



CHICAGO JOURNALS



---

Sex, Sound Symbolism, and Sociolinguistics

Author(s): Matthew Gordon and Jeffrey Heath

Reviewed work(s):

Source: *Current Anthropology*, Vol. 39, No. 4 (August/October 1998), pp. 421-449

Published by: [The University of Chicago Press](#) on behalf of [Wenner-Gren Foundation for Anthropological Research](#)

Stable URL: <http://www.jstor.org/stable/10.1086/204758>

Accessed: 09/08/2012 04:01

---

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at  
<http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



The University of Chicago Press and Wenner-Gren Foundation for Anthropological Research are collaborating with JSTOR to digitize, preserve and extend access to *Current Anthropology*.

<http://www.jstor.org>

# Sex, Sound Symbolism, and Sociolinguistics<sup>1</sup>

by Matthew Gordon  
and Jeffrey Heath

Two important general conclusions of sociolinguistics are that females tend to lead in linguistic changes and that vowel systems tend to rotate in fixed directions. We argue that these two results are linked in that females and males are attracted asymmetrically to different subjective poles of the vowel system, one being high front unrounded [i] and the other being somewhere in the back rounded area near [o ɔ]. We therefore adapt Ohala's "frequency code" theory to the sociolinguistic study of phonetic variation. We argue that such a model is superior to one in which individual speakers are attracted to particular phonetic targets only by virtue of a logically prior attraction to a class or similar social category which happens to use the pronunciation in question. Our study is in line with more general efforts to construct causal models for correlations between variable aesthetic preferences and "hard" (nonsubjective) social categories such as sex. It is, however, an open question whether sex-asymmetric preferences are wired-in or by-products of more general developmental phenomena sensitive to gender socialization patterns.

MATTHEW GORDON is Assistant Professor in the Department of English and Philosophy, Purdue University Calumet (gordonm@calumet.purdue.edu). Born in 1967, he was educated at Georgetown University (B.S., 1989) and the University of Michigan (Ph.D., 1997). His research interests are language change, American English, sociolinguistics, and dialectology.

JEFFREY HEATH is Professor of Linguistics at the University of Michigan (Ann Arbor, Mich. 48109-1285, U.S.A. [jheath@umich.edu]). He was born in 1949 and received his Ph.D. from the University of Chicago in 1976. He has done fieldwork and published on Australian Aboriginal languages and on Maghrebi Arabic; an article entitled "Hermit Crabs: Formal Renewal of Morphology by Phonologically Mediated Affix Substitution" is forthcoming in *Language*.

The present paper was submitted 11 XII 97 and accepted 22 XII 97; the final version reached the Editor's office 16 I 98.

1. Some of this material was presented by Gordon at a Symposium about Language and Society—Austin in 1995. We thank Pam Beddor for helpful discussions of phonetic issues and three CA referees for detailed commentaries.

For some 30 years the most prominent movement in sociolinguistics has been the study of linguistic variation within speech communities spearheaded by William Labov (1972c[1963], 1966, 1994). While this line of research entails a certain approach to the synchronic analysis of languages, it is most directly concerned with processes of change (and, conversely, stability). The central method involves minutely studying the distribution of a few carefully selected linguistic variables across a social spectrum within a community and (for individual subjects) across a stylistic spectrum elicited by means of judiciously designed multipart interview schedules. The method has been applied not only in North America but also in Britain (Trudgill 1974a, L. Milroy 1987 [1980]), the Arabic-speaking world, Asia, and elsewhere.

Variationists have intentionally avoided linguistic phenomena of an intuitively "social" nature such as personal pronouns and lexically defined speech registers—among the central concerns of linguistic anthropologists.<sup>2</sup> Nor, in general, have they attempted quantitative studies of the complex grammatical structures (e.g., complete verbal paradigms) that have been the bread-and-butter of traditional synchronic and historical linguistics. Instead, they have concentrated squarely on the study of phonetic variation and, more particularly, on variation in the articulation (and hence acoustic structure) of vowels. This restriction is driven by methodological considerations. A strongly quantitative line of research thrives on data which can be reliably elicited in brief interview situations and then measured or otherwise coded before being correlated with other types of variables.

To be sure, there are a number of technical difficulties in studying phonetic variation. The subjects, self-conscious about how they sound, may skew their speech in the interview context. Phonetic phenomena are internally complex because of local segmental interactions (vowels affected by flanking consonants or by the vowel of an adjacent syllable), the effect of variable stress on segments, and so forth. Spectrograms show several continuous, shifting formants (concentrations of energy at particular frequencies) for each vowel, and the sociolinguist must make decisions about which formants to examine and at which instant to measure them. Labov and other variationists have developed ingenious methods for overcoming these obstacles. Interview techniques have been designed to elicit well-chosen variables in multiple styles, and computational programs have been devised to quantify and then factor out the interfering linguistic contextual effects.

2. Labov has done elegant and important work on the structure of personal narratives, the dynamics of African-American ritual insults, and psychotherapeutic discourse (Labov 1972a, Labov and Fanshel 1977), but there is a kind of firewall between the variationist and the discourse-oriented research. While phonetic data are sometimes used in the discourse analysis, primarily to indicate rhetorically significant style shifting, there is no reference to the discourse analysis in Labov (1994), which contains 605 pp. of text and 20 pp. of references.

In this fashion, the phonetic variation data are stripped of purely linguistic complexities. For each speaker/style coordinate, the system-internal contextual factors are teased away, leaving a distilled residue in the form of one or more numbers (e.g., the frequency of the second vocalic formant, as adjusted). If two subjects in the sample differ at this point, holding their styles constant, the explanation can no longer be linguistic (system-internal) and so by default must be social in some sense.

The distilled numerical values that emerge from the phonetic analysis are then correlated with social data, which are preferably "hard" and easily codable, for example, sex, age, location, ethnic or racial group, and socioeconomic class. More subjective or transient phenomena (personality types, attitudes) are only occasionally considered. Statistical correlations then allow the analyst to follow the trajectory through social space of sound changes in progress, identifying the social categories or networks that are in the vanguard and those that are lagging behind or actively resisting. While the input and much of the analytical sophistication are linguistic, the product is a kind of sociological epidemiology of change. In the final analysis, it is almost irrelevant that the input data were phonetic as opposed to other linguistic or even nonlinguistic phenomena (voting patterns, musical preferences, favorite colors).

When the analysis has been completed, the work of interpretation goes in the opposite direction, from social to linguistic. Phonetic change—and, by implication, all linguistic (and cultural?) change—is seen as propagated by social factors.

Two dominant findings have emerged from many years of intense study, primarily of American and British English. First, it turns out that vowel systems undergo recurrent, unidirectional rotations. Second, women regularly lead linguistic changes, while men lag behind. Since there is no obvious linguistic reason for such sex asymmetries, scholars have tended to explain them by making general claims about the privileged role of women in social-symbolic change. Because of the rigorous analytical separation of "linguistic" and (hard) "social" factors in sociolinguistics, these two major results are interpretively disconnected. Tellingly, Labov's major summation of variationist research is to appear in three separate volumes; the first (Labov 1994) deals with "internal factors," while the announced subsequent volumes will cover "social factors" and "cognitive factors," respectively (p. 1).<sup>3</sup>

We argue that there is a way to connect the findings about vowel rotations with those about sex asymmetries. However, in order to make this connection it is necessary to reconsider the most fundamental assumptions of variationism. Variationist methodology is fo-

cused on phonetic variables in their mid-life and mature phases, where they already have clear-cut correlations to social categories within a community. The method permits detailed tracking of the continuing evolution of such variables, as certain groups push the innovative pronunciation farther while others resist. The beginnings of a sociolinguistic variable—the processes by which it acquires its initial, embryonic social correlates—are largely inaccessible. In Labov's original "abstract scheme" modeling "the spread and propagation" of changes, the starting point is a preexisting asymmetrical distribution: "A language feature used by a group A is marked by contrast with another standard dialect" (1972c[1963]:39).

If, however, we could account, in general theoretical terms, for the attraction of certain groups of people to particular phonetic values, then we could hypothesize that members of particular social categories are continuously induced to skew their articulations, however slightly, in preordained directions. The problem of origins would then become interpretable. Having identified the dynamic factors which initially generate sociolinguistic variables, we could reasonably suppose that the same factors continue to operate, though perhaps in a gradually attenuated fashion, as the variable evolves and becomes more sensitive to social pressures. Variationism should no longer limit its methodology to dismembering the pattern of variation into discrete "social" and "internal" (linguistic) factors. Rather, it should actively seek dynamic mechanisms which might connect these two domains.

That there might be such a direct motivation for such shifts has occasionally crossed the minds of sociolinguists, but in most cases the idea has been quickly dismissed as hopeless, the result being a reaffirmation of social-structural factors. As Labov (1990:219) puts it,

It would be quite satisfying if we could arrive at a straightforward grouping of male- and female-dominated changes by their phonetic character. Some of the first sound changes studied made it seem possible that females led in the upward movement of peripheral tense vowels that increased the dispersion of the vowel system, like the raising of (æh) and (oh), whereas males led in the opposite trend: shifts that moved toward the center corresponding to a "close-mouthed" tendency, like the centralization of (ay). But this would not account in any way for the consonantal changes that are led by women, nor for other recent female-dominated movements reported recently, such as the laxing (and centralizing) of /iy/, /ey/, and /uw/ before /l/. . . .

However, if we separate (steady-state) vowels from consonantal phenomena, interactions of vowels with following consonants, and diphthongs (especially the upgliding type) instead of looking for a single idea that solves all the problems at once, we may achieve some degree of success. If certain types of shifts are regularly

3. Another prominent variationist, Ralph Fasold, has treated separate material in *The Sociolinguistics of Society* (1984) and *The Sociolinguistics of Language* (1990). However, Fasold's division is really one of macro- versus microsocial, and gender is considered in the second work.

correlated with sex, there must be some causal link between the phonetic substance in question and (biological) sex or (constructed) gender. Each structurally distinct class of phonetic phenomena will have to be modeled separately rather than being lumped with others in a “unified” model that will surely founder. In this paper we focus on (more or less) steady-state vowels, though the nature of the English vowel system will force us to include some diphthongal data.

Specifically, we hypothesize that women are attracted to particular vocalic qualities, prototypically the high front unrounded vowel [i], while men are attracted to other vocalic qualities, prototypically back vowels, rounded or not, namely, [ɑ ɔ o u].<sup>4</sup> Much of the variationist data deals with vocalic rotations and can be elegantly accounted for by making this initial assumption. If we are correct, variationists have long been studying sound symbolism under other labels.

If our hypothesis holds up empirically, there are two ways to interpret it. First, the differential male/female preferences could be biologically determined, either as a secondary result of more basic anatomical or neural differences or as a dedicated wired-in structure. The biological approach is supported by evidence of male/female asymmetries in other perceptual modalities. For example, Doty (1991) reports that women outperform men on tests of odor detection, discrimination, and identification and that the two sexes have different aesthetic responses to various bodily odors. He notes that at least some of these differences are present by age 4 and that they appear to represent an inborn sexually dimorphic trait. Sex differences in color terminology have long been reported (e.g., Conklin 1955 on the Hanunóo). Recent studies have increased our awareness of sex differences in color perception, including pigment variation in retinal receptors (cones), and have identified relevant gene sequences on the sex-determining chromosomes (for overviews see Nathans et al. 1992 and Neitz and Neitz n.d.; see also Neitz, Neitz, and Jacobs 1991 and Winderickx et al. 1992 on “spectral tuning”). Furbie et al. (1997:237) suggest a possible evolutionary motivation for male/female differences in color perception in connection with gathering versus hunting activities in the Pleistocene.<sup>5</sup> In view of the massive sexual

dimorphism in lateralization and general brain development (for overviews see McEwen 1991 and Breedlove 1994), sex differences in both frontline perceptual processing and higher-level cognitive and aesthetic processing cannot be scoffed at, and we do not rule out a biological mechanism for the sex asymmetries in vowel preferences that we report.

An alternative approach would be to explain these phonetic asymmetries as by-products of more basic male/female differences in psychological and social development. This could begin, for example, with Chodorow’s (1978) psychoanalytic theory of the development of typical male versus female personality profiles as reflecting (mostly tacit) socialization within typical family structure, females preferring interpersonal continuities while males develop rigid ego boundaries (p. 169). It is possible, as we will see, to connect phonetic preferences with such personality differences, and therefore one could argue that the preferences are secondary consequences thereof.

The choice between these two approaches is, of course, the old “nature versus nurture” question. The polarity is misleading, as has long been noted (McBride 1971:36: “that old lemon, that mystical dichotomy”; cf. Lopreato 1984:68; Eldredge 1995:xiii). We do not suggest that sex-linked phonetic preferences, whether genetically or socially transmitted, are so deeply ingrained that they cannot be modified. On the contrary, male/female speech differences can readily be exaggerated, neutralized, or reversed, with or without conscious thematization, though the symbolic power of such modifications presupposes prior recognition of a baseline male/female difference. While male adoption of “female” pronunciation tends to be too infrequent and contextually specialized to show up in statistical sociolinguistic data, the female adoption of “male” pronunciation is more systematic.

We begin by summarizing the empirical results of variationist research (chiefly on English) on “internal” and “social” aspects. We go on to discuss relevant aspects of sound symbolism and its possible motivations. Next we explore ways to connect vowels asymmetrically with speaker sex and then take a closer look at English sociolinguistic data and supporting data from Arabic. Finally, we address the issue of long-term stability and review earlier efforts to motivate sociolinguistic variation directly.

## Vocalic Chain Shifts

Labov (1994) summarizes the linguistic patterns that have emerged from several decades of variationist research by him and many capable collaborators; much of the theory had already been expounded in Labov, Yaeger, and Steiner (1972). Although the 1994 book

4. We will use IPA (International Phonetic Alphabet) symbols for phonetic notation, “translating” where appropriate the symbols used in the studies we cite. To assist nonspecialist readers, we sometimes provide key words which, as pronounced in American English, usually contain the sound in question. Among the more commonly discussed vowels are the following: [i] as in *beet*, [ɪ] as in *bit*, [e] as in *bait*, [ɛ] as in *bet*, [æ] as in *bat*, unrounded low back [ɑ] in *hot*, rounded back [ɔ] as in *bought*, [o] as in *boat*, [U] as in *book*, and [u] as in *boot*. Brackets are used for phonetic transcriptions, slashes for phonemic transcriptions, and curly brackets for sets. Parentheses are used to denote sociolinguistic variables (i.e., ranges of phonetic realizations of phonemes or phoneme sequences), for example, (oh). In the primary literature from which we draw there is some variability in notation.

5. However, the survival value of color-perception mechanisms is not a simple function of the ability to discriminate colors of vegetables and game animals in full daylight. Food collection is only one aspect of survival, and a full range of lighting conditions must be

considered. Goldsmith (1991) points out that some apparently non-adaptive aspects of human cone pigments may have evolutionary motivations involving their indirect effect on spatial acuity.



deals almost exclusively with phonetic (rather than morphological, syntactic, semantic, or lexical) variation, it has the very general title *Principles of Linguistic Change: Internal Factors*. This is in keeping with a basic tenet of variationist theory, namely, that internal and social factors in variation are analytically separable. In this view, variation in any linguistic module is driven by a combination of (a) specific internal structural factors unique to that module and (b) general social factors that are independent of the particular linguistic manifestation. Phonetics is privileged not because it is more important or more interesting than other domains but because phonetic data are easier to quantify and decompose analytically than data from more structurally complex modules. A sustained, meticulous study of phonetic variation will therefore tell us much about variation (and change) in general.

Although certain types of consonantal variation have been studied, the vast majority of sociolinguistic research has focused on vowels. This is partly because most vocalic variation is intrinsically gradient, while consonantal variation is more discrete. We proceed from [e] to [i] through an infinitely gradable sequence of tiny steps which can be observed with a reasonable degree of accuracy by spectrographic measurements on the first two (or three) formants. There is no similar gradation in jumping from [ŋ] to [n] (*thinking* to *thinkin'*). But the asymmetry in the research is also motivated by the fact that most of the socially significant segmental variation, in English at least, happens to be vocalic. (Prosodic variation is intuitively very important but is difficult to code and so has been marginal in this line of research.)

The central result reported by Labov is a set of interrelated generalizations about "chain shifts" in vocalic systems, whereby several vocalic phonemes shift over time in a chainlike, coordinated fashion. His principles are as follows (Labov 1994:116):<sup>6</sup>

Principle I: In chain shifts, long vowels rise.

Principle II: In chain shifts, short vowels fall.

Principle IIA: In chain shifts, the nuclei of upgliding diphthongs fall.

Principle III: In chain shifts, back vowels move to the front.

6. As his work proceeds, some of these principles are reformulated. While (historically) "long" and "short" vowels broadly obey the generalizations, greater accuracy results from the notion of parallel peripheral (outer) and nonperipheral (inner) tracks. Moreover, "long/short" is replaced by "tense/lax," a more abstract feature whose phonetic characteristics involve some combination of duration, amplitude, articulatory peripherality, and the like. Principle I becomes "tense nuclei rise along a peripheral track" while Principles II and IIA are combined as "lax nuclei fall along a nonperipheral track" (1994:176). Principle III becomes "tense vowels move to the front along peripheral paths, and lax vowels move to the back along nonperipheral paths" (1994:200). We will begin by using the more familiar "long/short" terminology but will shift toward the more technical language where relevant toward the end of the paper. We use the term "shift" for the displacement over time of single segments as well as for more complex chain shifts.

The terms *rise* and *fall* in Principles I, II, and IIA relate to tongue height; [i] and [u], the vowels of *beet* and *boot*, are the highest vowels and [a] and [æ], the vowels of *hot* and *bat*, are the lowest. In Principle IIA, the *nucleus* of a diphthong is its vocalic center. In the word *my*, phonetic [maj], the nucleus [a] is followed by a *glide* (or semivowel) [j].<sup>7</sup> In Principle III, *back* vowels are those pronounced with retracted tongue, like [u o ɔ a], while *front* vowels are those pronounced with the tongue advanced toward the teeth, like [i e æ].

Labov states that Principles I and IIA are robustly supported by cross-linguistic as well as English data, the only apparent counterexamples being from East Lettish (Baltic language family); the larger Principle II and Principle III are fairly consistent but have occasional counterexamples (1994:137).

For our purposes, the most significant results are Principles I and III. The long vowels (Principle I) arguably have greater potential for sound-symbolic associations due to their greater perceptual salience. For example, in English, the (historically) long vowels are distinguished from the short vowels not only by duration but also by an increase in muscular tension and a more extreme (peripheral) tongue placement.<sup>8</sup> Principle III describes a general tendency independent of vowel length.

The combined effect of Principles I (raising) and III (fronting) is to push the long vowels toward the vowel quality [i] as their ultimate target. Consider a language with a set of unrounded front vowels [i: e: ə: æ:]. The vowel qualities in question are essentially those of *beet*, *bait*, *bet*, and *bat*, if we artificially lengthen the vowels of the last two. The effect of Principle I would be to shift *bat* toward *bet*, which in turn moves toward *bait*, which in turn moves toward *beet*. The vowel phonemes may remain phonemically distinct, but their lingual (tongue) articulation rises. Similarly, back vowels like [u o ɔ a] tend strongly to shift forward (vowel length is not a major factor in this instance). These are the vowels of *boot*, *boat*, *bought*, and *hot*. The high back vowel

7. [j] is the IPA symbol for the palatoalveolar semivowel; /y/ is used by many linguists in phonemic transcription.

