

# 19 Sociophonetics

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## 1 Introduction

In general terms, sociophonetics involves the integration of the principles, techniques, and theoretical frameworks of phonetics with those of sociolinguistics. However, there has been considerable variation both in the usage of the term and the definition of the field, so that sociophonetic research may orient more towards the concerns of sociolinguists on the one hand or phoneticians on the other.

The first recorded use of the term “socio-phonetic” (*sic*) is by Deshaies-Lafontaine (1974), a dissertation on variation in Canadian French carried out squarely within the emergent field of Labovian or variationist sociolinguistics. The term was coined as a parallel to “sociolinguistic” in order to capture the project’s emphasis on phonetic rather than syntactic or lexical variables (Deshaies, p.c.).<sup>1</sup> Among phoneticians, sociophonetics has been used as a thematic label at the quadrennial International Congress of Phonetic Sciences (ICPhS) since 1979. The nine papers presented under this heading at the 1979 conference followed the pattern set by Deshaies-Lafontaine in addressing central questions in sociolinguistics with reference to phonetic variables. Contributions included papers by eminent sociolinguists such as Labov (on vowel normalization) and Romaine (on variation and change in Scottish /r/). Probably the first example of explicitly sociophonetic work published in a prominent journal is the variationist study of Viennese German by Dressler and Wodak (1982, although they prefer the epithet “sociophonological,” with synonymous intent).

Since these early studies the quantity of research which can be described as sociophonetic has increased rapidly, particularly since the mid 1990s, and the scope of that research has become ever broader. To support this observation it is instructive to survey the set of papers presented at the 2003 ICPhS. Around 90 papers were presented on topics with a sociolinguistic connection, such as variation, change, socially informed fieldwork, and speaking style. However, discussions also included subjects as diverse as the phonological relationship

between liquids, descriptive accounts of Albanian and Cocos Malay, loanword pronunciation, conversation analysis, methods for developing large corpora, and psycholinguistic experiments on information processing.

Indeed, given the recent growth of the field and the disparate paths it has taken, providing an adequate definition of sociophonetics is far from straightforward. The discipline draws upon a rich empirical corpus which is generated through a wide set of methods and which is exploited to address a diverse range of theoretical questions. Circumscription of the field is similarly problematic. The boundaries of the discipline have become increasingly porous, such that sociophonetic research now amalgamates theories and methods not only from phonetics and sociolinguistics but also from related fields including psycholinguistics, clinical linguistics, first language (L1) and second language (L2) acquisition, theoretical phonology, and computational linguistics. At the same time, though, the eclecticism of sociophonetics may be misinterpreted as indicating a lack of clear focus. Its development through the marriage of traditionally separate disciplines has also led, perhaps, to its being viewed as a relatively peripheral concern to its contributory fields. However, whilst it remains something of a loose confederation of industries, the inclusion of this chapter in the second edition of this handbook bears witness to the claims of sociophonetics to be an independent discipline. With this in mind our goal in this chapter is both to survey the current state of the field and in doing so also attempt to delimit and define it. We will point to a number of important contemporary theoretical issues in phonetics more broadly where we think progress can best be made through work that draws on sociophonetic concepts and methods.

In our view, the unifying theme of sociophonetic work is the aim of identifying, and ultimately explaining, the sources, loci, parameters, and communicative functions of socially structured variation in speech. In this view the goals of sociophonetics include accounting for how socially structured variation in the sound system is learned, stored cognitively, subjectively evaluated, and processed in speaking and listening. Such work contributes to the development of theoretical models in phonetics and sociolinguistics, spanning speech production and perception, with a clear focus on the origin and spread of change. Sociophonetic methods and data also contribute to theoretical models in phonology, acquisition, and long-term storage of linguistic knowledge, because of the field's focus on fine phonetic detail, and structured variation.

Methodologically, socially structured variation offers great opportunities for experimental phoneticians to exploit, because micro-typological studies fall neatly between cross-linguistic and idiolexical comparisons. The fine granularity of the differences between related socially located linguistic systems provides an invaluable research tool, albeit one which has to date largely been exploited in cross-dialectal research defined geographically rather than socially. Phonetic research often draws on homogeneous pools of subjects to suppress variation, but intersubject differences in fine phonetic detail which function socially can be used in order to understand both the variation and the aspects which are common across closely related systems, by using structured pools of subjects.

