can make comparisons between the present state of their language and some as yet unrealized one, and opt for one or the other" (1978: 266). More recently, in his extensive treatment of the subject, Labov (1994) offers an intriguing compromise that seems to reconcile some of these differences. He accepts Martinet's basic notions of how chain shifts operate (see, e.g., his formulation of "The Chain-Shifting Principle" (1994: 184)) but rejects Martinet's teleological account of their motivations, describing instead how they result from a purely mechanical process inherent in auditory perception (1994: ch. 20). Labov (1994) also presents a typology of chain shifts and a series of general principles governing the process based on his analysis of several historical and ongoing shifts.[5]

   Questions about mechanisms and motivations are central to any treatment of chain shifting. Nevertheless, in the following discussion, these issues are examined rather indirectly by taking an empirical approach to the problem of chain shifting. In keeping with the focus of this chapter, the discussion here will address the seemingly basic question: How can an ongoing chain shift be identified and studied? Put more plainly, how do we know a chain shift when we see one up close? While similar methodological questions have been central to the study of merger, surprisingly this is an issue that has not been much discussed or even considered in the literature on chain shifts. To address these issues, the presentation below considers the two main definitional criteria related to chain shifting. First is the requirement that distinctions between sounds be preserved, and second is the fact that the sound changes involved

in the putative chain be interrelated. Several suggestions for examining these criteria are made, and the general points are illustrated with examples from research on the Northern Cities Shift, a pattern of change that has been much discussed in variationist work on chain shifting (e.g. Labov 1994).

3.1   What does it mean to preserve distinctions?

Fundamental to the definition of chain shifting is the end result that although the phonetic values associated with the affected phonemes are altered, no phonemic distinctions are lost. This observation has led to the interpretation that chain shifts are driven by an avoidance of merger (see, e.g., Martinet 1952). Still, one need not accept a functionalist view of the process to recognize the basic principle that chain shifts result, by whatever means, in the preservation of contrasts. With the understanding, therefore, that preserving contrasts is central to how chain shifts work, the discussion here examines ways of observing this aspect of the process in a series of ongoing changes.

   In a sense, determining whether contrasts are maintained is a straightforward matter, one that we have already covered in the discussion of mergers. The techniques developed to examine potential mergers in terms of production and perception can also be applied in the study of chain shift situations. If subjects demonstrate the ability to distinguish the sounds involved in a chain shift, then this criterion may be interpreted as fulfilled. However, simply establishing that distinctions are maintained is not enough; this observation must be tied to the changes taking place. Preservation of contrast is not an inadvertent consequence of a chain shift, but rather an integral part of the process. Whether we believe that chain shifting is driven by functional concerns or by more mechanical processes, we should expect to find evidence of contrasts being preserved in the operation of a putative chain shift.

   To clarify this point we may consider an example of series of changes that are commonly interpreted as participating in a chain shift. The changes are known as the Northern Cities Shift (NCS). This pattern of change is heard across a wide section of the northern USA and is particularly associated with the urban centers of the Great Lakes region (e.g., Chicago, Detroit, Buffalo). The NCS involves changes in six vowels and is commonly represented as in figure 9.1.
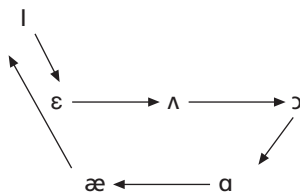

Figure 9.1   A view of the Northern Cities Shift
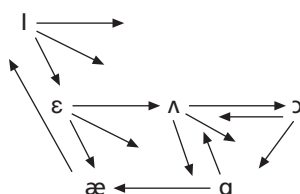
Source: based on Labov (1994: 191)

Figure 9.2 A different view of the Northern Cities Shift
Source: based on Gordon (2001)

When changes are represented as in figure 9.1, the process of contrast preservation seems obvious. The changes appear joined together in a loop where each vowel moves to maintain its distance from its neighbors. This picture, however, represents an extreme abstraction from phonetic reality. The actual variation associated with these vowels suggests a much more complicated picture, something more like the view in figure 9.2.