8. There are two possible explanations for the lowering (and backing) of short (lax) vowels. One is that this is a secondary readjustment triggered at least indirectly by a prior raising of long (tense) vowels (see the discussion of chain reactions below). This explanation is empirically supported to the extent that the lowering/backing processes can be shown to follow the fronting/raising processes chronologically. Alternatively, the lowering/backing processes might be considered to be driven by "male" sound-symbolic aesthetics. In this view, the polar opposites of sound symbolism are, on the one hand, long (tense) [i:] (consider the cumulative effect of the repeated long vowels in *teensy-weensy*, perhaps the ultimate English diminutive) and, on the other, short (lax) back, often rounded vowels (as in *dork*). This view would be supported if the lowering/backing processes were shown to be characteristically led by men, independent of chain-reaction contexts. There is some evidence for both chain-reaction and male-led aspects of lowering/backing processes, especially if diphthongs are excluded from consideration. However, we are not yet in a position to make confident assertions about causality, and both approaches may turn out to have some merit.

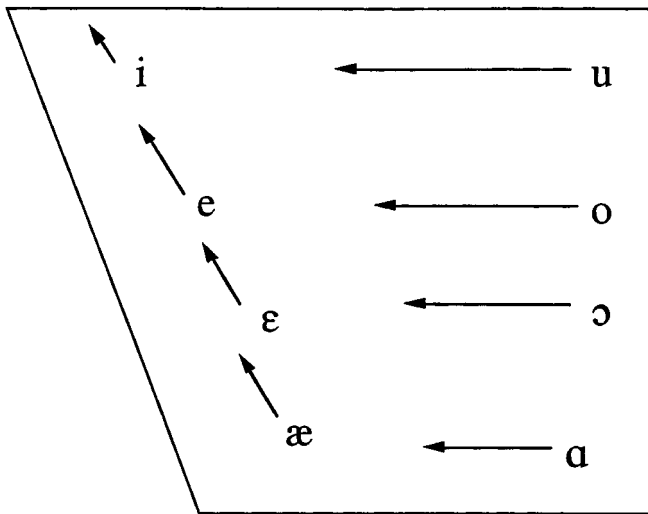


FIG. 1. Directions of vowel shifting predicted by Labov's Principles I and III.

[u] (*boot*) could thereby move in a straight line in the direction of high front [i] (*beet*). The lower back vowels such as [ɔ] (*bought*) and [ɑ] (*hot*) would move forward in the general direction of [æ] (*bat*), where they would (if long) become subject to Principle I and begin their ascent. So the ultimate target is [i] in all cases. The basic directionality of these types of vowel-shifting is illustrated in figure 1.

### Male and Female Roles in Phonetic Variation

One of the most consistent findings of sociolinguistic research has been the presence of sex-based variation. Linguistic differences between males and females have been documented for communities and languages around the world. Labov (1990) reviews much of this research, and, as with the vowel shifting evidence, proposes general principles to describe the findings:

Principle I: In stable sociolinguistic stratification, men use a higher frequency of nonstandard forms than women. [p. 205]

Principle Ia: In change from above, women favor the incoming prestige form more than men. [p. 213]<sup>9</sup>

Principle II: In change from below, women are most often the innovators. [p. 215]

While Labov's principles summarize the findings of a number of variationist studies, they do not have much explanatory value. In fact, they seem to pose a serious contradiction. Principles I and Ia predict that women should be prone to resist any innovation that does not

carry prestige. Yet by definition the "changes from below" of Principle II do not involve "any degree of social awareness" and therefore cannot be prestigious (Labov 1994:542). If women are so inclined toward standard, prestige forms, then why do they so readily abandon those forms to adopt nonprestigious ones?

Labov's account of the differing roles of men and women in language change is indicative of the dominant approach to sex-asymmetric linguistic behavior in general. The sex-of-speaker variable has generally been subordinated analytically to nonbiological social-structural formations. This approach is still followed, though there has been a gradual shift from a linear model of social classes to a more flexible network analysis.

Labov's early studies of New York City speech led to the theory that members of the lower middle class, aware of innovations in upper-middle-class speech and sensitive about their own social position, tended to shift toward the higher class's norms and even to overshoot (hypercorrect), particularly in middle age. This was seen as a key mechanism in accelerating the diffusion of innovative prestige norms to the larger community. Moreover, "Hypercorrectness is certainly strongest in women—and it may be that the lower-middle-class mother, and the grade-school teacher, are prime agents in the acceleration of this type of linguistic change" (Labov 1972b[1966]:141). In this model, speaker sex is important primarily because men and women have different attitudes to class symbolism, women being more attracted to the upper regions. The converse attraction of men to nonstandard and even stigmatized speech variants was more puzzling. The concept of *covert prestige* attached to nonstandard forms was developed. Sociolinguists began to speculate about the social-psychological factors driving male behavior (Wolfram and Fasold 1974:94):

Studies of linguistic change occurring across the United States indicate that females are often responsible for the initial adoption of new prestige variants in a given locale. . . . The tendency of males to use more stigmatized variants than females must be seen in terms of the possible positive value that non-standard speech can have for a male. Nonstandard speaking may indicate virtues of masculinity and toughness for a male.

Trudgill (1983 [1974b]: 87–88) offers a similar formulation. Although subjective qualities ("toughness") are mentioned, social class remains a key mediator between sex and sociolinguistic variables. Class differences are a preexisting "hard" social reality. The ends of the class spectrum are associated (perhaps by historical accident) with different variants of key variables; men are attracted to the lower class (perhaps because of its valorizing of manual labor, athletics, and street fighting) and therefore symbolically adopt lower-class speech; women are attracted to the upper social class and therefore symbolically adopt its speech.

9. The above/below distinction refers to speaker awareness of the change (whether it is above or below the level of consciousness) as well as to the social origins of the change (whether it began at the top or bottom of the social hierarchy) (Labov 1994:78).

This model proposes two powerful symbolic poles at the top and bottom of the class scale. It would be highly explanatory if it had turned out that innovations typically radiated outward from one or the other of these poles. However, it eventually became apparent that changes originating within speech communities (as opposed to regional or national norms coming into the community from the outside) in fact tended to develop in and spread from the center of the class scale.

An influential effort to modify sociolinguistic theory to handle this and other problems has been to (partially) replace linear social-class scales with a *network strength scale* (L. Milroy 1987 [1980]:142). The basic idea is that individuals who are tightly integrated into local interpersonal networks (family, work, associations) should be attracted to local speech norms, while weakly integrated persons should not be. The typical connection between males and nonstandard forms is explained by noting that nonstandard forms are typically local and that men are often more deeply integrated into their communities than women, especially in work contexts. However, in areas of high male unemployment, women may have higher network scores than men, with significant implications for the sex-of-speaker factor. This refinement is undoubtedly an improvement over the earlier class models, which never deeply analyzed “class” as a symbolic system. However, network models continue to see sex-of-speaker correlations with sociolinguistic behavior as being crucially mediated by “hard” social structures. The basic logic is this: local communities have (by historical accident) certain local speech features; persons who are strongly networked in the community have a special attraction to behavior symbolically associated with the community and therefore symbolically adopt these local speech features.

Although the specifics have changed, there continues to be little effort in mainstream sociolinguistics to look for possible direct links between speaker sex (or other social variables) and preferences for particular forms of sociolinguistic variables. All versions of mainstream sociolinguistics, from Labov’s pioneering New York City studies to the most recent network analyses, have the same intellectual foundation. Certain variables, primarily vocalic, are selected for study after they have already acquired visibly skewed distributions over social space. Careful linguistic analysis is applied to them in order to factor out internal factors such as local segment-to-segment interactions and stress, resulting in a purified distillate expressible as a number. This distillate varies from person to person and, for each person, from style to style. Data from a satisfactory sample of speakers are obtained. Separately, speakers are classified in terms of “hard” social variables, and speaker/style differences in the distilled linguistic output are correlated with the social variables.<sup>10</sup> Statistically significant results are inter-

preted as expressing the attraction of speakers to a social class (upper versus lower) or a level of community structure (local versus regional). Speakers favor particular vocalic articulations (and presumably a wide range of other symbolic behaviors, linguistic and nonlinguistic) because the latter are associated (by historical accident or otherwise) with the reference groups they are attracted to. Social structure always mediates between speaker variables (including sex) and linguistic variants, so there is no a priori reason that any particular speaker variable should be associated with any particular value of a phonetic (or other) variable.

This model has no account for the origin and initial diffusion of a sociolinguistic variable. Sociolinguists generally consider this to be an insoluble methodological problem, and it is only occasionally discussed (J. Milroy 1992:171). As a result, phonetic shifts are often described as “incipient” when they are really at “adolescent” stage, having already acquired socially definable distributions that show up on sociolinguistic radar. But the problem is conceptual as well as methodological; sociolinguists have no fully articulated hypothesis as to how new variables emerge.

We suggest that this difficulty cannot be overcome by further refinements of the existing methodology. Sociolinguists have focused on variation in vocalic articulations because this variation seems to have no direct motivation (it has no apparent semantic or pragmatic value) and because it can be measured spectrographically. We argue, on the contrary, that phonetic phenomena, particularly vowel qualities, have powerful aesthetic values and that these values have asymmetric connections to human sex categories. These connections play a role in the origin and initial diffusion of sociolinguistic variables, and they provide some (though attenuated) underpinning even for mature variables.

We will see that many sound shifts that take place on a communitywide basis over long periods of time are female-led. We will not here explore in depth the mechanism by which female preferences often win out over male preferences over time<sup>11</sup> and instead will focus on the analysis of these sex-asymmetric preferences.

## Sound Symbolism

While the processes that lead to the establishment of sociolinguistic variation have generally been attributed to random selection, we argue that the matching of lin-

---

components analysis, a statistical modeling procedure that identifies significant groupings of speakers on the basis of their linguistic behavior alone. Nevertheless, in interpreting the inductively established groupings, she relies on the usual “hard” social variables, for example, age, class, and ethnicity.

11. One hypothesis is that females have a greater influence on children (male and female) in their role as primary care givers and therefore the mechanism of change is intergenerational (see Labov 1990:243). Another hypothesis is that male life-cycle dynamics favor first an exaggeration (in adolescence) and then a playing down of symbolic masculinity. A third is that the male preferences are simply not as powerful as the female preferences.

10. An interesting variation on the standard approach is seen in Horvath’s study of Australian English (1985). She uses principal-



guistic form and social meaning can be mediated by sound symbolism. Sound-symbolic phenomena, such as onomatopoeia and synesthesia, have long been familiar to linguists, though in recent decades they have been considered minor exceptions to the fundamental arbitrariness that is felt to characterize linguistic signs. We agree with Friedrich, however, that this principle of arbitrariness has been a “debilitating premise” of the field in that it has led “scholars to avoid the exploration and description of facts and causes” (1979:2), and we hope to demonstrate the fruitfulness of an analysis not limited by that principle.

*Sound symbolism* denotes a relationship in which sound and meaning are directly connected. In the presence of such a relationship, phonological form “is endowed with its own plane of meaning” (Silverstein 1994:41), a privilege usually reserved for morphological and syntactic units. There is a broad spectrum of sound-symbolic phenomena (a typology is given in the introduction to Hinton, Nichols, and Ohala 1994). Among the most familiar examples are onomatopoeic forms such as *plop*, *meow*, and *boom*, which imitate nonlinguistic sounds using acoustically similar linguistic sequences. Closely related to such forms are cases of synesthesia involving the linguistic representation of nonacoustic properties, that is, associating a meaning from one sensory domain (visual, tactile, etc.) with a form from another domain (acoustic). Common among synesthetic forms are those denoting size or shape, such as diminutive affixes with high front vowels (e.g., *doggy*, *Billy*) and augmentative forms with lengthened vowels (e.g., *a lo-o-o-ong line*). These diminutive/augmentative forms of sound symbolism (including these very examples) are the ones that concern us here.

As we seek to explain patterns of vocalic shifting, our focus is on the sound-symbolic associations of different vowel qualities. A substantial literature on them can be adduced from earlier periods (see review in Jakobson and Waugh 1979:181–91). Of particular relevance are repeated descriptions of the symbolic use of the high front vowels /i/ and /I/. Jespersen (1922, 1933) details various symbolic functions of these vowels, including their use in deictics marking proximity (e.g., *this*, French *ci*, Malay *iki*), words indicating a short duration of time (e.g., *jiffy*, *quick*, *lickety-split*), and verbs denoting rapid motion (e.g., *flit*, *whisk*, *whiz*). However, the most common symbolic association of these vowels is with smallness.<sup>12</sup> Under this general heading, Jespersen (1933) lists numerous examples of words for “little,” “child,” “young animal,” and “small things,” as well as diminutive suffixes. While most of Jespersen’s data are taken from English or other Germanic languages, Ultan (1978) showed that the connection of high front vowels

with diminutive size is well represented across a much more diverse sample of languages.<sup>13</sup>

An interesting elaboration of these findings is offered by Cooper and Ross (1975),<sup>14</sup> who studied the phonetic patterning of quasi-reduplicative nonsense expressions in English and certain other languages.<sup>15</sup> In these expressions, which belong to a larger category that they dub *freezes*, the final term may differ from the initial in one or more of seven phonetic features including vocalism (*pitter-patter*), consonantism (*razzle-dazzle*), or syllabic patterning (*wild and woolly*). Their cautious interpretation is that four of the seven asymmetries “conspire to maximally reduce the phonetic content of place 1 elements in freezes” (p. 80). We could argue that all seven of the generalizations can be accounted for by claiming that they conspire to make the place 1 element subjectively “lighter” than the place 2 element. Regarding vocalism, the basic generalizations are that a short vowel precedes a long vowel and that if vowel length is constant the vowel-quality sequence is determined by the following hierarchy:

“light” i > I > ε > æ > a > ɔ > o > u “heavy.”

The labels “light” and “heavy” are ours<sup>16</sup> The evi-

13. Diffloth, in a paper provocatively entitled “*i*: big, *a*: small” (1994), purports to have uncovered a glaring counterexample. However, the vocalic symbolism he describes for Bahnar applies only to a special class of expressive descriptive reduplications which are far removed from the lexical domains associated with expressive diminutives in English and other languages. Moreover, the paper’s title misleadingly equates bigness with [i], whereas the adduced data show that high back rounded [u] is the target for mid and low back vowels, just as (high front unrounded) [i] is the target for mid and low front vowels. Since [i] and [u] are near opposite poles in the subjective “smallness” scale (see also our discussion of Cooper and Ross 1975 just below), Diffloth’s findings do not constitute a valid counterexample to the usual pattern. The paired descriptive reduplications have senses like (a) “of a large scintillating fire, of the last flashes of a large fire about to die” versus the same gloss with “small” replacing “large” and (b) “a large source of light” versus “a luminous point, a far-away light.” The variants with high vowels seem to involve increased intensity of perceptual patterns emanating from the entities in question rather than attributions of increased bulk of the referents.

14. The title of their paper is often miscited. The enigmatic title “World Order” is on the camera-ready copy provided by the authors and is explained in the paper’s final paragraphs. The mundanely incorrect “Word Order” is given in the volume’s table of contents and in some subsequent citations.

15. Ostensibly, Cooper and Ross were chiefly interested in semantically (or culturally) motivated orderings, as in *brothers and sisters*, but first had to distinguish such cases from orderings with a clear or possible phonetic basis.

16. The remaining five generalizations are that the place 2 element (a) has more syllables, (b) has more initial consonants, (c) has a more obstruent initial consonant, (d) has fewer final consonants, and (e) has a less obstruent final consonant. Generalizations *a*, *b*, and *c* and the vowel-length rule are those which give the place 2 element more “phonetic content.” But the vocalic progression corresponds to the sound-symbolic scales small/big, light/heavy, etc. Generalizations *d* and *e* seem at first sight to be inexplicable reversals of the patterns seen in *b* and *c*. However, *d* and *e* deal with the position after the vowel, while *b* and *c* deal with prevocalic position. Postvocalic obstruents like *k* and consonant clusters have the phonetic effect of shortening the preceding vowel, while single sonorant consonants tend to draw it out (note the descending phonetic vowel-length of *ban* > *bad* > *back*). Thus the effect of *d* and

12. Berlin (1994) has noted a strong correlation of first-syllable [i] with bird names and of first-syllable [a] with fish names in Huambisa and found that English-speaking subjects had good success in sorting Huambisa terms into the two life-form sets. In cases like this, however, it is not immediately clear whether the correlation reflects size symbolism or onomatopoeia.



dence for the individual pairwise asymmetries in this scale is variable. The most recurrent pairs are  $I > \text{æ}$  (*riff-raff*, *zigzag*) and  $I > \text{ɔ}$  (*dingdong*, *pingpong*), for which numerous minimal pairs can be adduced. Cooper and Ross suggest that the sequence is directly related to the frequency of the second formant (F<sub>2</sub>) of these vowels ([i] highest, [u] lowest), but in fact the F<sub>2</sub> of [u] is slightly higher than that of [o] (see below). While it seems clear that the pole opposite to [i] is in the [ɔ, o, u, a] (back vowel) region, we do not regard it as proven (or even likely) that [u] is the tail end of the subjective scale (see below).

The existence of subjective evaluations of differences in vowel quality has also been demonstrated in numerous psycholinguistic experiments beginning with those conducted by Sapir (1949a[1929]). Sapir tested the psychological basis of the synesthetic connection of size and sound using minimal pairs of nonsense words and found that when faced with a contrast of items containing [i] versus [a], both English- and Chinese-speakers overwhelmingly judged the [i]-items as referring to smaller objects. Other studies in this tradition include Brown, Black, and Horowitz (1955) and Tarte (1982). Newman (1933), extending Sapir's study, provided experimental data suggesting that [ɔ, o] (not [u]) was the subjective opposite of [i].<sup>17</sup> In Songhay languages of Mali, quasi-reduplicative nonsense freezes like /dikidaka/ 'hubbub', /ñimiñama/ 'swarming', /kuulukaala/ 'Bozo (ethnic group)', /ñuumiñaama/ 'swarm', and /wuukuwaaka/ 'noisy confusion' show [i u] in place 1 and /a/ in place 2. These facts suggest that the (universal) polar opposite of [i] is in the [a, ɔ, o] region and is not [u].

English diminutive suffix *-y/-ie*, phonetic [i], is of course an instance of canonical diminutive symbolism (*doggy*, *kitty*). Of special interest is the set of variants of the word *tiny*, where of course diminution is semantically foregrounded. Having once been pronounced \*[ti:ni], the word underwent the "Great Vowel Shift" in Early Modern English and acquired its current pronunciation [tʌjni], which left the final vowel unaffected but converted the stressed interior long vowel to a diphthong with low nucleus. But a new form *teeny* replicating the lost pronunciation [ti:ni] then (re)emerged, recovering the original sound-symbolic quality. Even more highly charged are the variants *teeny-weeny* and *teensy-weensy*, reduplications which permit quadruple occurrence of the symbolic vowel quality [i].