We continue this overview with a brief explanation of socially structured variation, identifying the kinds of phenomena that are investigated in sociophonetic studies. We then survey representative studies, first those with a focus on speech production, followed by a discussion of sociophonetically informed studies of speech perception. We highlight a number of important methodological issues and the principal theoretical contributions made by sociophonetic work. Finally, we address the potential contributions of sociophonetics to applied fields.<sup>2</sup>

## 2 Defining Sociophonetic Variation

Speech provides various kinds of information simultaneously, a fact recognized by the earliest scholars of language (see for example Chambers' 2002 discussion of the Sanskrit grammarian Pāṇini, writing in c. 600 BC). In modern linguistics it has become customary to draw a binary division between linguistic and extra-linguistic, or indexical, information.

Linguistic information is that conveyed in respect of propositional meaning – what we might loosely characterize as assertions about the world that can be abstracted from their contexts of utterance. We can generally identify multiple utterances as linguistically equivalent even if they are pronounced in different ways. We do this by selectively attending to the linguistic information carried by the signal, as we do when, for instance, writing down utterances using a standardized orthography.

As well as permitting the communication of semantic information, however, speech also provides a rich source of indexical information reflecting, for example, a speaker's background, pragmatic intent, and emotional state (Abercrombie, 1967).<sup>3</sup> Some sources of indexical information emerge as the product of the universal constraints of biology and physics. Organic factors, such as vocal tract anatomy and physiology, exert a clear influence on vowel formant values and fundamental frequency such that relatively abrupt differences can be observed between adult males, females, and children. Similar effects underlie developmental aspects of first language acquisition and physical changes through the life course, most noticeably in old age. Other indexical features are purely a social product, that is, arbitrary associations between linguistic variants and types of speaker or speech. To illustrate, a much cited example is that of coda (postvocalic) /r/ in English (e.g., Scobbie, 2006b). Studies of so-called rhotic varieties (e.g., in North America, Ireland, and Scotland) have found statistical differences in the production of coda /r/ across social classes (e.g., Labov, 1972; Reid, 1978; Romaine, 1978; Stuart-Smith, 2007a). In these varieties, members of higher socio-economic groups typically use audible consonantal rhoticity more than those of lower social groups. The rhotic nature of coda /r/<sup>4</sup> can therefore be said to index social class. The arbitrariness of the association between rhoticity and class is illustrated when we compare the same phonetic quality in non-rhotic dialects (e.g., in England), where the opposite social evaluation of coda /r/ can be observed: a rhotic pronunciation of the final consonant in a word like *car* when it is a coda is often taken as a sign of low rather than high social status (Wells, 1982, p. 35).

The example of English coda /r/ illustrates both the importance of social factors in directing change and, at this level of description, its phonetic arbitrariness. In both rhotic and non-rhotic communities variation encompasses phonetic weakening and vocalization of coda /r/, a commonality which phonetic and phonological theory attempt to explain. But considering the phenomenon in isolation from its social context, through study of articulatory, acoustic, or perceptual data, is likely to be less revealing than research which incorporates extra dimensions from sociophonetics which explore the functionality and indexical meanings of the variants and their role in the establishment of structured variation and the transmission of change.

The indexical functions of a linguistic variable are usually manifested in statistical differences in a form's distribution across speakers, groups, or speech styles, rather than resulting from categorical usage or non-usage of a particular variant. This is certainly true in the case of studies of English /r/, for instance. However, examples of the latter can be found: Macaulay (1991) found that use of the monophthong [ʌ] rather than [ʌʀ] in words like *house* and *down* in Scottish English was frequent in the speech of his working-class informants, but was altogether absent among his middle-class speakers. Discrete phonological differences have also been reported for males and females in other languages, including Gros Ventre (Taylor, 1982) and Chukchi (Dunn, 2000).