As this diagram reveals, almost all the vowels shift along multiple trajectories. Certainly some of the variants represented here are more common than others, but all have been documented with several speakers (Gordon 2001). When this fuller picture is considered, contrast preservation seems less a guiding force in the construction of the NCS. The alternative trajectories may still take the vowel out of the space of one of its neighbors, but they often bring it closer to another neighbor. Thus, the shift appears to work to preserve some distinctions while endangering others. Consider, for example, the low back corner of vowel space where the alternative paths taken by /ɔ/ and /ɑ/ (fronting and raising, respectively) appear to lead them directly into the path of /ʌ/ as it is backed or lowered.

Of course, even though figure 9.2 presents a more complete view of the variation found with the NCS, it too is an abstraction. A useful complement to such depictions can be sought in acoustic analysis. In the previous discussion of mergers, we saw the utility of acoustic analysis as a tool for investigating questions of contrast preservation. For the NCS case, the acoustic evidence tends to confirm the messiness of the picture in figure 9.2. In formant frequency plots (F1 × F2) such as those presented by Labov (1994), the ranges associated with the shifting vowels are seen not only to approach each other but in many cases to overlap.[6] To be sure, F1 and F2 measurements offer a very limited picture of the phonetic information available in the speech signal,[7] and for this reason, it would be premature to interpret this evidence as indicating that mergers are occurring or even that distinctions are necessarily being compromised. Nevertheless, if we accept the premise offered earlier that indications of contrasts being preserved should be evident in the operation of a chain shift, then these findings challenge the usual interpretation of the NCS. If maintaining contrasts were a principal concern influencing

the NCS changes, it seems unlikely that a pattern like that of figure 9.2 would result.

The NCS example raises important questions of interpretation that researchers will face with any putative chain shift. How can we determine whether contrast preservation plays a role in a given change? Should we expect all links in a chain to reflect the influence of contrast preservation? Is it appropriate to rely on the spatial perspective provided by auditory impressions and/or acoustic measurements of the shifting vowels in our search for evidence of contrast preservation? Such issues have not yet been raised in the literature on chain shifting, a fact that is, unfortunately, in keeping with the general absence of methodological considerations by scholars working in this area.

To further the present break with scholarly tradition, we might consider an example of an alternative approach to exploring the issue of contrast preservation, one that examines patterns of phonological conditioning. If we think about maintenance of contrast in terms of homophony avoidance, we can see the potential significance of context-sensitive effects. In a chain shift, the vowels often shift at differential rates according to phonological context; some environments seem to favor the change, and others disfavor it. The vocalic distinctions will best be preserved if the shifting elements respond similarly to their contexts. Returning to the Northern Cities Shift example, if the changes affecting both /ɔ/ and /ɑ/ are favored when the vowels appear before a /t/, then *caught* can be pronounced with an [ɑ] without being confused with *cot* since the vowel in *cot* has a quality closer to [æ]. Even if /ɑ/ words involving other contexts retain their [ɑ] pronunciation, the contrast between /ɔ/ and /ɑ/ is not threatened provided that the /ɔ/ items involving those same contexts maintain their [ɔ] value. In this way, phonemes can have overlapping allophonic distributions without necessarily losing the contrast between them, a fact that may help us understand the messy picture of the NCS described earlier. On the other hand, conflicting responses to phonological conditioning can endanger vocalic contrasts. In the NCS case, if the environment of following /t/ favors shifting of /ɔ/ but disfavors shifting of /ɑ/, then the potential for homophony between *caught* and *cot* is greater.