The corollary of the preference for high front [i] in di-

minutives should be a preference for "heavy" low and/or back vowels in augmentatives. However, stem-internal ablaut to express augmentation seems to be very rare, and many augmentative formations may result from frozen combinations of noun stems with a descriptive adjective ("big") or semantically bleached compounding element (e.g., "mother," "father"). Ulltan's (1978) survey found no strong augmentative sound-symbolic correlations. In English, stylistically marked lexical items like *huge*, *humongous*, and *gigantic* lack the consistent sound-symbolic patterning seen in corresponding diminutive items like *teeny-weeny*. However, it might be possible to show that stylistically marked augmentatives tend at least to avoid [i]. Augmentatives which are not immediately derived from compounds and which have pejorative/comical stylistic value<sup>18</sup> might show some cross-linguistic favoritism for back rounded vowels, for example, Romance augmentatives like Spanish *-ón(-)* in the (pejorative) *cabrón* 'billygoat' > 'son of a bitch' (all-purpose male insult). However, the correlations are likely to be considerably weaker than for diminutives.

As a final observation on the sound symbolism of diminutives we note that this semantic notion is often marked by consonantal as well as or instead of vocalic changes. In particular, it is common to find palatalization serving this function. Sapir (1949b[1915]) reported that the palatalization of sibilants was characteristic of the special variety of Nootka used when speaking of abnormally small people. Less bizarre examples are described by Nichols (1971), who documented palatalization of lexical consonants to express diminution in a wide swath of indigenous languages of western North America. Since consonantal palatalization involves the same general tongue position as [i], these two phenomena may derive from a single complex. However, consonantal alternations are tricky because they often result in concomitant effects on their phonological environment (influencing, for example, vowel length, pitch, syllable structure, etc.), and it is not clear that these effects have consistent symbolic associations. Thus, while consonantal alternations are quite interesting, they require separate and delicate treatment because of their complexities.

## Motivations for Vocalic Symbolism

The preceding discussion has considered linguistic evidence of various kinds in order to make a case for a sound-symbolic connection linking certain vowel sounds ([i], [I], etc.) with certain semantic categories (di-

*e* is related to the vocalic generalizations. Because the (direct and indirect) subjective effects of consonants can depend on their syllabic position, we prefer not to discuss possible sound-symbolic or other direct motivations for sociolinguistic changes involving consonants. It is also not certain that the specific hierarchical patterns seen in the Cooper and Ross freezes are precisely equivalent to polar sociolinguistic targets, since the freezes are basically rhythmic progressions.

17. Many experiments in the psychological literature involve *i*, *a*, and *u*, and it is not always clear what precise pronunciations (especially of *a*) are used. Newman, a linguist, used a fuller range of vowel sounds and gave accurate phonetic representations of them.

18. Augmentatives tend to have complex discourse functions. One distinction that should be made is between those with honorific function and those with pejorative or comical associations. In either case, there may be unusual combinations of augmentative and diminutive morphology (cf. English *Big Daddy* and similar appellations). This may be because extremes of size evoke similar pejorative/comical feelings. On interactions between diminutive and augmentative in Arabic, see Fleisch (1961:390–97).

minutive, light, etc.). While support for this connection is strong, the question is what it has to do with sex-based variation.

To answer this question we consider evidence of a rather different sort, beginning with consideration of the *frequency code*. This is the term used by Ohala (1984, 1994) to encapsulate a series of form-function correlations involving the *fundamental frequency* (the rate at which vocal cords vibrate during speech production, commonly denoted as  $F_0$  and perceived as pitch).<sup>19</sup> Briefly stated, Ohala describes a pattern in which “high  $F_0$  [fundamental frequency] signifies (broadly) smallness, nonthreatening attitude, desirous of the goodwill of the receiver, etc. and low  $F_0$  conveys largeness, threat, self-confidence and self-sufficiency” (Ohala 1984:114). This frequency code stands as a fundamental principle that underlies a variety of linguistic and nonlinguistic phenomena from the rising intonation of questions to the plaintive whimpering of puppies.

Of particular interest for the present hypothesis is Ohala’s treatment of the sound symbolism of size terms. He argues that certain segments, including the familiar high front vowels and palatal consonants, are commonly used in items denoting smallness because they are “characterized by high acoustic frequency” (1984:9). Here he is clearly talking not (just) about  $F_0$  but about the overall spectral profile of particular vowels.<sup>20</sup> It appears, then, that both  $F_0$  and formant patterns are relevant to the (perceptual) frequency code.

There is some behavioral evidence in support of such parallelism. In particular, while [i] vowels are cross-linguistically associated with diminutives, there is a similar association (limited of course to “tone” languages) between high tone and diminutives (Ulan 1978:545). This point has been reiterated recently by Matisoff (1994:122) and LaPolla (1994:140–41) using Asian data. Experiments reported by Tarte (1982) show that (pure) high tones have the same associations as the [i] vowel on relevant scales such as large/small, heavy/light, and masculine/feminine.

There is also direct interaction between vowel height and  $F_0$  by which high vowels /i u/ have, on average, higher  $F_0$  (and therefore higher perceived pitch) than mid-height and low vowels. Surveying a wide range of

published data from English and other languages, Whalen and Levitt (1995) have validated this pattern, known as intrinsic  $F_0$ , as a consistent cross-linguistic finding. They report overall means of 177.4 Hz for [u], 174.9 Hz for [i], and 160.9 Hz for the low vowel [a] (p. 356). Given the apparent universality of the phenomenon, it is often held to be the automatic and involuntary consequence of a slight pull on the vocal folds due to raising the tongue.<sup>21</sup>

The frequency code is ultimately motivated ethologically by the fact that both  $F_0$  and formants are determined by and therefore signal anatomical dimensions. There are significant anatomical differences between male and female vocal tracts (see below), and these differences have definite acoustic consequences. Therefore, Ohala’s work is important for our purposes in that it suggests a natural connection motivating sound-symbolic relations. There are also important behavioral and psychological implications to consider.

The ability to use frequency information about a signal to infer the size of its source is common to a variety of species. In fact, the ethological evidence suggests that many animals have developed behavioral strategies to take advantage of this ability in adversaries. For example, Ohala (1984, 1994), citing Morton (1977), points out that many animals use low-frequency vocalizations (such as growls) to intimidate rivals in “close-contact agonistic displays” in which individuals are in competition over access to food, mates, etc. Conversely, high-frequency vocalizations (such as yelps) are often used to express submission. These different vocalizations are evidently used to project different images of the animal’s size (to appear bigger or smaller) and are often paralleled by visual effects (e.g., the raising of the hackles and the lowering of the ears and tail in dogs).

Similar strategies are evident in human behavior, and there is evidence of a fairly consistent interpretation of the meanings of such acoustic cues. Ohala (1984), for example, elicited listeners’ judgments of speakers based on samples of “stripped speech” from which all spectral information (except that indicating amplitude and  $F_0$ ) had been removed. He found that, other things being equal, speakers using a lower  $F_0$  were overwhelmingly felt to be “more dominant” than those using a higher  $F_0$ . Ohala cites many confirming studies (p. 3) including Apple, Streeter, and Krauss (1979), who reported that speakers with higher fundamental frequencies were judged to be “less truthful, less emphatic, and less ‘potent’ (smaller) and more nervous” (quoted in Ohala 1984:2).<sup>22</sup> This evidence indicates the relevance of the

19. For an  $F_0$  of 110 Hz, numerous harmonics whose frequencies are multiples of this value (first harmonic = 110 Hz, second harmonic = 220 Hz, etc.) are generated. Pitch can be extracted from any set of audible neighboring harmonics even if the first harmonic itself is inaudible. Harmonics are not to be confused with formants, which depend on vocal-tract configurations (e.g., tongue, jaw, and lip position).

20. The formants are frequency bands which allow certain harmonics (that are generated by vocal-cord vibration) to resonate fully. Harmonics that do not coincide with one of the formant bands are suppressed. Presumably Ohala’s “high acoustic frequency” refers mainly to the middle and upper zone of the linguistically relevant frequencies. [i] has the highest frequency concentrations in this zone ( $F_2$  and  $F_3$ ) but also has a low  $F_1$ . Jakobson, Fant, and Halle (1961:29) treated [i] as “acute,” while acknowledging the difficulties in assigning values of the grave/acute feature.

21. While intrinsic  $F_0$  contributes to the small/light value of [i], it should do likewise for [u], which we situate near the opposite end of the subjective scale. This effect may indeed be a (modest) factor in favor of a small/light value for [u] as against [ɔ o]. However, all of these back vowels involve lip rounding, which significantly affects the formant values and, in the case of [u], probably outweighs the intrinsic  $F_0$  effect.

22. An interesting demonstration of the fundamental meaningfulness of  $F_0$  distinctions was provided by Lewis (1936), cited in Lieberman (1967:45–46). Lewis found that infants varied the  $F_0$  of

frequency code to human communication and further demonstrates the natural connection of frequency differences with certain social meanings.

## The Phonetics of Sexual Dimorphism

The full significance of the frequency-code theory for the present argument becomes apparent when we consider the phonetic differences between men and women. The heart of these differences is the sexual dimorphism that occurs in the vocal anatomy at puberty and results in larger larynxes and longer vocal tracts for males. In adult males the larynx is roughly 50% larger and the vocal cords it houses are roughly 50% longer than in adult females (Negus 1949).<sup>23</sup> Since the length of the vocal cords is inversely related to the rate at which they vibrate (other things being equal), men tend to have lower  $F_0$ , averaging around 125 Hz as compared with 200 Hz for women (Borden and Harris 1984). The acoustic effects of the differences in laryngeal size are compounded by the lower placement of the male larynx in the throat. This leads to male vocal tracts that are on average 15–20% longer (Ohala 1984:11). Longer vocal tracts resonate at lower frequencies, and so men's formant values tend to be significantly lower than women's.

The nature and direction of these acoustic differences suggest an immediate connection to the kinds of vowel changes shown above. We concentrate here on the formant data, since these are most useful in describing differences in vowel quality. Formant values can be roughly translated into the traditional articulatory terms of vowel description, using the first formant ( $F_1$ ) as the primary correlate of height and the second formant ( $F_2$ ) as the primary correlate of frontness. A comparison of male and female vowels can be made by plotting typical formant values for men and women in this two-dimensional ( $F_1 \times F_2$ ) acoustic approximation of vowel space, as in figure 2.<sup>24</sup> Here women's formant values (both  $F_1$  and  $F_2$ ) are consistently higher than men's, but the sex-based frequency differences are not uniform across all vowels. In some cases (e.g., /u/, /U/, /o/) the formant values of women and men are relatively similar, while in other cases (e.g., /i/, /æ/, /a/) they are quite divergent. Overall, the effect of this nonuniformity is a greater acoustic dispersion of vowels in women's speech; that is, the acoustic distances from, for example, /u/ to /i/ or from /o/ to /a/ are larger for women's vowels than for men's.<sup>25</sup>

their babbling depending on their "interlocutor," using a higher  $F_0$  in the presence of their mothers and a lower  $F_0$  with their fathers.

23. The length of male vocal cords generally varies from 17 to 23 mm, while female vocal cords tend to range from 12.5 to 17 mm (Negus 1949).

24. Although Peterson and Barney (1952) is commonly used as a source for such data, we use Yang (1996) here because it is based on a dialectally more consistent sample and because it includes data on /e/ and /o/.

25. Diehl et al. (1996:190) illustrate a similar pattern of male/female differences for Korean-speakers.

These acoustic facts appear to be easily related to the patterns of vowel shifting discussed above (see fig. 1), as the sex-based differences seem to indicate a predisposition for changes in particular directions. There are, however, complications involved in specifying this relationship. Raw acoustic differences such as those between females and males do not always translate directly into perceptual differences. Although an /i/ produced by a woman may have an  $F_2$  of 2,800 Hz while that of a man may have one around 2,300 Hz, both are effortlessly heard as instances of the /i/ phoneme. In other words, phonemic perception is based for at least some vowels on formant relationships or some other normalization process rather than on absolute values of a particular formant.

This normalizing, categorical phonemic perception does not make it impossible for listeners simultaneously to perceive other aspects of the acoustic signal. To the contrary, a number of recent phonetic studies have shown that this individualized information (e.g., absolute formant frequencies) is available during speech processing. Pisoni, for example, discusses data suggesting that "the indexical attributes of a talker's voice are perceived and encoded in memory by the perceptual system along with the linguistic message, and . . . information about a talker's voice is not lost or discarded as a consequence of perceptual analysis" (1997:11). Everyday experience confirms that we can recognize, for example, a telephone interlocutor by voice-quality features even as we do phonemic processing and morphosyntactic parsing. These findings are consistent with our contention that natural acoustic differences between males and females, including different  $F_2$  values for the same vowel phoneme, can serve as an impetus for sex-asymmetric vowel shifting.

A more vexing difficulty in relating acoustic facts to our model is the wider dispersion of women's vowels, which is only partially consistent with the observed tendencies for fronting and raising to be associated with women's speech. Thus, while higher  $F_2$  values are generally indicative of increased fronting, higher  $F_1$  values correspond to perceived lowering (not raising). The natural differences seen in figure 2, therefore, seem to predict that women will show a greater tendency toward fronting (which is in fact observed) but also lowering (which is not).

One resolution of this apparent discrepancy is to argue that what matters is not the absolute formant values but rather the relation between them, specifically the  $F_2$ - $F_1$  difference (or some perceptual function thereof). Under this proposal, fronting and raising are linked by the fact that both processes serve to increase the difference between  $F_2$  and  $F_1$ . Perceptually, the  $F_2$ - $F_1$  distance correlates with perceived frontness, so that increasing the distance results in vowels heard as more front (Ladefoged 1982:179). Given their overall higher formant values, the  $F_2$ - $F_1$  difference is naturally greater among women. For example, the data from figure 2 show that with /æ/  $F_2$  is separated from  $F_1$  by 1,234 Hz among women but only by 1,056 Hz among men. For

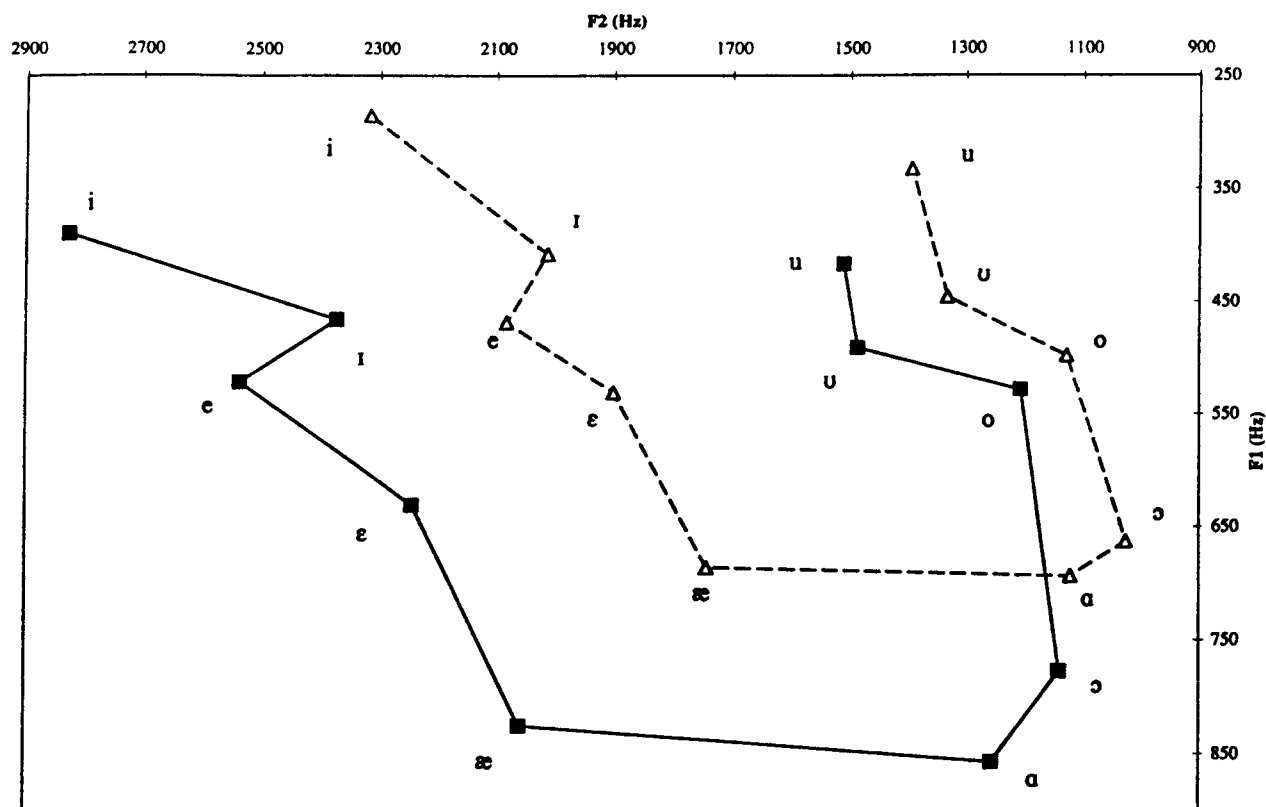


FIG. 2. Average formant frequencies of American English vowels produced by males ( $\Delta$ ) and females ( $\blacksquare$ ) (data from Yang 1996).

/i/, the contrast between women and men is even more pronounced, with an average  $F_2$ - $F_1$  difference of 2,436 Hz for women and 2,031 Hz for men. For the back vowels, women's and men's formant values differ less; however, this may be explained by the fact that  $F_2$  and  $F_1$  are much closer in this region, which means that there is less of a distinction upon which to build.

Perceptually, both the male-female divergence and the  $F_2$ - $F_1$  difference may be compounded by the influence of the third formant ( $F_3$ ) and/or the first harmonic (whose frequency is by definition equal to  $F_0$ ). With front vowels, especially /i/, the high  $F_2$  values approach those of  $F_3$ . When two formants come within a critical band, they seem to be merged perceptually; what we "hear" is a single formant whose perceived frequency is a kind of weighted average of the actual  $F_2$  and  $F_3$  (Carlson, Fant, and Granström 1975). This process is known as *spectral integration*.<sup>26</sup> It has been suggested that a similar interaction may occur between the first formant and first harmonic ( $= F_0$ ) in high vowels, which show the lowest  $F_1$  values. The perceptual result of  $F_0$ - $F_1$  proximity is an increase in perceived vowel height (Trautmüller 1981). The potential for this averaging seems to be greater for women's voices, because, at least

in the case of /i/, women tend to show smaller differences in both  $F_3$ - $F_2$  and  $F_1$ - $F_0$ .<sup>27</sup>

Another explanatory link between the male/female acoustic differences and the observed patterns of vowel shifting is found in the notion of peripherality. Phonetically, peripherality describes the position of vowels relative to the edges of the acoustically defined vowel space. Given their wider acoustic dispersion (as shown in figure 2), vowels produced by women are in some sense more peripheral than those produced by men. The vowels are farther from the center of their respective vowel space in the women's data than they are in the men's. Not only do women's vowels overall make broader use of acoustic vowel space, but within the vowel system women's vocalic peripherality oppositions are more pronounced as well. Thus, in terms of their linearly measured frequency differences, contrasts such as those between tense/lax (historically long/short) pairs like /i/ (*beet*) versus /I/ (*bit*) and /e/ (*bait*) versus /ε/ (*bet*) are greater among women. In other words, women's tense vowels are more peripheral (relative to lax counterparts) than are those of men. As we have seen, Labov has argued that peripherality plays a

26. For a discussion of some phonological implications of spectral integration, see Beddor (1991).

27. For example, Peterson and Barney (1952) reported an average  $F_3$ - $F_2$  difference of 520 Hz for women and 720 Hz for men and an average  $F_1$ - $F_0$  difference of 75 Hz for women and 134 Hz for men.



decisive role in determining directions of change, such that peripheral vowels tend to be raised and fronted while nonperipheral vowels tend to be lowered and backed (1994:176, 200). If these tendencies are valid, they have as a natural consequence that women should lead in vocalic fronting and raising.