A central question in the study of indexical features is how universal and social constraints interact. Johnson (2006), for example, compares vowel formant spaces for males and females in 17 languages and dialects. The magnitude of differences in F1/F2 distribution varies substantially across the languages, indicating that biology alone cannot account for the variation (see also Rosner & Pickering, 1994, pp. 49–73). Furthermore, there is evidence from studies of children which shows differences in average fundamental frequency, formant values, and voice quality between prepubescent boys and girls. These findings suggest that some gender-appropriate speech behavior must be learned in childhood rather than being determined solely by anatomical differences between the sexes (Sachs, 1975; Lee et al., 1995; Sederholm, 1998; Whiteside, 2001). It can therefore be difficult, even impossible, to disentangle socially-influenced variation from variation which is the product of biology and physics. In light of the difficulties presented to the analyst by this convolution of sources of variability, we recognize as sociophonetic any aspect of systematic phonetic variation in which the indexed factor is at least *in part* the product of social construction (following Foulkes & Docherty, 2006, p. 412).

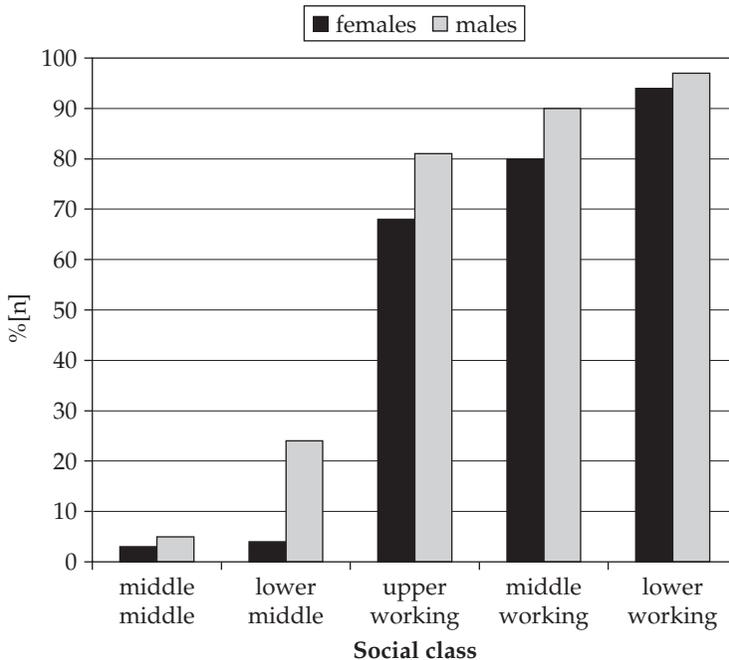
### 3 Sociophonetic Studies of Speech Production

#### 3.1 Sources of variation

The majority of work carried out under the rubric of sociophonetics has focused on identifying the indexical roles of features of speech production. It has been

established that speech varies in systematic ways as a function of a very wide range of social factors. This has been one of the fundamental contributions of Labovian sociolinguistics more generally, and is reflected in the early sociophonetic works referred to in the introduction. One of Labov's principal motivations at the inception of his highly influential studies of English in New York City was to show, contra earlier works on American urban varieties such as Hubbell (1950), that linguistic variation is not random, inexplicable, or theoretically irrelevant. This manifesto, laid out explicitly in Labov (1966a), informs all subsequent work carried out under the variationist sociolinguistics banner.

Early sociolinguistic work focused on sources of variation identified as correlating with broad demographic categories such as social class, age, speaker sex, and ethnicity, and with speaking style (e.g., Labov, 1966b; Labov et al., 1972). Figure 19.1 represents a typical example, illustrating quantified data for (ng) from Norwich English (Trudgill, 1974). The sociolinguistic variable (ng) refers to the final nasal in gerunds (*walking*, etc.) as well as in polysyllabic monomorphemes such as *ceiling* and in the words *anything*, *everything*, *nothing*, and *something*. In all varieties of English so far studied, speakers alternate between using the standard velar nasal [ŋ] and the nonstandard alveolar [n]. However, the data in Figure 19.1 show that variant selection is not random. Instead, it displays *structured heterogeneity* (Weinreich et al., 1968), correlating with both the sex and social class of the speaker.



**Figure 19.1** Usage of non-standard variant [n] for (ng) in Norwich English. (Adapted from Trudgill, 1974, p. 94)

Use of [n] is lowest for the middle-class groups, and rises across the social continuum, with an abrupt leap for the upper working class relative to the lower middle class. In all social groups the men use more [n] than the women. Use of [n] in Norwich is therefore an index of speaker gender and especially of social class.