A test of this approach to contrast preservation using the NCS case produced mixed results. The details are discussed in Gordon (2001), but we can consider the findings for /æ/, /ɑ/ and /ɔ/ as a representative sampling of the overall picture. The conditioning patterns for /æ/ and /ɑ/ showed a relatively high degree of consistency. Both of these changes are favored by preceding voiceless obstruents (e.g. in *fad*, *pad*, and *fox*, *pod*), following interdentals (e.g. *math* and *father*), and following /l/ (e.g. *pal* and *college*), and both are disfavored by preceding /r/ (e.g. *rap* and *rob*) and following palatal consonants (e.g. *match* and *Josh*). However, the responses of these vowels differ in the context of preceding palatals, which disfavor shifting of /æ/ but favor shifting of /ɑ/. This discrepancy is important to the topic at hand since it suggests that the contrast is reduced in this environment as /ɑ/ shifts forward while /æ/ remains in place (e.g. *shock* comes to sound like *shack*). A similar potential

threat to vocalic contrast is found in the data for /ɑ/ and /ɔ/. The context of preceding /r/ favors the lowering and fronting of /ɔ/, a movement that brings it well into the range of /ɑ/, whose shifting is disfavored in this same context. The vowels also show different tendencies in the context of preceding nasals, but in this case the contrast is not threatened because the environment serves to promote /ɑ/ fronting while disfavoring /ɔ/ shifting (e.g. *knotty* shifts forward but *naughty* remains back and rounded). The other links in the NCS chain reveal a similar variety of results.

As the examples discussed here suggest, evidence related to the preservation of phonemic contrasts can lead to questions about the status of a putative chain shift. The notion that chain shifts operate to preserve phonemic distinctions is central to the definition of this process, yet this matter is rarely examined directly. The objective in this section (and in the one that follows) has been not only to raise the issues but to offer some suggestions for how researchers may approach them.

3.2   What does it mean for changes to be interrelated?

A second fundamental aspect of the definition of chain shifting holds that the changes involved be interrelated. This criterion stems from the assumption that a causal relationship obtains between individual changes in a chain shift. While scholars may disagree about the nature of the causal connection (e.g. whether it is functionally motivated), some sort of causation is essential to the chain shift model. The interrelatedness question is examined here from various directions. We will discuss ways of exploring connections among putatively related changes in the spatial dimension as well as in the usage patterns of individual speakers. We begin, however, by considering relatedness in the temporal dimension. As before, the general points are illustrated with examples related to the Northern Cities Shift.

3.2.1   Temporal connections

As an initial approach to the issue of interrelatedness, we consider how changes involved in a chain shift are connected in time. The causal relations that are presumed to hold between changes in a chain shift rely crucially on sequential ordering. Determining that Change A occurred prior to Change B is a necessary (but, of course, not sufficient) component of any claim that A caused B. The methods available for making such determinations in the case of a chain shift are largely the same used in attempts to date any linguistic change. For researchers engaged in the study of changes in progress, these methods include the examination of "real-time" evidence, such as earlier dialectological or orthoepic research, as well as the collection of "apparent-time" evidence in the form of data from speakers representing a broad age-range. Because thorough

descriptions of general methods for gathering and interpreting real- and apparent-time evidence in variationist research are available elsewhere (see, e.g., Guy Bailey's contribution to this volume), the present discussion is framed as more of a case study highlighting how such evidence might be brought to bear on the more specific question of temporal ordering in a chain shift situation. The case that is studied here is the NCS, and the presentation summarizes aspects of the discussion from Gordon (2001: ch. 6).

In his account of the NCS, Labov (1994: 195) proposes a chronology of the changes based on the following scenario and represented in figure 9.1. The first element to shift was /æ/, whose raising and fronting created a void that /ɑ/ then fronted to fill. The shifting of /ɑ/, in turn, led /ɔ/ to lower and front. The next element to be affected was /ɛ/ which was lowered, inspiring a drag chain that also pulled down /ɪ/. Later, /ɛ/ changed its course and came to be backed which produced a push chain with /ʌ/ also backing to avoid encroachment by /ɛ/. Thus, the order of the changes from first to last is: /æ/ > /ɑ/ > /ɔ/ > /ɛ/ > /ɪ/ > /ʌ/.