While acoustic differences between men and women such as those represented in figure 2 clearly stack the deck in favor of certain vowel changes, it would be a mistake to assume that the processes involved in the actuation of such changes are purely mechanical. There are indications that speakers in fact tend to exaggerate the natural pattern of dimorphic variation, consciously or not. We have suggested above that the ultimate basis for the acoustic differences may lie in sex differences in the dimensions of vocal cords and supralaryngeal vocal tracts, but it is important to note that such anatomical differences alone cannot completely account for the acoustic contrast. A number of studies have found that differences in the actual formant frequencies produced by males and females are greater than can be predicted on the basis of physiology (Mattingly 1966, Fant 1966). An interesting corroboration of such findings comes from perceptual studies such as those of Sachs, Lieberman, and Erickson (1973), Sachs (1975), and Meditch (1975), which found that listeners can reliably judge the sex of a speaker even when the speech samples are those of preadolescent children.

It appears that females are primarily responsible for this discrepancy, as their formants consistently exceed anatomical predictions. Addressing these findings, Diehl et al. (1996) suggest that the increased formant values characteristic of women's vowels may be motivated by perceptual concerns for improving vowel identifiability. While such perceptual benefits may certainly play a role, less mechanical explanations must also be considered, as the data suggest that at some level a cultural component is operating in the production of male/female speech differences. As Sachs contends, "men and women may modify their articulators, lowering or raising their formant frequencies, to produce voices that aim toward male-female archetypes" (1975:154). These archetypes are cultural constructions even though they are grounded in universal physical phenomena. Sex differentiation in vocal anatomy provides a basic asymmetry that may be appropriated and cultivated to mark socially significant distinctions. Such strategies are apparently quite common. A simple nonlinguistic parallel is found in the case of facial hair, for which the association with men aligns with and surely derives from their biological propensity for growing it.<sup>28</sup> As such examples make clear, the archetypal conceptions of voices are just one part of the larger cultural web of gendered notions of what being "male" or "female" means.

28. Interestingly, Ohala (1984) relates the cultivation of facial hair, specifically beards, to the frequency-code evidence as another strategy for trying to appear larger.

Aside from the simple fact that male/female differences are "given" by nature, there may also be specific ethological factors favoring sex variation in phonetic patterns with deep roots in the hominid past. The need for females to attract and retain a male especially during vulnerable periods (pregnancy and its aftermath) and their role as primary care givers for young children presumably favored a predisposition for symbolic expressions of positive interpersonal affect. The need for males to deter predators and sexual rivals may have favored a predisposition for the symbolic expression of physical power. Among the ways these general predispositions are expressed is in slightly skewed vocalic articulations, females being attracted to the "light" [i] while males are, if anything, pulled toward the "dark/heavy" back rounded vowels.

Social psychological studies have noted sex-asymmetric dispositions toward the expression of affect and toward other-directedness in ways that support this model. For example, in one study, discourse patterns extracted from experimentally controlled speech in a context with no special affective features (elicited descriptions of photographs) fell into familiar patterns (Mulac and Lundell 1986:96):

the males were relatively informal, concerned with holding the floor, and thing-oriented . . . We believe that a reasonable, albeit overly general, characterisation of the female speakers' language use here is that it represents relative "emotional expressiveness" and "interpersonal sensitivity." . . . To this extent, the patterns of language use, as general as they are, also appear consistent with sex-role stereotypes.

This result is based on nonphonetic data (the judges evaluated transcripts rather than recordings of the subjects). We trust that it is not necessary to belabor the general point. To steer the analysis back to phonetics, we again consider diminutives, this time focusing on their functions rather than their forms.

The difference between *dog* and *doggy*, *Elizabeth* and *Betsy/Betsy/Betty/Beth/Liz/Lizzy*, and *train* and *choo-choo* is determined not by the objective size of the entities denoted (even allowing for context-specific comparative frameworks) but by the context of discourse. Favorable contexts for such forms are those involving the expression of positive affect, as prototypically in "parent-ese" directed to young children. It is true that diminution can also be significant in a very different kind of context, namely, carefully self-monitored discourse from an adult to a stranger or to a respected and feared superior, especially requests, veiled criticisms, and other sensitive speech acts. This mitigating diminution is usually expressed (in English), however, by the stylistically neutral (*a little*) rather than by affectively charged diminutives (e.g., *Could I have a little water?* and *I think your paper could be shortened a little*). The phonetically marked and stylistically charged diminutives therefore relate more strongly, in social-psycho-

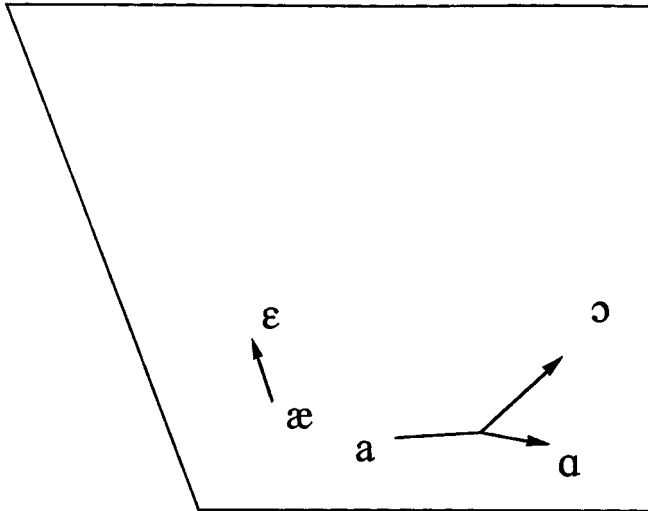


FIG. 3. Vowel changes in Belfast (Milroy and Milroy 1985).

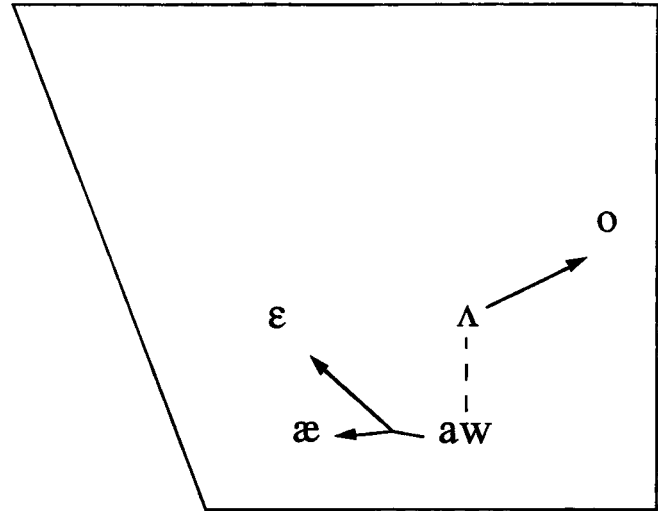


FIG. 4. Vowel changes in Vancouver (Chambers and Hardwick 1986). Dashed line indicates traditional pattern of centralization.

logical terms, to the affective ("warm/cold") than to the power dimension.<sup>29</sup>

The interpersonal role of vocalic symbolism is also related to another finding of cross-linguistic study, namely, that [i] (or a palatal consonant) tends strongly to occur in here-and-now indexicals, notably proximal demonstratives. Ultan's survey (1978) concludes that "proximal distance is symbolized overwhelmingly by front or high vowels" (p. 525), the statistical results being even more robust than for diminutives.

We now return to empirical sociolinguistic data, starting with a closer look at English and going on to an excursus into Arabic sociolinguistics.

### Sex Asymmetries in English Data

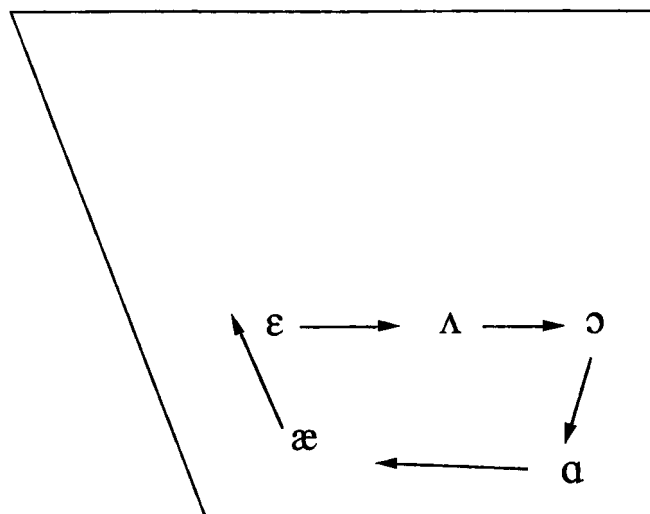
A review of the sociolinguistic literature on sex-based variation reveals ample evidence of sound-symbolic influences, as men and women seem drawn to different regions of vowel space. Consider, for example, the two changes in progress in Belfast represented in figure 3. The raising and lengthening from [æ] to [ɛ:] shown in figure 3 applies to the word class that includes *bet*, *neck*, *set*, etc., and actually represents a reversal of an earlier lowering in Belfast vernacular speech. This change is being led by women. At the same time, the backing and occasional rounding of the /a/ class (e.g., *bat*, *can*, etc.) is led by men. This divergence in sex patterning is all the more remarkable because both incoming changes are thought to have originated in the same source dialect, that of the rural Ulster Scots area outside Belfast (Milroy and Milroy 1985, 1993). Thus, the

changes entered the community with the same (rural) associations but in this new urban setting "each has assumed a diametrically opposed social value" (J. Milroy 1992:118). Within our model, the directionality (both social and phonetic) of these changes—the fact that women came to lead the change involving raising of a low front vowel while men dominated the change involving backing and rounding—fits our predictions.

Recent developments in Canadian English reveal a similar pattern. Chambers and Hardwick (1986) report that in Vancouver the traditional pattern of centralization of the /aw/ diphthong, known as *Canadian raising*, is being challenged by the innovations represented in figure 4. The tendency to front and raise the nucleus of this diphthong, which produces variants like [æw] or [ew], is most frequent among women. Chambers (1980) and Chambers and Hardwick (1986) have reported the same tendency for women in Toronto. The opposite type of movement, in which the nucleus is backed and rounded (with slight raising) to produce a variant like [ow], is led by men. This patterning, like the one in Belfast, matches our predictions.

More support is offered by data from Eckert's study (1989) of a suburban Detroit high school. Detroit, like other urban centers in the region including Chicago, Cleveland, and Buffalo, is currently participating in a complex change known as the *Northern Cities Shift*. This shift involves the clockwise rotation of several vowels as shown in figure 5. Eckert reports statistically significant sex differences for three of the five variables in figure 5, with girls more advanced in all of these three. The significant variables are the raising (with some fronting) of [æ], the fronting of [ɑ], and the fronting, unrounding, and lowering of [ɔ]. Thus, each of the changes that involves raising and/or fronting is dominated by female speakers. As for the remaining two

29. Linguistic anthropologists may be most familiar with these as the "power" and "solidarity" dimensions in Brown and Gilman (1960).

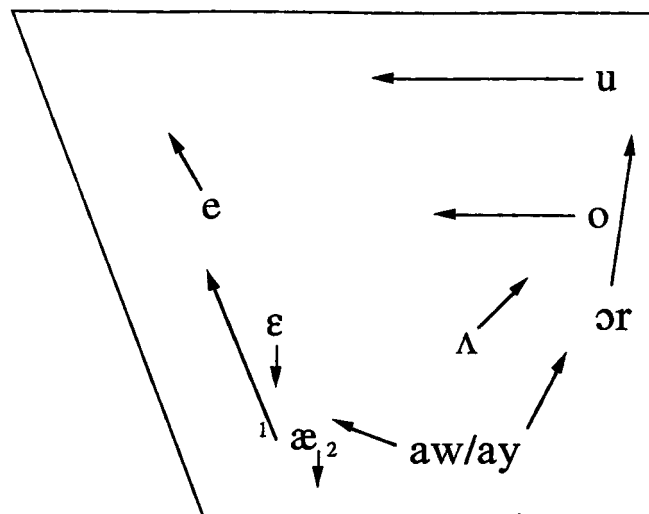
FIG. 5. *The Northern Cities Shift* (Eckert 1989).

variables, the backing of (ε) and (Λ) (the central vowel of *but*), Eckert found no statistically significant overall correlations with sex, although boys were shown to have a slight lead with regard to (ε).

Eckert explains the difference between the first three (sex-linked) and the other two (non-sex-linked) variables in terms of the chronological priority of the former group. The more mature shifts “have a more generalized function associated with expressiveness and perhaps general membership” (1989:264) and so function as broad gender indicators. In contrast, the newer and hotter shifts “are ripe for association with counteradult norms” (1989:264) and split on more culturally constructed axes such as *jocks* versus *burnouts*. The jocks are college-bound preppies (not necessarily athletes) who are enthusiastic about school social activities, while the burnouts expect to move directly into blue-collar jobs and form a “rebellious” or “alienated” category associated with covert cigarette-smoking sessions on the fringe of the school (1991:216). The jock/burnout division is sharpest among females, since “girls are asserting their category identities through language more than are the boys” (1989:265).

Assuming that Eckert’s chronological ordering is correct,<sup>30</sup> we also note that the female-led shifts are those involving raising and fronting, while the (apparently) sex-neutral shifts involve backing. Moreover, a male association may be hidden in the data concerning the backing of (Λ) (*but*), where the boys collectively occupy the middle ground, flanked by jock females and burnout females, who show widely separated norms. If male/female behavioral variation among the socially respectable jocks represents the societal norm for gender symbolism against which female burnouts rebel by adopting

30. Eckert adopts the chronology proposed by Labov, Yaeger, and Steiner (1972). However, linguistic atlases and other earlier dialectological studies do not give clear evidence regarding the chronology, and the recent sociolinguistic work has not included a systematic sampling of speakers from a broad age-range.

FIG. 6. *Vowel changes in Philadelphia* (Labov 1990, 1994).

and overshooting symbolically masculine variants (“tomboy” behavior), it would follow that the initial impulse for the backing of (Λ) came from boys (cutting across the jock/burnout split).<sup>31</sup>

For Philadelphia, Labov (1990, 1994) presents a detailed acoustic analysis of ten vocalic changes currently in progress among white speakers. A simplified representation of these changes is found in figure 6.<sup>32</sup> Most of these innovations are being led by women.<sup>33</sup> The exceptions are the variables (Λ) (Λr), and (ay) [= (aj)], which are led by men (Labov 1990:231). Each of the male-led changes involves raising and backing, and it is their backing that distinguishes them from the female-led changes. The female-led changes include the fronting of (u) and (o) and changes in (e), (æ₁) and (aw) that involve both raising and fronting.

The remaining two female-led innovations—the lowering of (ε) and (æ₂)—are weak counterexamples to our proposal. For (ε), the lead among women is not statistically significant (Labov 1990:231). Furthermore, in both cases the degree of lowering is very slight, especially for

31. The first author’s dissertation (Gordon 1997) analyzes the development and spread of the Northern Cities Shift.

32. Labov’s (ahr) (= /or/) and (i) (= /I/) variables are omitted here because the former is a “completed” change and the latter does not show statistically significant sex differentiation (see Labov 1990:231). Also omitted from figure 5 is Labov’s (iy) (= /i/) because no information is provided about its variation by sex of speaker.

33. The previously cited studies of Milroy and Milroy (1985), Chambers and Hardwick (1986), and Eckert (1989) based their determination of which sex was leading the sound change on counts of the relative frequency of use of innovative forms. By contrast, Labov’s (1990, 1994) conclusions are based on acoustic differences between female and male speakers. To make comparisons across speakers, some mathematical normalization procedure must be applied to the raw acoustic data. Various such procedures have been proposed, and none has escaped criticism. Labov’s conclusions are subject to this caveat. Nevertheless, in the absence of contradictory evidence, we will accept his claims about the vowel changes in figure 6.

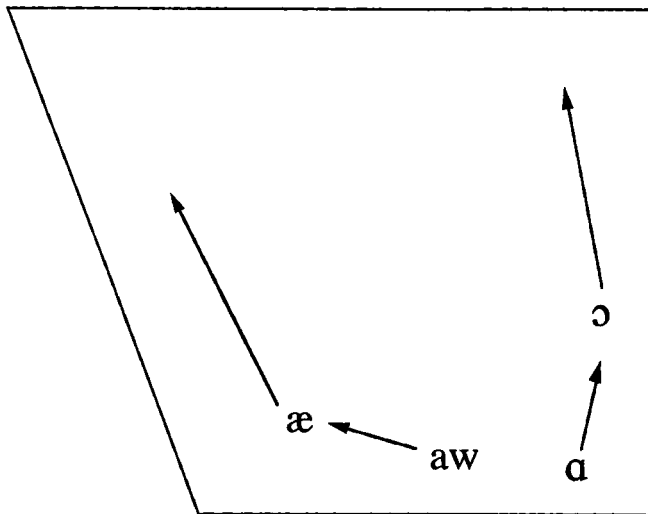


FIG. 7. *Vowel changes in New York City* (Labov 1966, 1990).

(æ<sub>2</sub>), and seems to involve only an increase in F<sub>1</sub>, with little or no change in F<sub>2</sub>—that is, the vowels are lowered but not backed.

The evidence from Belfast, Vancouver, Detroit, and Philadelphia establishes a pattern of women leading in vowel changes marked by fronting, often accompanied by raising, and a somewhat weaker complementary pattern of men leading changes marked by backing. Further examples can be cited in favor of the female-led pattern. In the San Francisco Bay area, the back vowels /u/ and /o/ are being shifted forward. These changes parallel those heard in Philadelphia, and, like their eastern counterparts, they are led by women (Luthin 1987). Similarly, the fronting (and raising) of /aw/ that is active in Vancouver and Philadelphia has also been heard in rural western Illinois by Frazer (1983), who found it more advanced among women in this area as well.

Labov's New York City data are more equivocal. The relevant vocalic changes are shown in figure 7. Summarizing the data, Labov indicates (1990:216) that women led men in all of the changes indicated. The raising of (æ) [his "æh"] and (ɔ) [his "oh"]<sup>34</sup> and the fronting of the nucleus of (aw) are consistent with our model, though the latter is an upgliding diphthong of the sort we are not treating in detail here. The female-led backing of (a), however, seems to be a notable counterexample to our findings. Nevertheless, the fuller discussion of (a) in the original report makes it clear that the backing of (a) [his "ah"] is very closely coordinated with the raising of (ɔ) [his "oh"], to the point that low-level ethnic-group variation in details of the raising of (ɔ) induce corre-

sponding variations in the trajectory of (a) (Labov 1966: 534, brackets original):

The question to be answered is whether these correlations of (ah) with independent variables are secondary [byproducts of the immediate dependence of (ah) on (oh)], or whether (ah) is directly associated with these variables, just as (oh) is. . . . We can conclude that the relationship of these two variables is virtually independent of both social and stylistic factors: the distribution of (ah) and (oh) positions is a purely internal product of the highly structured relationships within the phonological system.