Figure 19.1 is a typical example of early sociolinguistic research in that it shows that vernacular or nonstandard forms tend to be more frequent for males and for members of lower socio-economic groups. However, plenty of counter-examples have since been reported which reflect particularly marked social differences in the community under investigation. One such example is Mees and Collins' (1999) analysis of the distribution of glottalization features in Cardiff English, in which, contrary to the pattern found in other parts of the UK, glottal pronunciations of preconsontal and prepausal /t/ are apparently evaluated locally as prestigious. In another example, Watt and Milroy (1999) discuss variation in Newcastle English in the vowels of the FACE, GOAT, and NURSE lexical sets (following the notation system devised by Wells, 1982). The patterns of variation do not align on a standard–nonstandard continuum. Instead, younger females appear to be leading a change away from the traditional local vernacular forms [fɪəs], [gʊət], and [nɜ:s] towards other nonstandard variants that have wider currency across the north of England: [fe:s], [go:t] and [nø:s].

Much sociolinguistic work since the 1960s, informed by theoretical advances from adjacent fields such as sociology and anthropology, has been devoted to refining our understanding of the relevant social sources of variation. One important result of such work has been a move beyond broad demographic categories in both methodology and theorizing. We offer below a brief review of some important advances in our understanding of the main sources of learned variability.

**3.1.1 Social class, communities, and networks** Ash (2002) discusses problems in defining and measuring social class, and assesses the value of class for studies in non-Western societies (see for example Haeri's (2003) critique of conventional notions of class, gender, and speech style among Cairene Arabic speakers). Yet social/stylistic stratification of some kind, e.g., diglossia (Ferguson, 1959), can occur in many different societies, including those where Western analytic categories may not straightforwardly apply. And even in Western societies, concepts such as social class require deconstruction in order to identify more precisely the root causes and functions of linguistic variation. For example, studies in the *communities of practice* framework (Eckert & McConnell-Ginet, 1999; Meyerhoff, 2002) show how linguistic forms are affected by an individual's chosen membership of groups. Groups may be defined at a local level (such as belonging to a particular sports team or professional organization), but they may also reflect more widespread and abstract patterns of social practice (exemplified by adolescents and their choices in behaviors, clothing, slang terminology, and arguably vernacular pronunciation on a nationwide basis).

Mendoza-Denton's work on the language of young Latina gang girls in California, for instance, links sociophonetic and discourse variation to gang members'

“expectation-violating” modes of (nonlinguistic) behavior, such as fighting, that transgress what is conventionally considered appropriate for young women (Mendoza-Denton, 1996, 1999). Linguistic choices are viewed as one type of symbolic resource in the construction and maintenance of identities. In a similar vein, Bucholtz (1998, 1999) demonstrates that “nerds” (students who consciously adopt an “uncool” identity) differentiate themselves from their peers through various social practices including phonetic and linguistic choices. Californian nerds, for instance, did not participate in ongoing vowel changes such as fronting of GOAT and GOOSE, used released forms of word-final /t/ instead of the typical unreleased or glottalized forms, and avoided current slang. Other studies on the role of phonetic variants in establishing social identity include Eckert (2000) on socially polarized school groups, Kiesling (1998) on members of American college fraternities and sports teams, and Bunin Benor (2001) on orthodox Jewish women. There is a relatively wide collection of studies on the phonetic properties of gay, lesbian, and bisexual speakers and speech styles, including Pierrehumbert et al. (2004), Munson et al. (2006), and Munson (2007). It is increasingly apparent from studies such as these that individuals exercise a considerable degree of choice – whether conscious or subconscious – over the phonetic forms they use in their speech, within the constraints imposed by intelligibility considerations. These choices can make an essential contribution to the indexing of personal stance, identity, and communicative function. The freedom which speakers have to define, use, change, and move between different identity-based sociolects starkly shows the pitfalls which phoneticians and phonologists risk by failing to take social variation into account when positing functional explanations for patterns that may exist in a standard variety, but in a different form in other varieties.

The individual’s degree of entrenchment in a group has also been assessed through studies which take account of the speaker’s *social network* (Milroy, 1987b). Generally speaking, the more central the place of the individual in a group, the stronger their adherence to the group’s norms of behavior and the greater the normative influence of linguistic forms associated with that group. For example, Labov (1972) investigated several sociolinguistic variables in the speech of the rival Harlem street gangs, the Aces and the Thunderbirds. Members of both gangs used many nonstandard phonological forms, including [n] for (ng) and [d] or [v] for (th) (in *brother*, etc.). The nonstandard usage of core members was relatively similar across the gangs, and considerably higher than that for peripheral associates of either gang. Strength of social networks may also be affected by factors such as differences in geographical *mobility* (Britain, 2002), the extent of *routine* behaviors such as those based around sport and leisure activities (Britain, 1997), and general social structures such as patterns of employment (Milroy, 1987b).