Labov notes that this chronology is based on "apparent-time data and the limited evidence from real-time differences" (1994: 195), and some support for his proposal can be seen by comparing the vowel systems of speakers surveyed by Labov et al. (1972). For example, the oldest speakers in that study show apparent fronting and raising of /æ/ while /ɑ/ and /ɔ/ appear to be more conservative. Still, the ordering of some other elements is not so clear from this evidence. Some middle-aged speakers with fairly conservative positioning of /ɑ/ and /ɔ/ show lowering and/or centralization of /ɛ/ and /ɪ/, while some younger speakers with innovative positioning of /ɑ/ and /ɔ/ show no movement of /ɛ/ and /ɪ/.[8] Much of the difficulty in verifying the proposed chronology stems from the limitations presented by the evidence offered. The vowel systems of the speakers are represented using raw formant frequency data (F1 × F2), which, as discussed below, allow only for impressionistic comparisons across the systems of different speakers.

A more quantifiable approach is possible using data from index scores. An index score is a measure of a speaker's usage of a given variable. With vocalic variables, they are constructed by assigning numbers to variants on a scale from conservative to innovative. The number of points on the scale will vary depending on the sound change being measured and the ability of the researcher to reliably distinguish variants (see, e.g., Labov 1966). For each speaker, several tokens of the variable are coded (0, 1, 2, etc.) as to which variant was produced and an average is calculated from these codes. This average is the index score and it, thus, provides a combined measure of how far and how frequently a vowel is shifted by a given speaker. Index scores from several speakers can be averaged to provide an overall measure of the degree of shifting of a given vowel, and these measures, in turn, can be used as a kind of apparent-time evidence. Higher mean scores demonstrate greater shifting of the vowel and, thus, indicate an older, more established change, while lower scores suggest the reverse. Some caution is advised, however, in comparing the values for different

Table 9.1 Mean index scores for the NCS vowels (*n* = 32)

Variable	/ɔ/	/æ/	/ɑ/	/ɛ/	/ɪ/	/ʌ/
Mean index	.815	.521	.469	.181	.075	.055

variables in this way. Even when the same basic coding scheme is applied for all the variables investigated and the codes attempt to mark equal distances in vowel space, it is not a given that the codes represent equivalent measures for each vowel in terms of perceptibility, the consequences for the system, etc.

With this caveat in mind, the ordering of the NCS elements can be examined through the data in table 9.1. Listed here are the mean index scores for the six NCS variables from a study of 32 speakers (Gordon 2001).

These scores suggest a chronology of the NCS changes very much in line with Labov's proposal. Certainly, the data for the upper half of the shift (/ɛ/, /ɪ/, and /ʌ/) are consistent with the suggestion that movement of /ɛ/ spurred movement of /ɪ/ then of /ʌ/. For the lower half of the NCS, the only inconsistency with Labov's chronology relates to /ɔ/ which was found to have the highest mean score. It should be noted, however, that the comparability problem mentioned above may be of particular concern in the case of /ɔ/ given that the change affecting this vowel and the coding system used to measure it involve not only tongue movement (fronting and lowering) but also reduced lip-rounding. For this reason, we might question the deduction that the high mean index score for /ɔ/ is an accurate reflection of its time depth.