Similar system-internal factors seem to account for another apparent counterexample, the case of the Canadian shift (Clarke, Elms, and Youssef 1995). This shift involves the lowering and partial backing of the front vowels /I/, /ε/, and /æ/ and the fronting and partial lowering of the central /ʌ/. Clarke et al. found all of these tendencies to be more common among female speakers. The front vowel changes run counter to the predictions of our model. However, like (a) in New York City, these developments appear to be a reaction to an earlier change, the merger of the back vowels /a/ and /ɔ/ (the "cot/caught merger"). This merger left unoccupied the low, central region of vowel space, which provided "the trigger for the lowering and retraction of the entire front lax vowel system" (p. 212). Interestingly, the change affecting /ʌ/ is not readily connected to the other vocalic movements, yet its trajectory does accord with our model.

The functional motivations proposed for such "chain" effects are controversial; they are discussed more fully below. The methodological point is that proposed individual counterexamples to our model should be carefully examined in the context of any larger rotations that may affect them. Ideally, longitudinal data as well as logical arguments concerning the cause-effect relationships among the individual components of complex shifts may be critically relevant.

The most extreme counterexample to our model would be one where a fronting of [a] toward [æ] or a raising of a low or mid-height front vowel [æ ε e] in the direction of [i] was led by men, particularly if long or tensed vowels were involved and we were not dealing with chain-reaction effects. Similarly, female-led movements in the reverse direction involving long or tensed vowels would be serious counterexamples. Female-led backing, rounding, or lowering of lax or previously centralized vowels not attributable to chain reactions (see below) would be less apocalyptic. In the empirical data, the male lead in backing and lowering processes is less sharp than the female lead in the opposite processes. This might have to do with social factors,<sup>35</sup> but it might also simply reflect the lack of a unique, precisely defined "male" target. While the evidence for [i] as the

34. There is a superficial similarity between the female-led change in (ɔ) in New York City and the male-led movement of this vowel before /r/ in Philadelphia (fig. 6). Nevertheless, acoustic descriptions show that the Philadelphia change brings (ɔr) to the high back corner of vowel space (Labov 1990:229), while New York City (ɔ) has more of a centralizing trajectory, as suggested by figure 7 (Labov, Yaeger, and Steiner 1972:96 and figs. 9 and 10).

35. See n. 11. To assess this question it would be necessary to review nonvocalic sociolinguistic shifts (consonantal shifts, morphological shifts, etc.), which is beyond the scope of this paper.



unique target for female-led changes (and diminutive sound symbolism) is very strong, we have seen that the evidence for a single back vowel quality as the polar target for male-led vocalic movements (and for augmentative sound symbolism) is weaker.

## Sex Asymmetries in Arabic Sociolinguistic Data

We hope to test our ideas on a respectable range of other languages and would be grateful for any correspondence from international readers with information (however informal) and bibliographical references. That our proposal is not entirely English-centric can be shown by applying it in some detail to Arabic. Aside from the fact that there is by now a substantial sociolinguistic literature on the vast array of its vernaculars from West Africa to Central Asia, Arabic is of particular interest because of suggestions that it may display a distinct pattern of sex asymmetries due to restrictions on the public interactions and education of women. One recent sociolinguistic textbook gives prominence to Arabic data in its section on sex and gender, with the justifiable warning that that sex asymmetries in use of literary Arabic forms (cf. Latinisms in modern Romance languages) must be distinguished from developmental patterns involving the spoken vernaculars themselves (Chambers 1995:139–43).

Rosenhouse (1995) surveys recent sociolinguistic work on vernacular Arabic, much of it unpublished and difficult to obtain (e.g., dissertations from Arab universities). From her list of phonetic variables for which sex asymmetries have been reported for one or more Arabic dialects, it appears that all of the studies have focused on consonants and/or diphthongs rather than simple vowels. This reflects the fact that Arabic vowels are notoriously subject to allophonic variation determined by adjoining consonants. Moreover, it is somewhat difficult to isolate sex-of-speaker asymmetries, since Arabic dialectology generally involves a notable urban/rural split—a distinction already present in Arabia at the time of Muhammad and re-created in the conquered extrapeninsular Arab territories (Morocco, Iraq, etc.) as Arabian urbanites established themselves in the early towns while Arabian beduin followed them and became farmers or pastoralists in the surrounding countryside.

For reasons we have indicated or hinted at earlier, we consider steady-state vocalic data with relatively little consonantal interference to be ideal for our purposes, since diphthongs and consonants have more complex and context-sensitive subjective values. We will therefore focus on two variables, the reflex of \*q as [q], [g], or (glottal stop) [ʔ] and the articulation of “emphatic” consonants /t̤, d̤, ð̤, s̤/, since these consonantal variables have the most significant effect on the articulation of neighboring vowels.

The sociolinguistic variable (q) was commented on by the earliest Arab grammarians, who contrasted the ur-

ban voiceless uvular [q] (in some cities probably [qʰ] including an ejective glottalic release) with the beduin voiced velar [g].<sup>36</sup> In some areas, such as the Maghreb, competition between [q] and [g] continues, but because of lexical diffusion and other sound changes all sub-dialects now have both /q/ and /g/ as phonemes and therefore the sociolinguistically interesting variation is confined to the set of lexical items where both pronunciations are still found, for example, Moroccan /qal/ versus /gal/ ‘say’. In some other locations, such as the Cairo area, it appears that urban \*q (phonetic \*[qʰ]) lost its constriction and simplified to the glottal stop [ʔ], but [q] articulations are now returning under literary influence (Haeri 1997). Concerning speaker sex, the basic empirical finding in modern studies is that women favor [g] (or glottal stop) while men favor [q]: “This finding has proved to be remarkably consistent across a variety of speech communities” (Haeri 1997: 146). Analysts have generally explained this as a function of men’s greater exposure to literary Arabic.<sup>37</sup> This is probably necessary in Cairo and other once q-less dialect areas, but in dialect areas with inherited /q/ and /g/ the variation also applies to everyday words like ‘say’, ‘heart’, ‘before’, and ‘cow’, where such influence is most unlikely.

From our point of view, whatever additional factors may be involved,<sup>38</sup> it is interesting that men favor and women disfavor the more retracted uvular [q]. This articulation conspicuously backs an adjacent /a/ and induces at least some lowering and/or centralization of /i/ and /u/, these being the three basic vocalic phonemes of most Arabic dialects. On the other hand, the [g] articulation favored by women co-occurs with a fronted allophone of /a/, approaching or attaining [æ] (English *bat*), and with maximally high articulations of /i/ and /u/. The verb ‘say’ is therefore /qal/ ([qal], resembling English *call*) or /gal/ ([gæl], like English *gal*).<sup>39</sup>

In addition to uvulars like /q/ and pharyngeal consonants like /ʕ/, Arabic has “emphatic” consonants whose primary coronal (tip- or blade-of-tongue) articulation is complemented by a secondary *pharyngealized* articulation<sup>40</sup> involving raising of the back of the

36. Uvulars are articulated farther back in the vocal tract than velars; /q/ resembles a retracted /k/.

37. The Classical (and Modern Literary) Arabic letter transliterated “q” is pronounced [q] in most traditions, occasionally as [g] or [ɣ].

38. Since [q] is voiceless and [g] is voiced, there is a possible further difference in perceived “harshness” that would have to be considered in a more comprehensive study of sex-asymmetric sound patterning. The precise articulation of [q] (glottalized unaspirated, unglottalized aspirated, affricated release, etc.) is somewhat variable across the dialects.

39. The effect of glottal stop [ʔ] on adjoining vowels is problematic. Its articulation is by definition purely laryngeal, and it therefore should have no intrinsic effect on vocalic spectra, but in some dialects the vowels retain backed or lowered allophones reflecting an older \*[qʰ]. Synchronically, this may require recognition of an “emphatic” glottal stop, either as the sole glottal stop phoneme or in phonemic contrast with a “plain” glottal stop. A phonemic opposition occurs, for example, in many Moroccan Jewish dialects.

40. In the “pharyngeal” consonants, the constriction involving the base of the tongue in the pharyngeal region is the primary (not secondary) articulation.

tongue. These phonemes are usually transcribed with a subscripted dot: /ṭ, ḍ, ð̣, ʃ̣/, etc. Pharyngealization is gradient, and the precise extent and phonological role of this secondary articulation varies from dialect to dialect and among speakers within each dialect area. Pharyngealization has fairly little effect on the acoustic value of the consonant itself (except for the sonorants /r/ and /l/, which are less well established as phonemes than the others). However, pharyngealization has a significant effect on adjoining vowels and often spreads to the boundaries of the stem or word. In some dialects, one is at least tempted to reanalyze pharyngealization as a vocalic rather than a consonantal feature, or possibly as a harmony feature applying to the entire stem or word and affecting all of its vowels and other sonorants.<sup>41</sup> Leaving this aside, the important point is that pharyngealization induces backing of /a/ and lowering or centralization of high vowels /i/ and /u/ or at least has similar acoustic effects. In Jakobson, Fant, and Halle (1961:31), pharyngealization was therefore treated as a special case of the phonetic feature *flat* (no longer in common use), which also covered quite different secondary articulations (such as lip rounding) that had similar acoustic effects.

Of particular interest to us is a finding by Royal (1985) cited in Rosenhouse (1995:212) to the effect that loss of the pharyngealization feature in some Egyptian upper-class circles was overtly evaluated as “less masculine” by working-class male subjects. Further experimental data from Egyptian Arabic, validating earlier comments by Arabists on the “affected and effeminate” evaluation of low pharyngealization, is given by Kahn (1975:41). She argues that the male/female differences are not attributable to anatomical dimorphism; in fact, “[the] acoustic difference is in completely the opposite direction of the difference expected from anatomical difference” (p. 46). Here we sense the familiar pattern wherein symbolic masculinity is associated with a working-class milieu in contrast to the “effeminate” refinement of the leisure class. With the upper-class loss of pharyngealization, a phonemic sequence like / . . . aṭa . . . /, previously pronounced [ . . . aṭa . . . ] with back /a/’s (near English *hot*), now approaches [ . . . ætæ . . . ] with fronted allophones (English *bat*). Perceiving [a] as symbolically masculine and [æ] as “effeminate” is consistent with our model. More studies like this which report subjective evaluations and do not merely correlate the variants with social-structural positions are vitally needed, even though they run counter to the hard-nosed “scientific” spirit of modern sociolinguistics.

41. Haeri’s (1997) sociolinguistic study of Egyptian Arabic includes a discussion of the “palatalization” of “pharyngeal” (i.e., pharyngealized) consonants. In some phonetic frameworks, a “palatalized pharyngealized” consonant is an oxymoron, since palatalization and pharyngealization are mechanically incompatible gestures. However, if pharyngealization is analyzed as a more abstract feature expressed largely by adjoining vowels, it is compatible with a local palatalization expressed by an affricated release, as when phonemic /ti . . . / is realized as [tʃi . . . ], the dot under the [i] denoting some form of phonetic pharyngealization of the vowel.

Too recent to have been covered by Rosenhouse (1995) is Wahba’s (1996) sociolinguistic study of pharyngealization in the Alexandrian dialect of Egyptian Arabic. Wahba correlated degrees of pharyngealization with eight social categories constituted by the intersection of binary variables for age (16–30 versus over 30), sex, and education level. As expected, women overall showed notably less pharyngealization than men. However, the “young non-educated female” group unexpectedly diverged from the female norm and actually overshot the male norm, showing the most extreme pharyngealization of any social category. Within the standard variationist framework which Wahba uses, explaining such patterns is difficult. However, it is the same “tomboy” pattern observed among the Detroit jocks and burnouts, discussed in the preceding section, whereby working-class girls and young women temporarily adopt (and overshoot) masculine phonetic variants.

Walters (1991) studied *imaala* (the raising and fronting of reflexes of Classical Arabic /a/ and /aa/, which takes place under somewhat different syllabic and morphological conditions in the different vernaculars) in Tunisia and reported that the highest variants were favored by women, especially older women, in the face of some stigmatization. This does not appear to be a change in progress. It is easily explained by our model but not by one that expects females to lead innovations regardless of phonetic substance. In the conference version of her 1995 paper, Rosenhouse additionally mentioned further female-associated items involving vowels from one Arabic dialect or another: first-person-singular pronoun /’ani/ instead of the usual /’ana/ in Yemen and Bahrain, more extensive use of ablaut diminutives (for endearment, not just diminution), and “persuasive imperatives” with prefix /di-/ in Baghdad. (Note the /i/ vowels; Arabic diminutive ablaut involves this vowel and/or the related semivowel /y/ [IPA [j]].)

General sociolinguists have been relieved by the new findings by Haeri and others on the (q) variable, having been puzzled by earlier reports of shifts led by Arab men. Chambers (1995:144) surveys the literature and concludes: “The revised results are consistent with the hypothesis of a sex-based difference in the linguistic behaviour of females and males. Although the sociocultural organizations differ remarkably from the Western world, the sociolinguistic behaviour is essentially the same. The female advantage in verbal abilities apparently overrides the sociocultural differences.”

We concur that the Arabic data can be reconciled with the English sociolinguistic data. We also concur with the belief that sex is likely to play a similar role in sociolinguistic shifts in different types of societies. We do not, however, appeal to general sex-asymmetric cognitive differences of the sort which Chambers advocates to replace the mainstream sociolinguistic model in which lower-middle-class female social anxiety plays a key role in the spread of shifts.<sup>42</sup> Neither a global

42. Chambers relies on psychological (including neuropsychological) literature suggesting that women have naturally wider verbal

cognitive-difference theory nor any model in which phonetic variables acquire sociolinguistic significance by historically fortuitous association with social categories can account for regular associations of specific types of shifts led, respectively, by females and males. In our model, the Arabic and English data converge not merely because women lead the most conspicuous shifts but also because members of the respective sexes in the two societies appear to favor similar vocalic sounds.<sup>43</sup>

## Homeostasis

Over time, there are no drastic unilineal evolutionary changes in the typology of vowel systems. Cross-linguistic surveys show that a core triad of [i], [a], and [u] is at the heart of nearly all vocalic systems.<sup>44</sup> The comparison of modern languages with recorded ancient languages shows many phonetic changes, including the rotations in the history of English, but the modern vocalic systems have basically the same center of gravity as the ancient ones. We assume that this is ultimately because the information-bearing work of vowel phonemes continuously imposes engineering requirements on the synchronic system, favoring the maintenance (or, if disturbed, reestablishment) of clear phonemic oppositions.<sup>45</sup>

Our model argues that vocalic chain shifts are driven mainly by female-led fronting and raising of vowels, with [i] as the ultimate target. While men show some preference for back rounded vowels, female-led shifts have some tendency to generalize. This accounts parsimoniously for a considerable amount of data but might lead to a false prediction that all vowels will eventually end up as [i]. To be sure, Labov (1994:127, 229) notes that no fewer than eight different vowels have fallen together as a single /i/ phoneme in the long recorded history of Greek. However, in spite of this Modern Greek

has a normal synchronic vowel system. Our model must therefore be completed by accounting for long-term homeostasis (the “plus ça change . . .” effect).

Prior to Labov’s work, the classic study of phonological geometry was that of Martinet (1955), who argued that phonological systems were subject to three basic types of forces, sometimes in conflict with each other: *function* (favoring maximally distanced articulations to insure clarity), *economy* (favoring lax articulation), and *structure* (favoring the regimentation of the phonemes into symmetric matrices satisfying higher-level cognitive requirements).<sup>46</sup> He was particularly interested in the way a shift affecting one vowel induced shifts in its neighbors in phonetic space. He interpreted complex vocalic shifts as cases in which one (catalyst) vowel began moving, driving those in front of it farther ahead (*push-chain*), while the vacuum left behind it sucked those behind it into its wake (*pull-chain* or *drag-chain*).

Labov’s intellectual debt to Martinet is considerable, but Labov now has reservations about some aspects of a current functional teleology derived (in part) from his predecessor’s work. Labov uses a two-track model, with vowels in a peripheral track moving in opposite directions from other vowels in a nonperipheral track. These tracks are sufficiently close to each other that a vowel moving up on the peripheral track may (at least temporarily) become perceptually indistinguishable from another vowel moving down on the nonperipheral track. For this and other reasons, Labov argues that chain shifts are not primarily motivated by functional (i.e., phoneme separation) principles. He does, however, explicitly endorse the pull-chain part of Martinet’s theory: “the direction of the leaving element follows Principles I–III, while the direction of the entering element may be governed by the basic chain-shifting principle” (1994:184). He also makes some use of the concept of push-chain (e.g., pp. 199–200).

In our view, the vocalic shifts are driven primarily by a female-led raising and fronting of the most clearly articulated vowels, long and/or peripheral vowels. We have no comparable direct explanation for shifts away from the [i] target—for lowering and backing processes. Logically possible accounts for long-term homeostasis that do no violence to our model include the following, singly or in combination:

1. While the inherited vocabulary shifts toward [i] targets, the new lexical items which replenish the vocabulary favor low and back vowels.
2. The fronting and raising effects apply only in certain positions (e.g., under stress), and shifts in opposite directions may occur in other positions, and this combined with periodic stress shifts and other phonological changes results in homeostasis over time.
3. New back and/or low vowels are created in inherited vocabulary by vocalization of previously nonvocalic phonemes, particularly liquids ([l, r]) and nasals.
4. High vowels including [i] have shorter duration

46. Martinet included prosody (e.g., stress patterns) as a further element in his system.

repertoires than men, whereas men have greater spatial skills (1995:132). We do not specifically dispute the general point.

43. Though our focus has been limited to data from English and Arabic, we note that evidence consistent with our hypothesis has been reported for other languages. For example, Thomas (1988) describes a Welsh community in which a fronted and raised [e:] is used by women (particularly older women) in place of the more common low vowel [a:]. Trudgill (1983 [1974]:83) details a more elaborate case for Darkhat Mongolian, in which the high and mid vowels used by men differ from those used by women. Specifically, men’s back vowels correspond to central vowels in women’s speech, while men’s central vowels correspond to front vowels used by women. Thus, the women’s forms are consistently farther front than the men’s.

44. The few languages with just two vowel phonemes have rich consonantal repertoires, and allophonic variation in the vowels plays a role in expressing distinctive consonantal features. For a recent summary of cross-linguistic data on vocalic systems, see Ladefoged and Maddieson (1996:chap. 9).

45. The favoritism for the {i a u} system and others built on it can be explained either as the opportunistic maximization of vocal-tract space or in terms of a *quantal* model (Stevens 1989) wherein these vowels are optimally distinguishable perceptually because of their spectral characteristics.



than low vowels (the jaw movement of the latter requires added duration) and are therefore more vulnerable to deletion word-medially (syncope), word-finally (apocope), and word-initially (aphesis).

5. The fronting and raising of certain vowels induces compensating backing and lowering of other vowels (push-chain), preserving the center of gravity in the vocalic system.

We will here discuss only 5, since it is most directly linked to the issues at hand. In order to make a plausible case for push- (and pull-) chain effects in the context of our model, it is desirable to show that the initial catalyzing movement of one or more vowels toward the [i] target antedates the other shifts. In this event, we can attribute the vocalic movements away from the target as secondary adjustments. Rather than survey the entire literature we will return to the Northern Cities Shift mentioned earlier. We rely here on Labov's (1994) detailed survey, which draws on the work of other sociolinguists, notably Eckert (e.g., 1989). Labov calls this "the most complex chain shift yet recorded within one subsystem, involving six members of the English vowel system in one continuous and connected pattern" (1994:178). All developmental stages of this shift can be directly studied (by elicitation from elderly and rural subjects as well as younger urban subjects), and there are some longitudinal data.