On the other hand, examination of the real-time evidence related to the NCS changes tends to complicate matters. For example, DeCamp (1940) describes lowered and unrounded pronunciations of /ɔ/ as well as fronted pronunciations of /ɑ/ in his study of Scranton, PA. A similar tendency for /ɔ/ to be lowered and have reduced rounding was documented by Marckwardt (1941, 1942) for a broad section of the Northern dialect region. To my knowledge, the earliest report describing /æ/-raising like that heard in the NCS comes from Thomas' (1935–7) study of upstate New York. Thomas, however, sampled the usage of college students, most of whom were presumably born around 1915, whereas Marckwardt studied much older speakers who were born around or before 1870. Thus, the limited real-time evidence tends to agree with the index data suggesting /ɔ/ is the earliest piece in the NCS puzzle. Of course, under this scenario, we must reexamine the ordering of /æ/ and /ɑ/ indicated by the index data if we want to claim that the NCS is indeed a chain shift. Still, given that the difference between /æ/ and /ɑ/ in terms of their mean index scores is fairly slight, it is not unreasonable to suggest that the shifting affected /ɑ/ before /æ/. As will be discussed below, the data from many of the individual speakers support this possibility in that they show relatively high levels of shifting of /ɑ/ with less enthusiastic shifting of /æ/. The real-time

evidence of DeCamp (1940) also supports the ordering of /ɑ/ before /æ/ as do other reports of /ɑ/-fronting in the Northern region including Thomas (1958) and Kurath and McDavid (1961).

While the discussion here has raised questions about the chronology of the NCS, there are, I hope, more general lessons to be learned. The case of the NCS is offered as an example of some of the challenges facing the researcher investigating the temporal ordering of elements in a chain shift. It illustrates the necessity and the value of considering a range of evidence and of remaining open to alternative interpretations.

3.2.2   *Spatial connections*

Clarifying the temporal relationships among changes is essential to establishing a chronology for a putative chain shift. Nevertheless, even the strongest chrono-logical evidence cannot by itself prove a causal connection between changes. Other types of evidence must be sought. This section outlines some of the ques-tions involved in the investigation of spatial connections among sound changes.

To approach this issue, it is useful to consider space in geographical as well as linguistic terms. The geographical requirement seems fairly obvious; for changes to constitute a chain shift, they must be found in the same dialect. The reasoning is clear when we are dealing with regional dialects, but the require-ment should also apply in the case of social dialects. It is possible for a change in one variety to contribute somehow to a change in another variety, but these changes would not qualify as a chain shift as it is usually understood. By this same reasoning, if changes are indeed related through chain shifting, we should expect them to co-occur in the same varieties. If Change A is causally linked to Change B, then every variety that has one of the changes should also have the other.

Another approach to the issue of spatial connectedness focuses on the lin-guistic system. The changes in a chain shift involve related sounds. Relatedness in this sense might be examined phonologically or phonetically. Sounds might be counted as phonologically related if they belong to the same subclass. For example, in the case of the NCS, most of the vowels are related as members of the category of short (or lax) vowels. This class is distinguished from that of long (or tense) vowels by phonetic characteristics (e.g. the absence of accom-panying upglides) as well as by distributional characteristics (e.g. they never appear word finally). Such classificatory distinctions are clearly relevant to the question of contrast preservation. The threat to vocalic contrast is greater when a vowel encroaches on another vowel of the same subclass than when it en-croaches on a vowel of a different class since it has more in common (phonet-ically and distributionally) with the former.

Vowel space, defined in articulatory and acoustic terms, offers another arena in which relatedness between sounds can be examined. Changes involved in a chain shift affect vowels that are contiguous in this two-dimensional space, and the connection between the changes should be clearly represented by one vowel entering the space previously occupied by another. Whether any

reasonably complete representation of the variation found with an ongoing shift would ever actually show these relationships among the shifting elements remains to be seen. As discussed above, this certainly has not been the case with the NCS evidence. If we re-examine figure 9.2, we see the causal links are often far from obvious. Consider, for example, the shifting of /ɪ/. According to the usual chronology of the NCS changes (as will be discussed below), the change to /ɪ/ is a drag-chain response to earlier lowering of /ɛ/. While this might account for /ɪ/'s lowering tendency, it is hard to relate it to the backing also seen with this vowel. Similarly, the backing of /ʌ/ makes some sense as a push-chain reaction to the backing of /ɛ/, but the other trajectories taken by /ʌ/ are harder to connect with changes to /ɛ/ or any other vowel.[9] In short, describing changes in terms of their relations within vowel space can be a useful approach to the question of spatial connectedness, but the resulting picture is often more complicated than expected, and investigators must keep in mind that the usual two-dimensional view offers a rather limited perspective on phonetic reality.

3.2.3   Connections within the speech of individuals

If we accept that changes linked in a chain shift must co-occur in space, a logical extension of that premise is that they also must co-occur in the vowel systems of individual speakers. While speaker-based approaches may draw criticism within traditional historical linguistics (e.g. Lass 1978), standard accounts of the functioning of chain shifts suggest that individuals do have a role to play. Such a role is evident in Martinet's conception of the process as motivated by "the basic necessity of securing mutual understanding" (1952: 126). Even the antifunctionalist account proposed by Labov (1994) seems to rely on the interactions of individual speaker/hearers. For this reason, therefore, when we look for causal connections among elements in a chain shift, we should also consider the speech patterns of individuals.

   As a way of investigating such connections, we can compare the effects that various changes have on the speech of individuals. If two changes are related, then we expect their effects on a given speaker's system to be similar. We also expect the relative usage of such changes to be mostly consistent across speakers; we do not expect to find one speaker using a lot of Change A and very little of Change B, while another speaker uses a lot of Change B and very little of Change A.

   The kind of acoustic data (F1 × F2) that are commonly used to represent relations among vowels offer one way of approaching these questions. Such representations usually describe the vowel systems of individual speakers because of the difficulties in normalizing the data in order to compare individuals in a single plot. Connections among shifting vowels can be examined by comparing the relative influence of the changes on the systems of several speakers plotted individually. In an early example of this approach, Labov et al. (1972: 118) traced the relations among /ɔ/, /ɑ/, and /æ/ in the NCS by comparing
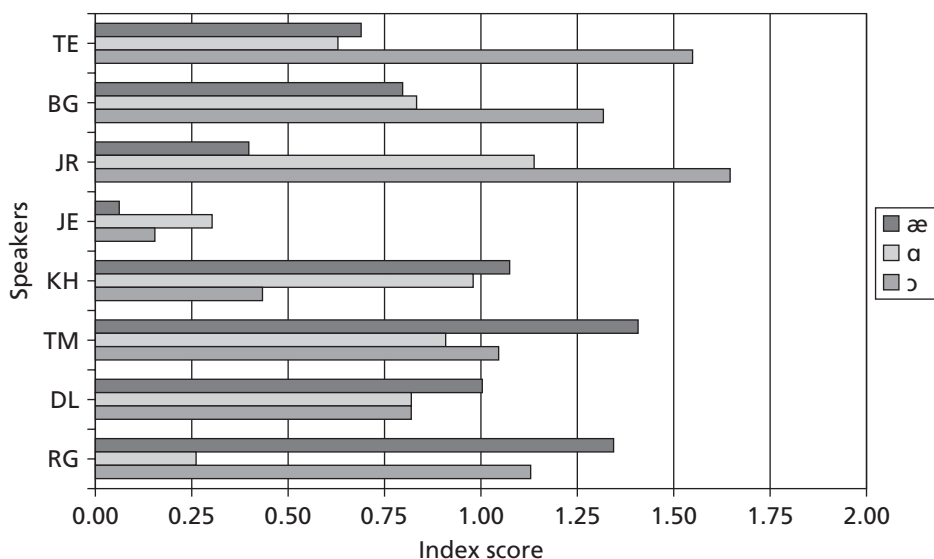
Figure 9.3   Index scores from adult females showing shifting of NCS vowels
Source: Gordon (2001)

formant frequency plots from three generations of speakers from Buffalo, NY. When the acoustic picture is fairly clear, this approach can be quite useful. However, when the pictures are more ambiguous, this technique has its limitations. Comparing vowel systems in this way is necessarily impressionistic. A researcher can see the relative positions of vowels in a speaker's system and compare those positions with the situation in another speaker's system, but the characterization of any differences or similarities between the systems can only be done in terms of "more" or "less," because the frequency measurements from one speaker cannot be directly compared to another.[10]

Direct comparisons among speakers can be much easier when the data from index scores are used. The index scores from different speakers can readily be compared because they come from auditorially coded data, for which the ear does the normalization. Still, as noted earlier, comparison across variables is in some ways more questionable. We should recall this caveat, therefore, as we consider the following illustration of how index data may represent connections among elements in a chain shift.