Labov (1994:195) posits a chronology of the changes in the Northern Cities Shift based on his observations. He argues that the early stages of this shift are dominated by the dramatic raising and fronting of tensed short *a*, which is shown as /æ/ in figure 5 and which he represents phonemically as /æh/ (the "h" indicates an ingliding diphthongal coda) (pp. 178–96). In extreme cases, this change results in raised ingliding variants of /æ/ which approach [iə] (like the second vowel of *idea*). Thus, the name *Ann* may sound more like *Ian*.<sup>47</sup> As the shift progresses, the raising of this vowel appears to create a drag-chain on the peripheral vowels behind it: /ɑ/ shifts to [æ] (*hot* pronounced like *hat*), then /ɔ/ is fronted and unrounded to approach [ɑ] (*caught* pronounced like *cot*). These changes are followed by lowering and backing processes affecting the nonperipheral short vowels, the chronology of which suggests a combination of push-chain and drag-chain effects. The overall shift comes full circle when nonperipheral /ʌ/, the last vowel to be affected, shifts to peripheral /oh/ (*but* pronounced like *bought*).

If we step back from the minutiae and survey the overall process, we can analyze the Northern Cities Shift (as described by Labov) as consisting of an initial catalyzing raising/fronting of a low front [æ] in the direction of [i], followed by a chain reaction whose ultimate effect is to reestablish the prior center of gravity

(and indeed to reestablish most of the actual vocalic sounds of the prior system).

In the Northern Cities Shift, the tense /æ/ phoneme never merges with the preexisting [i:] (the vowel of *beet*; Labov's /iy/), since even the fully raised /æ/ is pronounced as an ingliding diphthong [iə]. However, it is also possible for chain shifts to involve the shift of a preexisting [i:] into another sound as it is displaced by another phoneme which becomes the new [i:]. This was the case in the English Great Vowel Shift, where the stressed vowel of *tiny* (mentioned earlier) acquired its diphthongal value. Labov sees these as cases in which [i:] is diphthongized into [ij] with a lax nucleus which entered the nonperipheral track and began its steady descent into the lower regions. This is reasonable, but the mechanism behind this may be another push-chain effect.

Interestingly, in the Great Vowel Shift it appears that the primary initial impulses were again the raising of a tense low front vowel [æ:] and the associated fronting of tense low back [ɑ:] to fill the vacated space (Labov 1994: 145). This was followed by the more spectacular shifts by which mid-height tense vowels rose and the preexisting high tense vowels [i:] and [u:] diphthongized (Modern English *mice* and *mouse*). There is some dispute about the relative chronology of the raising of mid-height vowels and the diphthongal breaking of the old high vowels, but insofar as the whole cycle was triggered by the raising of [æ:] we can view the breaking of [i:] into its modern diphthongal articulation as due directly or indirectly to push-chain effects (see Labov [1994:145–48] and references there). Of course we do not have details of sex-of-speaker asymmetries in the development of these shifts from earlier times.

## Some Alternative Models

We are of course not the first to seek direct accounts of patterns of phonetic change. Labov ventures few speculations about the dynamics behind the recurrent patterns he describes but expresses interest (1994:218–21) in "mechanical explanations," citing with approval a passage from the mid-19th-century Indo-Europeanist Eduard Sievers.

Kroch (1978) attempted to motivate the particular phonetic content of sociolects within a community (Greater Philadelphia), with emphasis on a social-class scale. He argued that the doyens and doyennes of high society have an ideological commitment to precise articulation; as one descends the social scale this commitment decreases, allowing natural phonetic processes to apply. The predicted empirical result is that innovations percolate up from the lowest classes rather than trickling down from the elite in the fashion of early "supply-side" sociolinguistic models. Since it is now much clearer to sociolinguists than in the 1970s that the middle sector of the class scale plays a more important role than the lowest in propagating shifts, Kroch's model has not been influential of late.

47. This change is phonetically similar to the raising of (æ) in Philadelphia and New York City. However, in the Northern Cities Shift all members of the "short *a*" class may be tensed and raised. At the same time, in the Mid-Atlantic dialects (including Philadelphia), the lexical class is split into separate tense and lax phonemes.



In an early paper on Martha's Vineyard, Labov (1972c[1973]) pointed out that several vocalic variables seemed to function as manifestations of a broader close-mouthed versus open-mouthed articulatory style. This was picked up by Eckert in one of her recent papers on the jock/burnout division with respect to the Northern Studies Shift (1991:229):

The burnouts' lead in the backing of both (e) [= (ɛ)] and (uh) [= (ʌ)] could be taken as an indication of a similar phenomenon, whereby the two categories are differentiated by a preference for a fronted or backed setting. Such a differentiation could be seen as iconic in some sense, insofar as it corresponds to a striking difference in jock and burnout demeanor. The jocks' open-faced smiling demeanor contrasts overwhelmingly with the burnouts' more somber demeanor, which in turn corresponds to a more general open versus closed body posture, and even to the choice of light versus dark colors in clothing and makeup.

In Bourdieu's study of the social distribution of taste there is a brief but provocative passage giving a slightly different spin on buccal aesthetics, emphasizing gender symbolism (1979:211). Bourdieu contrasts a masculine style of eating (large mouthfuls, use of the full mouth and throat, conspicuous gulping) with a feminine style (nibbling, use of the front of the mouth). He connects this to food preferences (e.g., a thick steak versus a filet of trout) but also to speaking, the masculine style making greater use of the posterior regions of the vocal tract. The proposed eating/speaking homology is part of Bourdieu's larger program of constructing detailed causal models of the specific content of class- and sex-asymmetric aesthetic phenomena.

Another effort to motivate aesthetic values of specific sounds is that of Zajonc, Murphy, and Inglehart (1989). The starting point is the notion, supported by extensive experimental and clinical data, that blood temperature levels in the arteries carrying blood to the brain have a direct effect on hedonic state (euphoria/dysphoria). It follows that emotion "metaphors" like *hot-headed* and *cool* are highly motivated. The *facial efference* theory which derives from this is that facial gestures that involve lip movements (e.g., smiling) and shifts between nose and mouth breathing (due to thumb sucking, surgical interventions, etc.) can affect arterial blood temperature and therefore hedonic state. With regard to language, it is further predicted that the pursing of the lips in the articulation of high front rounded vowels (as in French *u* or German *ü*) may have measurable hedonic consequences, and the experiments reported provide evidence from forehead temperature measurements that pronouncing such vowels has the predicted effect.

These models present, or could be elaborated into, motivations for phonetic change that might complement or compete with our own. Kroch's analysis is somewhat orthogonal to ours, since it applies most directly to segment deletions and consonantal lenitions

rather than to vocalic rotations. Zajonc makes no connections between facial efference and sociolinguistics, and before a broad application could be attempted the model would have to be extended to the gamut of vowel sounds, not just to front rounded versus all other vowels. No well-developed mechanical or buccal-aesthetics model for sociolinguistics has been put forward, given the continuing dominance of social-structural causation models in the field.<sup>48</sup> Our model differs from all of these in that we put considerable emphasis on auditory aesthetics, as opposed to proprioception or other aspects of articulation. A serious rival model would have to account at least as well as ours for the same observed recurrences in the directionality of vocalic shifts and their correlations with speaker sex. At the same time, we acknowledge that our model is designed to deal only with vocalism, and other approaches might be more successful in accounting for regularities in other types of sociolinguistic change.

Finally, we hope it is clear that we do not propose to eliminate the "socio-" in sociolinguistics. We do not claim that the hypothesized sex asymmetries lead to automatic vocalic rotations at constant speed. Speakers must play an active role in this process. In our view, sound-symbolic features are a resource available to a speech community for marking socially significant differences, and speakers may choose to draw on that resource as they see fit. Furthermore, linguistic changes, whether they are inspired by sound symbolism or not, are subject to socially motivated acceleration, deceleration, and occasional reversal, and the theoretical machinery developed by sociolinguistics to describe these phenomena is needed. We hope rather to complement existing sociolinguistic theory, expand its scope and explanatory power, and reconnect it with the symbolic and aesthetic concerns of linguistic anthropology. Our model is strongest where that theory is weakest—in motivating the mysterious initial connection between an embryonic phonetic shift and the social matrix in which it is destined to blossom.

## Comments

NILOOFAR HAERI

*Department of Anthropology, Johns Hopkins University, Baltimore, Md. 21218-2684, U.S.A. 5 v 98*

The central aim of this article is to relate causally and explain two consistent findings of sociolinguistic studies: the fixed directions of vocalic changes and women's lead in the majority of such changes. The authors argue

48. In the case of buccal aesthetics, the cause-effect relationships would be tricky, since for example the closed-mouth style could be analyzed variously as an automatic response to emotional states, as an effort to manage one's external appearance, or as driven by unconscious experiential associations with other buccal activities (smiling, eating).

that physiological differences in men's and women's vocal tract sizes and their differing "attractions" to "sound symbolisms" underpin such systematic results. At the very least, they claim, these differences explain the *origin* of sound changes. Thus women show a lead in all changes involving fronting, that is, toward the high, front [i], because the smaller size of their vocal tracts makes their second formant frequencies (F2) higher than men's and because [i] is associated symbolically with "smallness."

I agree with Gordon and Heath that the origin of most linguistic changes remains a mystery. Weinreich, Labov, and Herzog (1968:186) called this the "actuation problem." In recent research on this problem Herold (1990, 1997) examines the merger of "caught" and "cot" in the towns of eastern Pennsylvania and concludes that it probably has its origin in the "massive in-migration" of speakers of Polish and other non-Germanic languages (1997:165). I also agree with the general intent of the article in not shying away from attempting to explore the role of physiological differences in the hope of illuminating part of the story, so to speak, with regard to gender differences in speech. Indeed, vocal tract size differences and sound symbolism may play a role in some linguistic changes.

However, a surprisingly large part of this article is devoted to shoring up support for physiological "asymmetries," as if either research on them were recent or linguists had simply denied their existence and potential implications. At issue is not that such asymmetries exist but how they are mediated by sociocultural and historical factors. This mediation, as everyone knows, is quite complex, but it is only mentioned by the authors in a few lines and left unexplored. If we agree that women's smaller vocal tract size "preordains" their lead in certain sound changes, where are we to go from there? The far more difficult task is to explain how any presumably "original" difference enters into and interacts with other differentiating processes, all of which in turn mutually influence each other's constructions, for example, gender, class, and ethnicity. There is not one example of a sound change (or linguistic change) in the sociolinguistic literature whose propagation, distribution, or trajectory can be fully explained purely in terms of physiological asymmetries or, for that matter, any single factor, social or other. Equally important, of the changes of which women have been the "leaders," none has yet become part of any extralocal standard variety.

Even experimental phonetic studies concerned with vocal tract size differences resort to social and cultural explanations when acoustic differences between women and men are found to be greater than their physiologies would predict. Lieberman (1986:359) states that "human beings are not automata, completely constrained by their anatomy. . . . There is in essence a 'male' dialect that is culturally transmitted" (see also Sachs 1975:154, among others).

This article aims at (re)interpreting the findings of sociolinguistics, yet there are a number of inaccuracies some of which are perhaps a result of the authors' insuf-

ficient familiarity with the very literature they would like to contribute to. The field of sociolinguistics is represented as though there were no substantial debates in it, and the use of textbooks and survey articles throughout helps reinforce this surprising representation. Because of space limitations, I will give only a few examples. It is stated that "the sociolinguist must make decisions about which formants to examine and at which instant to measure them." Most studies of linguistic changes carried out by sociolinguists are *impressionistically* not instrumentally coded. That is, the coding of the segments in question is not done on the basis of acoustic information alone. If a novel pronunciation is picked up instrumentally but not by any human ear, it is at best unclear how to proceed, and at worst it is not a sociolinguistic variable at all.

On explaining gender differences in the use of the Classical Arabic sound [q], Gordon and Heath say that "analysts have generally explained this as a function of men's greater exposure to literary Arabic." Strong challenges to this early explanation in terms of "exposure" or "access" have long been articulated (e.g., Ibrahim 1986; Haeri 1987, 1994, 1997). Note 37 states that in Egypt [q] is "often [pronounced] as [g]," but [g] belongs to the rural dialects of southern Egypt, and these have not been the subject of sociolinguistic studies. In urban areas the variant of [q] is the glottal stop (*hamza*), studied extensively by sociolinguists.

The "serious contradiction" with regard to the role of gender, characterized as the "paradoxical" behavior of women, has served as the impetus for one of the most central debates on the role of gender and its interpretation in linguistic variation and change (see, e.g., Labov 1982, 1990; Eckert 1989, 1991; Eckert and McConnell-Ginet 1992; Walters 1994; Haeri 1991, 1997; Graddol and Swan 1989), and this debate continues.

The findings of Royal (1985) would speak to the aims of Gordon and Heath's article while pointing up its major weakness, and they deserve more than consultation through a secondary source. Weak pharyngealization is associated not only with women but also with the upper classes as a whole (Royal 1985: 94–95). What would be a contribution would be to articulate how the vocal tract size differential between men and women and sound symbolism might help here in understanding the interaction of class, gender, and the prescriptive norms of Classical Arabic which disfavor weak pharyngealization.

Having said this, I would argue, as I did in my 1995 article on sex and gender differences in speech, that explorations of the possible role of physiological differences and the iconic value of certain sounds are important to pursue. There, examining the same studies described by Gordon and Heath and two others (Gauchat 1905, Haeri 1991), I listed 19 variable processes, both vocalic and consonantal, in which in general women lead in fronting processes while men lead in backing ones (pp. 102–3). At the same time, I argued that "the physical differences that underlie certain speech differences are not construed, nor remain, as

merely physical. Rather, they feed into social constructions of 'difference' (p. 102). The close examination of the variables of palatalization and pharyngealization in that article reveals the difficulty of disentangling the roles of gender, class, education, the prescriptive norms of Classical Arabic, and speakers' ideologies with regard to the latter and Cairene Arabic. In short, the possible role of iconicity has "crossed the minds" of many sociolinguists, but how it does so continues to remain unclear.

JANET HOLMES AND DAVID BRITAIN

*School of Linguistics and Applied Language Studies,  
Victoria University, P.O. Box 600, Wellington, New  
Zealand/University of Essex, Colchester, U.K.*

20 IV 98

Gordon and Heath present a number of interesting and thought-provoking arguments supporting their claim that women universally lead sound change in the direction of the high front vowel [i] while men lead change towards back vowels. The reasons for these patterns, they argue, can be traced to natural biological imperatives, supported by socio-psychological pressures reflecting (presumably universal) gender socialisation patterns. It is difficult for sociolinguists to assess the validity of evidence from anatomical and neural research or to grasp the relevance of women's reportedly superior abilities in areas such as "odor detection" to their claimed "preference" for high front vowels. And though, in our view, arguments about phonetic iconicity are dubious (e.g., Bauer 1996), we do not have space to debate them in detail. Rather, we focus on the use Gordon and Heath make of social dialect research to support their position.

As they acknowledge, Labov first stated the generalizations about sex and sound change put forward in this paper, but Labov notes that these generalizations do not account for changes involving diphthongs or consonants. Gordon and Heath resolve this problem by excluding diphthongs and consonants (and later short vowels and prosodic patterns too) from their universal claims. Their justification, that most social dialectology has focussed on vowels, may be true of American English research, but it does not hold universally. In Britain and New Zealand, consonants such as [t], final [ŋ], and initial [h] have attracted much attention, and in many other languages (including Arabic, as they illustrate) consonants have been a major focus of attention—for example, Swahili (Russell 1982), Spanish (Williams 1983; Labov 1994: chap. 19), and Dutch (Van de Velde, van Hout, and Gerritsen 1997). One might reasonably expect that universal biologically motivated pressures resulting in sound change should not be restricted to long steady-state vowels.

Secondly, in supporting their claims, Gordon and Heath oversimplify the cited research results to the point of parody. They ignore many detailed qualifications presented by Labov (1990), Eckert (1989), Cham-

bers (1992, 1995), J. Milroy (1992), James (1996), and Holmes (1997), among others, particularly in relation to patterns of stylistic variation (e.g., Escure 1991). Thus, for instance, claims that women use more standard forms than men and favour incoming prestige forms generally relate to formal speech styles, especially where reading aloud is involved, but they often do not hold for casual styles. In addition, Gordon and Heath frequently use both changes from above and changes from below to support their view, without considering the consequences of combining types of change with such very different origins. And though social network research locating men at the core of local communities is cited, critiques (e.g., Cameron and Coates 1989) and counterexamples (e.g., Thomas 1989) are ignored.

Thirdly, there are a number of changes in progress which challenge their claims. We cite just a few examples: New Zealand women led in the centralisation of the KIT vowel (Bell 1997); British English /ʊ/ lowering and unrounding is being led by young women, as is the use of [ɑ:] forms of (ai) in the English Fens (Britain 1997). Since Gordon and Heath cite morphological evidence from Arabic to support their claims, we can look to Tagliamonte's (1997) finding that, in York, women favour the past-tense form *was*, with its back vowel, over the form *were*. In the Southern United States, Feagin (1986) found that women led the diphthongisation of long front vowels, resulting in more open onsets than in their male compatriots. Beyond English, Kerswill (1994: 122) found that schwa lowering is a female-led change in certain dialects of Norwegian; Yaeger-Dror (1986) provides evidence that women are lowering mid-open vowels in Montreal French, and in Uciedan Spanish women replace close dialectal final [u] with the more open Castilian [o] (Holmquist 1985).

Gordon and Heath express puzzlement that sociolinguists do not look for possible *direct* links between speaker sex and preferences for particular forms of sociolinguistic variables. From our perspective, the reasons seem obvious. Sound symbolism and biology provide much less plausible explanations of sound change than explanations which both take account of the sociolinguistic complexity of sound change, including stylistic variation, and give due weight to the evidence that some changes proceed in just the opposite direction from those noted in this paper.

JUDITH ROSENHOUSE

*Department of General Studies, Technion–I.I.T.,  
Haifa 32000, Israel. 23 III 98*

The paper deals mainly with sound symbolism, seeking to unify studies of sound changes and gender under a new perspective of sociolinguistics. The examples are drawn mainly from two genetically very different languages, English and Arabic. It is therefore interesting that various features of sound symbolism are similar in these and in certain other unrelated languages. The authors approach the issue from a general phonetic view-

point adapted from Ohala's "frequency code" (1994). This theory (put simply) associates things that make sounds at generally high frequencies with small, harmless things and things with low frequencies with big, threatening objects. The authors extend this theory to vowel differences and changes that seem to be generally related to male/female sex differences. They claim that female speech tends (mainly) to raising and fronting of vowels whereas male speech tends to use back and (spectrally) low vowels. They also compare this vowel-system rotation to large-scale diachronic developments (homeostasis), discussed in some detail for English. Competing theories dealing with aesthetics and manner of articulation are also briefly surveyed. The authors state that their model differs from other models in the considerable emphasis on auditory aesthetics. In my opinion, the paper is interesting and thought-provoking. As I understand it, it challenges existing sociolinguistic models and sheds new light on existing theories. It needs to be strengthened, however, by more data from additional languages and language domains (that is, not only vowels).