In Gordon (2001), I compare index scores for all six of the NCS vowels from a survey of 32 Michigan speakers. A sampling of those data is presented in figures 9.3 and 9.4, which graph the scores for the vowels /æ/, /ɑ/, and /ɔ/ from female speakers representing two generations. According to the chronology of the NCS proposed by Labov (1994: 195), the first element to change was /æ/, whose fronting and raising created a drag chain leading to the fronting of /ɑ/ which in turn led to the lowering and fronting of /ɔ/. If this scenario is
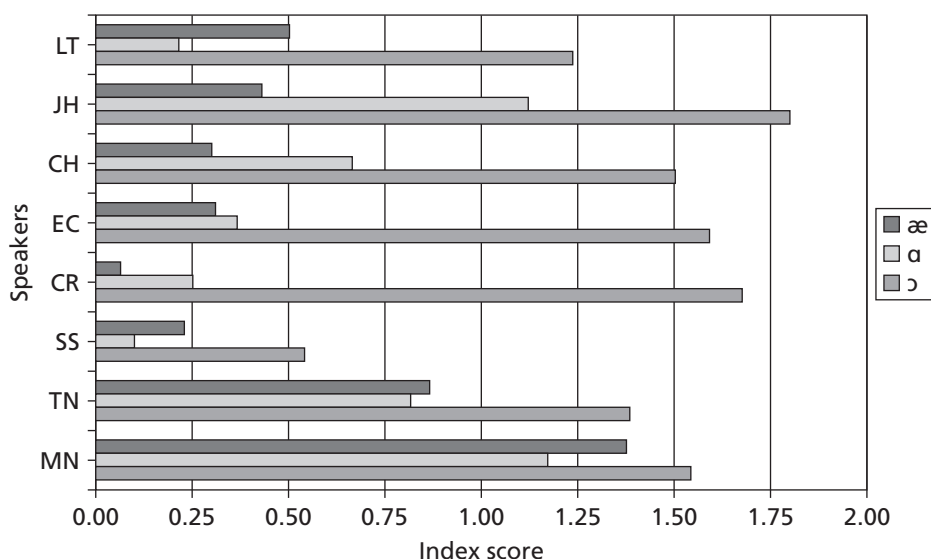
Figure 9.4 Index scores from adolescent females showing shifting of NCS vowels
Source: Gordon (2001)

correct, we might expect speakers to show the highest rates of shifting for the /æ/ variable, somewhat less shifting for /ɑ/, and even less for /ɔ/. In areas where the NCS has run its course and is more fully implemented, we might find speakers showing very high usage of all three of these elements. We should not, however, find speakers with high rates of shifting for /ɑ/ but not for /æ/ or for /ɔ/ but not for /ɑ/.

The evidence presented in these graphs offers mixed results for the usual interpretation of the NCS changes. The fact that at least some usage of each variable was found with each of these speakers confirms the regular co-occurrence of the changes. Moreover, we see hints of a correlation among the changes in speakers with consistently high or consistently low scores for all the variables. Consider, for example, TM (figure 9.3) and MN (figure 9.4) who actively shift all three vowels and JE (figure 9.3) and SS (figure 9.4) who do not shift any of the vowels very commonly; these cases suggest the changes come as a kind of package deal. With regard to the temporal ordering of the changes, support for all three stages in Labov's chronology is seen in some speakers' patterns (viz. KH and DL (figure 9.3)). If we examine just the relationship between /æ/ and /ɑ/, many more speakers seem to conform to expectations (viz. TE, TM, and RG (figure 9.3); LT, SS, TN, and MN (figure 9.4)). There are, however, several speakers who shift /ɑ/ at a higher rate than /æ/, a pattern that contradicts Labov's proposal (see, e.g., JR (figure 9.3) and JH and CH (figure 9.4)). Furthermore, the evidence regarding the relationship between