In the discussion of Belfast English vowel features it is said that "this divergence in sex patterning is all the more remarkable because both incoming changes are thought to have originated in the same source dialect." This raises questions about the "source dialect." Were there no sex differences in that earlier period? Did these changes start only when these people came to Belfast? It seems plausible that if sex is a factor in sound changes, then these processes did not start at a certain point in time—they should have been there all along, though people perhaps did not record them. Because of the lack of adequate literature we might not be able to unearth these effects, if they existed, but Gordon and Heath's statement seems somewhat unsatisfactory for a general model.

A similar question arises with regard to the assertion that "the vocalic shifts are driven primarily by a female-led raising and fronting of the most clearly articulated vowels." Would not long-term diachronic features affect all the speakers of a language variety, whereas sex-dependent features would be analysed in the short term? In the long run all the speakers adopted, for example, the new English vowel system, and the lead of one gender over the other is irrelevant for the system.

With regard to the series of "possible accounts of long-term homeostasis that do no violence" to the model, considering Arabic I suggest the following:

1. Since the Arabic lexical system is bound to morphological patterns, patterns with low, high, fronted, and back vowels exist in Arabic. Not much can be changed in word formation because of phonological considerations, it would seem. Furthermore, it remains to be shown (statistically?) that new words (what is the meaning of this expression: artificial innovations by the language academies? words borrowed or adapted from foreign languages? from the colloquial dialects? words belonging to certain semantic fields?) prefer certain vowels to others.

2. In Arabic the raising of /a/ towards /e,i/ is triggered by phonological environment (non-back consonants draw the raising and fronting of /a/). Stress shifts may change syllable structures, which may yield phonological changes, including fronting. So far the description seems to be valid for Arabic, but the condition "under stress" does not seem to apply here, since /a/ raising occurs in both stressed and unstressed syllables.

3. Certain colloquial Arabic dialects reveal this phenomenon near the mentioned consonants, by inserting an anaptyctic vowel mainly in word-final clusters, for example, *kalb* > *kaleb* (dog), *bint* > *binet* (girl). However, this phenomenon is not restricted to these consonants, and the case cannot be considered general.

4. This case seems to be almost generally valid for many colloquial Arabic dialects. Still, modern literary Arabic has hardly changed its phonological system, and no vowel deletion is normatively allowed.

5. On the Arabic sociolinguistic data I will only say that in the literature I surveyed not just vowels were studied. As to the *qal/gal* difference, many Bedouin dialects also use velarized [g], along with some other velarized non-back consonants ([b, m, r]), without sex-related differences in their use. A further consideration is, for example, that Bedouin dialects are (and have been) considered by some speakers more "virile" and "fierce" than the "effeminate" urban dialects. At the same time basic velarized consonants tend to lose their velarization in some (non-Bedouin) dialects not mentioned by the authors. Therefore one should be careful not to oversimplify the picture for the sake of a model. On the whole, this approach is interesting and obviously deserves more work.

ELLEN ZIMMERMAN

*Sociology Department, Framingham State College,  
Framingham, Mass. 01702, U.S.A. 23 IV 98*

Gordon and Heath launch a well-aimed critique at the variationist assumptions and methodology which currently dominate the field of sociolinguistics. As they point out, much sociolinguistic research is linguistic in only a peripheral way. What is actually going on is sociological investigation of behavior patterns and preferences which happen to involve language. The linguistic variables are interesting indices of social group membership, social attitudes, and social change.

However, as Gordon and Heath suggest, variationist methodology deals with phonetic variables which are already clearly associated with certain social categories in a speech community. The variationist model does nothing to account for how and why certain variables come to be associated with those particular groups to begin with. If such origins can be ascertained, then one may be able to track their operation and modification under the influence of social forces. Gordon and Heath argue convincingly for a regular correlation between sex (female) and certain vocalic qualities (fronting and raising), citing ethological and sociobiological determi-



nants. They do not, however, suggest any way in which their model might be extended to include sociolinguistic variation associated with social groups other than gender.

Gordon and Heath present one of the more balanced treatments I have seen of the nature/nurture question. Without making an issue of it, they develop a model which looks to sex-linked biological factors for an explanation of the origins of certain sound symbolic values while still recognizing the role of culture in guiding the ways in which those values will be played out in speech. They also recognize the possibility of social transmission of sex-linked tendencies through gender-specific socialization processes within the family structure. Biology, socialization, and cultural value may all be at work in sex-linked tendencies, and Gordon and Heath's treatment allows for this probability.

Iconicity in language has been recognized for decades, but the considerable work on it has been largely ignored or marginalized because of the supposition of arbitrariness that has held sway ever since de Saussure (even in the face of the outstanding work of scholars such as those represented in Hinton, Nichols, and Ohala 1994). This underlying assumption has left huge gaps in linguistic explanation, which Gordon and Heath help to fill. Their focus on fundamental frequency and formant values (following Ohala 1994) seems especially promising.

However, this focus on the acoustic ignores the role played by articulatory factors and the proprioceptive sensations associated with them. One supposes that Gordon and Heath would treat Diffloth's Bahnar data as an example of a cultural override of "natural" sound symbolic associations. In this Mon-Khmer language of Vietnam, high vowels are regularly associated with bigness and lower vowels with smallness. Although this is precisely opposite to the usual pattern, in which /i/ is associated with smallness while /a/ is associated with bigness, Diffloth offers a persuasive account of an iconic basis for this divergence. He submits that in the articulation of high vowels "the tongue occupies a much larger volume of the mouth than it does for low vowels." In addition, there is greater contact between the sides of the tongue and the teeth with high vowels. These "articulatory feedback sensations" provide the basis for an iconic relationship. As Diffloth suggests, "two different languages may easily use the same phonetic variable (vowel height) to convey the same range of sensations (size), and come up with exactly opposite solutions, both being iconic; all they need to do is focus upon different parts of the rich sensation package provided by articulatory gestures" (1994:113). A model which concentrates solely on acoustic factors may be unable to account for a considerable range of sound-symbolic material.

Gordon and Heath set the stage for several avenues of further investigation: Why do women take the lead in linguistic change? Is this a universal tendency or one associated with societies having a certain type of social structure or ideology (e.g., patriarchal)? Is there a way

in which social categories other than gender connect with this model? Are sound-symbolic values integrated into a wider, nonlinguistic aesthetic for various social groups (e.g., the "jocks" and the "burn-outs")? Can this model, or a modification of it, be used to explain aesthetic values attached to phonological features or processes other than fronting and raising? This last would be a test of the model's general usefulness.

## Reply

MATTHEW GORDON AND JEFFREY HEATH  
*Calumet, Ill./Ann Arbor, Mich., U.S.A. 5 VI 98*

The general drift of the commentaries (particularly those by linguists) is that things are really more complicated than we make them out to be. Such criticism is perhaps inevitable with a paper that brings together evidence of various kinds and from various fields. It is certainly true that in our concern with general patterns we have looked past some details. However, the fact that the situation is more complex does not negate the possibility that the fundamental patterns we describe are involved as well. Before addressing this and other broader issues raised by the commentators, we would like to respond to some of the finer points made.

Rosenhouse, while cautiously supportive, calls for closer study of some of the English cases and provides additional details about Arabic dialects. She offers several suggestions as to how Arabic might restore imbalances in its vowel system due to vocalic shifts. However, the recorded history of Arabic (including the dialects) involves relatively little in the way of vocalic chain shifts, the basic inherited /i a u/ system having been moderately stable at least in the long vowels (with some exceptions). The fronting and raising of \*a and \*aa in various dialects tends to be context-sensitive rather than applying across the board. In any event, were an Arabic variety to become unbalanced by such a fronting/raising process, it would always be possible to restore homeostasis by selectively increasing and decreasing the productivity of derivational ablaut patterns, especially for nouns and their plurals.

Moroccan Arabic, for example, has a newly productive CCuCa plural (note the back and low vowels) for simple trilateral noun stems, with only weak Classical Arabic precedents. Though this development may have been ultimately driven by neutralizations of old short vowels rather than by fronting and raising processes, it suffices to show that mechanisms for altering the frequencies of particular vowels are available even in Arabic.

On another issue, Holmes and Britain, like the other commentators, suggest that diphthongal and consonantal variation should also be addressed. Haeri had included them along with (simple) vocalic cases in her 1995 paper. In principle, we agree, but we do not yet

have good data from cross-linguistic surveys or controlled experiments on the symbolic value of diphthongs or consonants. Diphthongs with a polarized nucleus and coda, such as /iw/ and /uy/, seem to have special properties. Consonantal variation is often of the lenition/fortition type, especially if a shift like that of a peripheral (velar or labial) nasal to the unmarked nasal /n/ is considered a type of lenition. Consonantal phenomena therefore quickly lead us into considerations of meticulous versus casual enunciation, and their social valuations are likely to be of a rather different character from those of (tense) steady-state vowels. Moreover, consonantal shifts may have substantial effects on the articulation and duration of adjoining vowels, an extreme case being the Arabic pharyngealization that we discussed.

Holmes and Britain also provide a list of possible counterexamples to our empirical predictions. We appreciate it, though we do not see these as particularly damaging to our hypothesis. They all involve female-led changes, most of which take place in the low and back areas of vowel space. Also, most of them apparently involve short (lax) vowels, morphological rather than phonetic change (was/were), or the inroads of national standards on regional varieties. We noted that most reported vocalic changes are led by women, commented on the importance of chronologizing chain effects, and stated that the most serious counterexamples to our model would involve male-led fronting and/or raising of tense (or long) vowels in the [æ ε e] sector. It is too early to tell how well our empirical hypotheses will stand up, though the fact that Haeri (1995) noticed similar broad differences between men and women in phonetic targets is encouraging.

One of the significant general issues raised by the commentaries is the nature of the relationship between gender-based symbolism and other aspects of social identity. Haeri makes the point that sociolinguistic changes are not controlled in a simple way by any single factor and that sex/gender interacts with class and ethnicity. Our brief discussions of "tomboy" phenomena in American and Arab contexts suggest ways in which the gender symbolism of the vocalic patterns can be manipulated in the context of groupings defined by sex, age, and class. Precisely because gender symbolism is so powerful and malleable, if we take the primary or initial force of these vocalic differences to be sex-related we can see the inevitably complex course of their sociolinguistic development as reflecting different spins on masculinity and femininity across a society. Gender has a (relatively) natural basis in sexual dimorphism and physiology, while "class" and "ethnicity" have no intrinsic biological basis and build up their symbolic substance from other, more basic phenomena. We commented, for example, on "the familiar pattern wherein symbolic masculinity is associated with a working-class milieu in contrast to the 'effeminate' refinement of the leisure class." Compare Rosenhouse's comment on the perceived "virile" and "fierce" versus "effeminate" character of Arabic dialects. An appreciation of

(symbolic) masculine or feminine qualities of geographical or social dialects is a commonplace in everyday life, whether verbalized or expressed by exaggerated imitation. We wholeheartedly agree with Haeri that interactions between gender and other categories are complex, but if we can identify the primary symbolic force of vocalic patterns as sex-related we can then more fruitfully explore how it ramifies.

Our criticism is of sociolinguistic models that take the "social" value of linguistic variation to be produced entirely by population movements which secondarily bring groups (differing in social status and, as it happens, in dialect) into contact, whereupon the dialectal features become (arbitrary) signifiers of status. There is an implicit associationist psychology here with its roots in an outdated behaviorism and a simplistically vertical sociology. While dialect mixing and official standardization are important phenomena, we argue that there is also a more primordial element underlying the social value of certain types of phonetic variation. Haeri's 1995 Festschrift paper (which we did not know of) suggests a measure of agreement with us on this point, as she considers certain phonetic processes (viz., palatalization and pharyngealization) as bearing "iconic values based on sex differences" (1995:106). However, her substantive studies of Egyptian Arabic (which we did discuss) use a fairly standard sociolinguistic interpretive framework, and the implications of such iconic relations versus other (e.g., conventional) symbolic connections are not fully explored. It appears from her commentary on our paper that she is still grappling with these issues, and it will be interesting to see how her views evolve.

Holmes and Britain offer a laundry list of bibliographical references the main point of which is to emphasize "the sociolinguistic complexity of sound change." They present no hypotheses as to what drives sociolinguistic change, but the impression given is that they believe in "hard," largely vertical, and society-specific sociological structures onto which linguistic variation is grafted. If these linguists (and others) reject the concept of causal linkages between biology and sociolinguistic behavior, they are logically committed to the claim that there is a random correlation between the linguistic (e.g., phonetic) content of variants and sex. The arbitrariness underlying such a null hypothesis is belied by the data themselves. If the pairing of sound change and social meaning were completely random, we might expect to find the ratio of vowel frontings (and raisings) to backings (and lowerings) the same for male-led and female-led changes, even if in absolute terms there are far more female-led changes. However, the data show that among female-led changes fronting (and raising) is more common than backing (and lowering), while among male-led changes the opposite is the case. Counterexamples such as those noted by Holmes and Britain may muddy the waters somewhat, but the general patterns hold. The argument for nonarbitrary connections is strengthened by the independent evidence of the symbolic associations carried by these phonetic variants

(e.g., the ethological data regarding the “frequency code”).

While sociolinguists trained in linguistics departments tend to have a rather austere notion of social science as survey methodology writ large, Zimmerman (a sociologist) understands that more abstract and integrative conceptual theorizing is normal and essential in real sociological analysis. She differs with us on one point, supporting Diffloth’s view that Bahnar reverses the usual pattern by associating bigness with high vowels and smallness with low vowels. We treated this at some length in our n.19. The problem here is that what the vocalic transformations in Bahnar denote is not bigness/smallness but intensity of verbal activities. The presumed causal model involving proprioception of tongue activity and position (perceived large tongue suggests bigness of referent) is therefore questionable. One could just as easily argue that low vowels, articulated with lowered jaw and tongue and therefore with an expanded vocal tract and mouth, should correlate with semantic bigness. Readers can try this for themselves, silently articulating a long [i] (“ee”) and then a long [a] (“ah”) and seeing if they can feel an association with object size in either case.

Still, the larger issue of whether acoustic (perceptual) or articulatory (proprioceptive) factors are more central determinants of social valuation remains an interesting one. In addition to Diffloth, we mentioned other models emphasizing proprioception which deserve consideration. Zimmerman concludes by asking whether phonological features or processes other than fronting and raising can be incorporated into our model. To the extent that meticulous/casual is a fundamental axis of consonantal variation (see above), it is possible that proprioceptive considerations play a greater role in consonantal than in (tense) vocalic variation. Given that (tense) vowels have much greater acoustic energy than consonants, it is not unthinkable that the analytical pendulum will have to swing as we go from one to the other.

## References Cited

- APPLE, WILLIAM, LYNN STREETER, AND ROBERT KRAUSS. 1979. Effects of pitch and speech rate on personal attributions. *Journal of Personality and Social Psychology* 37: 715–27.
- BAUER, LAURIE. 1996. No phonetic iconicity in evaluative morphology. *Studia Linguistica* 50:189–206. [JH, DB]
- BEDDOR, PATRICE. 1991. Predicting the structure of phonological systems. *Phonetica* 48:83–107.
- BELL, ALLAN. 1997. The phonetics of fish, chips, and ethnic identity in New Zealand. *English World-Wide* 18:243–70. [JH, DB]
- BERLIN, BRENT. 1994. “Evidence for pervasive synesthetic sound symbolism in ethnozoological nomenclature,” in *Sound symbolism*. Edited by L. Hinton, J. Nichols, and J. Ohala, pp. 76–93. Cambridge: Cambridge University Press.
- BORDEN, GLORIA, AND KATHERINE HARRIS. 1984. 2d edition. *Speech science primer*. Baltimore: Williams and Wilkins.
- BOURDIEU, PIERRE. 1979. *La distinction: Critique sociale du jugement*. Paris: Editions de Minuit.
- BREEDLOVE, S. MARC. 1994. Sexual differentiation of the human nervous system. *Annual Review of Psychology* 1994, pp. 389–418.
- BRITAIN, DAVID. 1997. Dialect contact and phonological reallocation: “Canadian raising” in the English Fens. *Language in Society* 26:15–46. [JH, DB]
- BROWN, ROGER, ABRAHAM BLACK, AND ARNOLD HOROWITZ. 1955. Phonetic symbolism in natural languages. *Journal of Abnormal and Social Psychology* 50:388–93.
- BROWN, ROGER, AND ALBERT GILMAN. 1960. “The pronouns of power and solidarity,” in *Style in language*. Edited by Thomas Sebeok, pp. 253–76. Cambridge: MIT Press.
- CAMERON, DEBORAH, AND JENNIFER COATES. 1989. “Some problems in the sociolinguistic explanation of sex differences,” in *Women in their speech communities*. Edited by Jennifer Coates and Deborah Cameron, pp. 13–26. London: Longman. [JH, DB]
- CARLSON, ROLF, GUNNAR FANT, AND BJÖRN GRANSTRÖM. 1975. “Two-formant models, pitch, and vowel perception,” in *Auditory analysis and perception of speech*. Edited by Gunnar Fant and M[arcel] A. A. Tatham, pp. 55–82. London/New York: Academic Press.
- CHAMBERS, J. K. 1980. “Linguistic variation and Chomsky’s ‘homogeneous speech community,’” in *Papers from the Fourth Annual Meeting of the Atlantic Provinces Linguistic Association*. Edited by M. Kinloch and A. B. House, pp. 1–32. New Brunswick: University of New Brunswick.
- . 1992. Linguistic correlates of gender and sex. *English World-Wide* 13:173–218. [JH, DB]
- . 1995. *Sociolinguistic theory*. Oxford and Cambridge, Mass: Blackwell.
- CHAMBERS, J. K., AND MARGARET HARDWICK. 1986. Comparative sociolinguistics of a sound change in Canadian English. *English World-Wide* 7:23–46.
- CHODOROW, NANCY. 1978. *The reproduction of mothering: Psychoanalysis and the sociology of gender*. Berkeley: University of California Press.
- CLARKE, SANDRA, FORD ELMS, AND AMANI YOUSSEF. 1995. The third dialect of English: Some Canadian evidence. *Language Variation and Change* 7:209–28.
- CONKLIN, HAROLD. 1955. Hanunóo categories. *Southwestern Journal of Anthropology* 11:339–44.
- COOPER, WILLIAM, AND JOHN ROSS. 1975. “World order,” in *Papers from the parasession on functionalism*. Edited by Robin Grossman et al., pp. 63–111. Chicago: Chicago Linguistic Society.
- DIEHL, RANDY, BJÖRN LINDBLOM, KATHRYN HOEMEKE, AND RICHARD FAHEY. 1996. On explaining certain male-female differences in the phonetic realization of vowel categories. *Journal of Phonetics* 24:187–208.
- DIFFLOTH, GÉRARD. 1994. “i: big, a: small,” in *Sound symbolism*. Edited by L. Hinton, J. Nichols, and J. Ohala, pp. 107–14. Cambridge: Cambridge University Press.
- DOTY, RICHARD. 1991. “Psychophysical measurement of odor perception in humans,” in *The human sense of smell*. Edited by David Lang, Richard Doty, and Winrich Breipohl, pp. 95–134. Berlin: Springer.
- ECKERT, PENELOPE. 1989. The whole woman: Sex and gender differences in variation. *Language Variation and Change* 1: 245–67.
- . 1991. “Social polarization and the choice of linguistic variants,” in *New ways of analyzing sound change*. Edited P. Eckert, pp. 213–32. San Diego: Academic Press.
- ECKERT, PENELOPE, AND S. MC CONNELL-GINET. 1992. Think practically and look locally: Language and gender as community-based practice. *Annual Review of Anthropology* 21:461–90. [NH]
- EISIKOVITS, EDINA. 1989. “Girl-talk/boy-talk: Sex differences in adolescent speech,” in *Australian English: The language of a new society*. Edited by Peter Collins and David Blair, pp. 35–54. Brisbane: University of Queensland Press. [JH, DB]



- ELDREDGE, NILES. 1995. *Dominion*. New York: Holt.
- ESQUIRE, GENEVIEVE. 1991. "Gender roles and linguistic variation in the Belizean Creole community," in *English around the world: Sociolinguistic perspectives*. Edited by Jenny Cheshire, pp. 595–609. Cambridge: Cambridge University Press. [JH, DB]
- FANT, GUNNAR. 1996. A note on vocal tract size factors and non-uniform F-pattern scalings. *Speech Transmission Laboratory Quarterly Progress and Status Report* 4:22–30.
- FASOLD, RALPH. 1984. *The sociolinguistics of society*. Oxford and New York: Blackwell.
- . 1990. *The sociolinguistics of language*. Oxford and Cambridge, Mass.: Blackwell.
- FEAGIN, C. 1986. "More evidence for major vowel change in the South," in *Diversity and diachrony*. Edited by D. Sankoff, pp. 83–96. Amsterdam: Benjamins. [JH, DB]
- FLEISCH, HENRI. 1961. *Traité de philologie arabe*. Vol. 1. *Préliminaires, phonétique, morphologie nominale*. Institut de Lettres Orientales de Beyrouth, Recherches, 16.
- FRAZER, TIMOTHY. 1983. Sound change and social structure in a rural community. *Language in Society* 12:313–26.
- FRIEDRICH, PAUL. 1979. "The symbol and its relative non-arbitrariness," in *Language, context, and the imagination*, pp. 1–61. Stanford: Stanford University Press.
- FURBEE, N. LOUANNA, KELLEY MAYNARD, J. JEROME SMITH, ROBERT BENFER JR., SARAH QUICK, AND LARRY ROSS. 1997. The emergence of color cognition from color perception. *Journal of Linguistic Anthropology* 6:223–40.
- GAUCHAT, LOUIS. 1905. "L'unité phonétique dans le patois d'une commune," in *Aus romanischen Sprachen und Literaturen: Festschrift Heinrich Morf*, pp. 175–232. Halle: M. Niemeyer.
- GOLDSMITH, TIMOTHY. 1991. "The evolution of visual pigments and colour vision," in *The perception of colour*. Edited by Peter Gouras, pp. 62–89. Boca Raton, Ann Arbor, and Boston: CRC Press.
- GORDON, MATTHEW J. 1997. Urban sound change beyond city limits: The spread of the Northern Cities Shift in Michigan. Ph.D. diss., University of Michigan, Ann Arbor, Mich.
- GRADDOL, DAVID, AND JOAN SWANN. 1989. *Gender voices*. Oxford: Basil Blackwell. [NH]
- HAERI, NILOOFAR. 1987. "Male/female differences in speech: An alternative interpretation," in *Variation in language: NWAV-XV*. Edited by K. M. Dennig, S. Inkelas, F. C. McNair-Knox, and J. R. Rickford, pp. 173–82. Stanford: Stanford University Press. [NH]
- . 1991. Sociolinguistic variation in Cairene Arabic: Palatalization and the qaf in the speech of men and women. Ph.D. diss., University of Pennsylvania, Philadelphia, Pa. [NH]
- . 1994. A linguistic innovation of women in Cairo. *Language Variation and Change* 6:87–112. [NH]
- . 1995. "'Why do women do this?' Sex and gender differences in speech," in *Towards a social science of language: Papers in honor of William Labov*, vol. 1. Edited by G. Guy, C. Feagin, D. Schiffrin, and J. Baugh, pp. 101–15. Amsterdam and Philadelphia: Benjamins. [NH]
- . 1997. *The sociolinguistic market of Cairo: Gender, class, and education*. London and New York: Kegan Paul International.
- HEROLD, RUTH. 1990. Mechanisms of merger: The implementation and distribution of the low back merger in eastern Pennsylvania. Ph.D. diss., University of Pennsylvania, Philadelphia, Pa. [NH]
- . 1997. Solving the actuation problem: Merger and immigration in eastern Pennsylvania. *Language Variation and Change* 9:156–89. [NH]
- HINTON, LEANNE, JOHANNA NICHOLS, AND JOHN OHALA. Editors. 1994. *Sound symbolism*. Cambridge: Cambridge University Press.
- HOLMES, JANET. 1997. Setting new standards: Sound changes and gender in New Zealand English. *English World-Wide* 18: 107–42. [JH, DB]
- HOLMQUIST, JONATHAN C. 1985. Social correlates of a linguistic variable: A study in a Spanish village. *Language in Society* 14:191–203. [JH, DB]
- HORVATH, BARBARA. 1985. *Variation in Australian English*. Cambridge: Cambridge University Press.
- IBRAHIM, M. 1986. Standard and prestige language: A problem in Arabic sociolinguistics. *Anthropological Linguistics* 28:115–26. [NH]
- JAKOBSON, ROMAN, GUNNAR FANT, AND MORRIS HALLE. 1961. *Preliminaries to speech analysis*. Cambridge: MIT Press.
- JAKOBSON, ROMAN, AND LINDA WAUGH. 1979. *The sound shape of language*. Bloomington and London: Indiana University Press.
- JAMES, DEBORAH. 1996. "Women, men, and prestige speech forms: A critical review," in *Rethinking language and gender research: Theory and practice*. Edited by Victoria L. Bergvall, Janet M. Bing, and Alice F. Freed, pp. 98–125. New York: Longman. [JH, DB]
- JESPersen, OTTO. 1922. *Language: Its nature, development, and origin*. London: Allen and Unwin.
- . 1933. "Symbolic value of the vowel I," in *Linguistica: Selected papers in English, French, and German*, pp. 283–303. Copenhagen: Levin and Munksgaard.
- KAHN, MARGARET. 1975. Arabic emphatics: The evidence for cultural determinants of phonetic sex-typing. *Phonetica* 31:38–50.
- KERSWILL, PAUL. 1994. *Dialects converging*. Oxford: Clarendon Press. [JH, DB]
- KROCH, ANTHONY. 1978. Towards a theory of social dialect variation. *Language in Society* 7(1):17–36.
- LABOV, WILLIAM. 1966. *The social stratification of English in New York City*. Washington, D.C.: Center for Applied Linguistics.
- . 1972a. *Language in the inner city: Studies in the Black English Vernacular*. Philadelphia: University of Pennsylvania Press.
- . 1972b. "Hypercorrection by the lower middle class as a factor in linguistic change," in *Sociolinguistic patterns*, pp. 122–42. Philadelphia: University of Pennsylvania Press. (Reprinted from *Sociolinguistics*, edited by William Bright, pp. 84–102. The Hague: Mouton, 1966.)
- . 1972c. "The social motivation of a sound change," in *Sociolinguistic patterns*, pp. 1–42. Philadelphia: University of Pennsylvania Press. (Reprinted from *Word* 19[1963]:273–309.)
- . 1982. "Building on empirical foundations," in *Perspectives on historical linguistics: Current issues in linguistic theory*, vol. 24. Edited by W. Lehmann and Y. Malkiel, pp. 17–92. Philadelphia: Benjamins. [NH]
- . 1990. The intersection of sex and social class in the course of linguistic change. *Language Variation and Change* 2:205–54.
- . 1994. *Principles of linguistic change*. Vol. 1. *Internal factors*. Oxford and Cambridge, Mass.: Blackwell.
- LABOV, WILLIAM, AND DAVID FANSHIEL. 1977. *Therapeutic discourse*. New York: Academic Press.
- LABOV, WILLIAM, MALCAH YAEGER, AND RICHARD STEINER. 1972. *A quantitative study of sound change in progress*. Philadelphia: U.S. Regional Survey.
- LADEFOGED, PETER. 1982. 2d edition. *A course in phonetics*. New York: Harcourt Brace Jovanovitch.
- LADEFOGED, PETER, AND IAN MADDIESON. 1996. *The sounds of the world's languages*. Oxford and Cambridge, Mass.: Blackwell.
- LA POLLA, RANDY. 1994. "An experimental investigation into phonetic symbolism as it relates to Mandarin Chinese," in *Sound symbolism*. Edited by L. Hinton, J. Nichols, and J. Ohala, pp. 130–47. Cambridge: Cambridge University Press.
- LEWIS, MORRIS. 1936. *Infant speech: A study of the beginnings of language*. London: K. Paul, Trench, Trubner.
- LIEBERMAN, PHILIP. 1967. *Intonation, perception, and language*. Cambridge: MIT Press.
- LOPREATO, JOSEPH. 1984. *Human nature and biocultural evolution*. Boston: Allen and Unwin.



- LUTHIN, HERBERT. 1987. "The story of California (ow): The coming-of-age of English in California," in *Variation in language: NWAV-XV at Stanford*, pp. 312–24. Stanford: Department of Linguistics, Stanford University.
- MC BRIDE, GLEN. 1971. "The nature-nurture problem in social evolution," in *Man and beast: Comparative social behavior*. Edited by John Eisenberg and Wilton Dillon, pp. 35–56. Washington, D.C.: Smithsonian Institution.
- MC EWEN, BRUCE. 1991. "Sex differences in the brain: What they are and how they arise," in *Woman and men*. Edited by M. Notman and C. Nadelson, pp. 35–41. Washington, D.C., and London: American Psychiatric Press.
- MARTINET, ANDRÉ. 1955. *L'économie des changements phonétiques*. Berne: Francke.
- MATISOFF, JAMES. 1994. "Tone, intonation, and sound symbolism in Lahu: Loading the syllable canon," in *Sound symbolism*. Edited by L. Hinton, J. Nichols, and J. Ohala, pp. 115–29. Cambridge: Cambridge University Press.
- MATTINGLY, IGNATIUS. 1966. Speaker variation and vocal tract size. *Journal of the Acoustical Society of America* 39: 1219.
- MEDITCH, ANDREA. 1975. The development of sex-specific speech patterns in young children. *Anthropological Linguistics* 17:421–33.
- MILROY, JAMES. 1992. *Linguistic variation and change*. Oxford: Blackwell.
- MILROY, JAMES, AND LESLEY MILROY. 1985. Linguistic change, social network, and speaker innovation. *Journal of Linguistics* 21:339–84.
- . 1993. Mechanisms of change in urban dialects: The role of class, social network, and gender. *International Journal of Applied Linguistics* 21:339–84.
- MILROY, LESLEY. 1987 [1980]. 2d edition. *Language and social networks*. Oxford: Blackwell.
- . 1992. "New perspectives in the analysis of sex differentiation in language," in *Sociolinguistics today: International perspectives*. Edited by Kingsley Bolton and Helen Kwok, pp. 163–79. London: Routledge. [JH, DB]
- MORTON, EUGENE. 1977. On the occurrence and significance of motivation-structural rules in some bird and mammal sounds. *American Naturalist* 111:855–69.
- MULAC, ANTHONY, AND TORBORG LUNDELL. 1986. Linguistic contributors to the gender-linked language effect. *Journal of Language and Social Psychology* 5:81–101.
- NATHANS, JEREMY, SHANNATH MEBS, CHING-HWA SUNG, CHARLES WEITZ, AND YANSHU WANG. 1992. Molecular genetics of human visual pigments. *Annual Review of Genetics* 26:403–24.
- NEGUS, VICTOR. 1949. *The comparative anatomy and physiology of the larynx*. New York: Hafner.
- NEITZ, MAUREEN, AND JAY NEITZ. n.d. "Molecular genetics and the biological basis of colour vision," in *Color vision*. Edited by W. Backhaus, R. Kliegl, and J. Werner. Berlin/New York: de Gruyter. In press.
- NEITZ, MAUREEN, JAY NEITZ, AND GERALD JACOBS. 1991. Spectral tuning of pigments underlying red-green color vision. *Science* 252:971–74.
- NEWMAN, STANLEY. 1933. Further experiments on phonetic symbolism. *American Journal of Psychology* 45:53–75.
- NICHOLS, JOHANNA. 1971. Diminutive consonant symbolism in western North America. *Language* 47:826–48.
- NOTMAN, MALKAH, AND CAROL NADELSON. 1991. *Women and men: New perspectives on gender differences*. Washington, D.C., and London: American Psychiatric Press.
- OHALA, JOHN. 1984. An ethological perspective on common cross-language utilization of  $F_0$  of voice. *Phonetica* 41:1–16.
- . 1994. "The frequency code underlies the sound-symbolic use of voice pitch," in *Sound symbolism*. Edited by L. Hinton, J. Nichols, and J. Ohala, pp. 325–47. Cambridge: Cambridge University Press.
- PETERSON, GORDON, AND HAROLD BARNEY. 1952. Control methods used in a study of the vowels. *Journal of the Acoustical Society of America* 24:175–84.
- PISONI, DAVID. 1997. "Some thoughts on 'normalization' in speech perception," in *Talker variability in speech processing*. Edited by Keith Johnson and John Mullennix, pp. 9–32. San Diego: Academic Press.
- ROSENHOUSE, JUDITH. 1995. "Features of women's speech in Arabic dialects: An interim survey." *Proceedings of the 2nd International Conference of l'Association Internationale pour la Dialectologie Arabe (Cambridge, England 10–14 September 1995)*, pp. 207–16. Cambridge: Middle East Centre, University of Cambridge.
- ROYAL, A. M. 1985. Male/female pharyngealization patterns in Cairo Arabic: A sociolinguistic study of two neighborhoods. Ph.D. diss., University of Texas, Austin, Tex.
- RUSSELL, JOAN. 1982. "Networks and sociolinguistic variation in an African urban setting," in *Sociolinguistic variation in speech communities*. Edited by Suzanne Romaine, pp. 125–40. London: Edward Arnold. [JH, DB]
- SACHS, JACQUELINE. 1975. "Cues to the identification of sex in children's speech," in *Language and sex: Difference and dominance*, Edited by Barrie Thorne and Nancy Henley, pp. 152–71. Rowley, Mass.: Newbury House.
- SACHS, JACQUELINE, PHILIP LIEBERMAN, AND DONNA ERICKSON. 1973. "Anatomical and cultural determinants of male and female speech," in *Language attitudes: Current trends and prospects*. Edited by Roger Shuy and Ralph Fasold, pp. 74–84. Washington, D.C.: Georgetown University Press.
- SAPIR, EDWARD. 1949a [1929]. "A study in phonetic symbolism," in *Selected writings of Edward Sapir*. Edited by David Mandelbaum, pp. 61–72. Berkeley: University of California Press. (Reprinted from *Journal of Experimental Psychology* 12: 225–39.)
- . 1949b [1915]. "Abnormal types of speech in Nootka," in *Selected writings of Edward Sapir*. Edited by David Mandelbaum, pp. 179–96. (Reprinted from *Canada Geological Survey Memoir* 62, *Anthropological Series* 5.)
- SILVERSTEIN, MICHAEL. 1994. "Relative motivation in denotational and indexical sound symbolism of Wasco-Wishram Chinookan," in *Sound symbolism*. Edited by L. Hinton, J. Nichols, and J. Ohala, pp. 40–60. Cambridge: Cambridge University Press.
- STEVENS, KENNETH. 1989. On the quantal nature of speech. *Journal of Phonetics* 17:3–45.
- TAGLIAMONTE, SALI. 1997. *Was/were* variation across the generations: The view from the city of York. Paper presented at the First Language Variation Workshop, University of Reading, April. [JH, DB]
- TARTE, ROBERT. 1982. The relationship between monosyllables and pure tones: An investigation of phonetic symbolism. *Journal of Verbal Learning and Verbal Behavior* 21:352–60.
- THOMAS, BETH. 1988. "Differences of sex and sects: Linguistic variation and social networks in a Welsh mining village," in *Women in their speech communities: New perspectives on language and sex*. Edited by Jennifer Coates and D. Cameron, pp. 51–60. London: Longman.
- TRAUNMÜLLER, HARTMUT. 1981. Perceptual dimension of openness in vowels. *Journal of the Acoustical Society of America* 69:1465–75.
- TRUDGILL, PETER. 1974a. *The social differentiation of English in Norwich*. Cambridge: Cambridge University Press.
- . 1983 [1974]. 2d edition. *Sociolinguistics: An introduction to language and society*. Harmondsworth and New York: Pelican Books.
- ULTAN, RUSSELL. 1978. "Size-sound symbolism," in *Universals of human language*, vol. 2, *Phonology*, Edited by Joseph Greenberg, pp. 525–68. Stanford: Stanford University Press.
- VAN DE VELDE, HANS, ROELAND VAN HOUT, AND MARINEL GERRITSEN. 1997. Watching Dutch change: A real-time study of variation and change in standard Dutch pronunciation. *Journal of Sociolinguistics* 1:361–91. [JH, DB]
- WAHBA, KASSEM. "Linguistic variation in Alexandrian Arabic," in *Understanding Arabic: Essays in contemporary Arabic linguistics in honor of El-Said Badawi*. Edited by Alaa Elgibali, pp. 103–28. Cairo: American University in Cairo Press.

- WALTERS, KEITH. 1991. "Women, men, and linguistic variation in the Arab world," in *Perspectives on Arabic linguistics*. Edited by Bernard Comrie and Mushira Eid, pp. 119–229. Amsterdam and Philadelphia: Benjamins.
- . 1994. "Imagining language and gender at home and abroad," in *Communication in, through, and across cultures: Proceedings of the 1994 Berkeley Women and Language Conference*. Edited by M. Bucholtz, A. Liang, and L. Sutton. Berkeley. [NH]
- WEINREICH, U., W. LABOV, AND M. HERZOG. 1968. "Empirical foundations for a theory of language change," in *Directions for historical linguistics*. Edited by W. Lehmann and J. Malkiel, pp. 95–188. Austin: University of Texas Press. [NH]
- WHALEN, D. H., AND A. G. LEVITT. 1995. The universality of intrinsic  $F_0$  of vowels. *Journal of Phonetics* 23:349–66.
- WILLIAMS, LYNN. 1983. The pronunciation of women: Some Spanish evidence. *Language and Communication* 3:171–90.
- WINDERICKX, JORIS, DELWIN LINDSEY, ELIZABETH SANOCKI, DAVIDA TELLER, ARNO MOTULSKY, AND SAMIR DEEB. 1992. Polymorphism in red photopigment underlies variation in colour matching. *Nature* 356:431–33.
- WOLFRAM, WALT, AND RALPH FASOLD. 1974. *The study of social dialects in American English*. Englewood Cliffs: Prentice-Hall.
- YAEGER-DROR, M. 1986. "Changements en chaîne dans le français montréalais," in *Diversity and diachrony*. Edited by D. Sankoff, pp. 223–38. Amsterdam: Benjamins. [JH, DB]
- YANG, BYUNG-GON. 1996. A comparative study of American English and Korean vowels produced by male and female speakers. *Journal of Phonetics* 24:245–61.
- ZAJONC, R[OBERT] B., SHEILA, MURPHY, AND MARITA INGLEHART. 1989. Feeling and facial efference: Implications of the vascular theory of emotion. *Psychological Review* 96: 395–416.