/ɑ/ and /ɔ/ rarely patterns as expected. Some of the highest scores for /ɔ/ shifting are found with speakers who show some of the lowest scores for /ɑ/ shifting (e.g. TE and RG (figure 9.3); LT and CR (figure 9.4)). Even more bizarre for the drag-chain scenario is the fact that RG and LT also shift /æ/ at relatively high rates. For these speakers, therefore, the front /æ/ and the back /ɔ/ are shifting, but somehow /ɑ/, which lies between them, is left largely unaffected.

Once again, an examination of evidence from the NCS has shown some of the difficulties in establishing the relatedness of changes reported to be a chain shift. As before, we must ask ourselves whether these difficulties indicate problems with the NCS case in particular or whether we are expecting too much of the methods. Ultimately, this question can only be answered through further research on other putative chain shifts. The approaches described here offer suggestions for how such research might proceed.

4   Conclusion

Chain shifts and mergers illustrate the advantages as well as the difficulties of studying language change in progress. Having access to communities in which these sound changes are active allows investigators a wealth of evidence that is simply not available in the case of historical changes. This evidence not only illuminates the facts of a given situation but may also suggest new possibilities for understanding the processes in general (e.g. "near mergers," a scenario previously unimagined). As some of the above examples have indicated, however, evidence from in-depth studies of ongoing changes does not always point clearly in a single direction, and researchers must be prepared to wade carefully through the often muddy waters of linguistic variability. Still, as scientists, we welcome the new data and the new methods for mining it.

Generations of historical linguists and more recently sociolinguists have been fascinated by mergers and chain shifts. These changes raise fundamental issues about the forces shaping language structure. Understanding more about the processes that underlie mergers and chain shifts can offer important insight for the study of language change in general. Variationist research of the type described here has opened new avenues of investigation, but clearly much work remains to be done.

NOTES

1   Labov (1994: 343–5) observes that mergers seem not to draw the social awareness found with many other types of sound change. As he admits, however, research directly addressing this issue has been

lacking. If future research shows this to be indeed the case, it raises interesting questions of why mergers should escape social evaluation.

2   It is also possible to use different subjects as judges as was done by Labov et al. (1972) and by Di Paolo and Faber (1990). Labov cautions, however, that "if there is variation within the community, the experimenter does not know whether the rate of success is due to the ability of one speaker to produce the distinction or the ability of the other speaker to discriminate the tokens produced" (1994: 356).

3   Certainly, allophonic differences operate in this way, but in these cases the differences are typically conditioned by distinct phonetic environments.

4   Many of the ideas and examples presented here are discussed more fully in Gordon (2001).

5   For a discussion and critique of some of Labov's proposals see Gordon (2001) and Stockwell and Minkova (1997).

6   See, e.g., Labov's figure 6.13 (1994: 187) which presents acoustic data from an adolescent Chicagoan. For this speaker, the range of /ɛ/ is almost completely included within the range of /ɑ/ and both these vowels overlap with /æ/ and /ɪ/.

7   For a critique of the common (over)reliance on formant frequency data by sociolinguists see Watt (1998).

8   See the data for Dulsey Hankey, aged 64 (Labov et al. 1972: figure 14) and Joyce Norton, aged 16 (Labov et al. 1972: figure 20).

9   Actually, in Gordon (2001), I suggest that the alternative trajectories associated with /ʌ/, /ɛ/, and /ɪ/ are connected through a kind of parallelism.

10   Frequency data from multiple speakers can be compared if they are subjected to normalization. Various formulae have been developed for this purpose and there is no general agreement among phoneticians as to which routine is most accurate.

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