Network strength and structure interact in complex ways with the more conventional demographic categories typically employed in sociolinguistic research. For example, Dubois and Horvath’s (1998, 1999) study of variability in dental fricatives among Louisiana Cajun English speakers revealed a resurgent use of the traditional stops [t̪] and [d̪] (for /θ/ and /ð/ respectively) by younger informants (20–39 years of age). The informants were distinguished by their membership of

networks which were described as either “closed” (enclave or otherwise insular communities) or “open” (in which individuals are more participative in wider society). The revitalization of (th)-stopping, they argue, is best accounted for by attending to speakers’ membership of open and closed networks as well as by their gender. Young closed network men and women tended to “recycle” the traditional stop variants, but among open network speakers this habit was only observed among men. (th)-stopping in Cajun English thus has multiple indexical functions which differ depending on the relative openness of the networks in which its speakers are integrated. Dubois and Horvath link the resurgence of the stop variants to a revival of positive associations with the formerly stigmatized Cajun culture and identity.

**3.1.2 Age and life stages** Biological age is obviously an important contributor to phonetic and linguistic differences through childhood (Vihman, 1996) and again in later life (Beck, this volume). However, age differences may also reflect socially determined divisions of the age continuum, or *life stages*. Eckert (1997) argues that in most Western societies there are three main life stages: childhood, adolescence, and adulthood. Each is defined by major differences in typical lifestyle, which in turn exert radically different influences both on general behavior and specifically language use. The number of stages, their distinct patterns of social behavior, and their effects on language may differ from society to society or change over time. Speakers of particular ages in particular communities may also show marked linguistic differences as a consequence not only of long-term social convention, but also because of major historical or social events. In his study of dialect change in Gaza Arabic, for example, Al Shareef (2002) divided speakers into age groups according to their experiences of mass migration into Gaza following political events in 1948 and 1967. Those who were adults before 1948 were found to maintain their original local dialects, while those born after migration showed effects of contact with other dialects.

In childhood, lifestyle is dominated by the family setting. Children receive the bulk of their linguistic input from the immediate family and they conform broadly to the norms of the input model(s). For example, Foulkes and Docherty (2006) examined the use of pre-aspirated voiceless stops in Newcastle English, finding a close correlation between usage by 2- to 4-year-old children and that of their mothers. Kerswill and Williams (2000) offer a clear illustration of the importance of the home model in their study of children’s speech in Milton Keynes, a town which underwent huge expansion in the 1960s to create a commuter residence for London and other cities in the south east of England. As a result the new town experienced very high rates of in-migration from all over the UK and further afield. In Kerswill and Williams’ study, 4-year-old children showed great phonological diversity as a group, reflecting the mix of dialects in their homes. Children of rhotic parents, for example, displayed rhoticity themselves.

Input variation has also been the focus of a series of studies on acquisition of Scottish English, including Hewlett et al. (1999) and Scobbie (2005). They examined the acquisition of the complex phonological pattern referred to as the Scottish

Vowel Length Rule (SVLR). Most varieties of English display vowel length differences dependent on the voicing of the following consonant such that the vowels of *brood* and *bruise* are longer than that of *brute*. The effect of the SVLR is that vowels preceding voiced stops are also short, such that in SVLR accents *brood* and *brute* are short, while *bruise* is long. The impact on acquisition of SVLR of different parental models was assessed, considering whether children have two, one, or no Scottish parents. Their findings indicate that the pattern is harder to learn if one or neither parent is Scottish. Scobbie (2005) shows in detail how a “mixed” speaker can incorporate aspects of both parental and community targets to result in new and typologically marked patterns. Sociophonetic studies can therefore be highly instructive for our understanding of phonological acquisition. A great deal can be learnt from how children form their own system (Vihman, 1996) on the basis of different input systems, whether the inputs vary as part of the community’s sociolinguistic norms (the standard sociolinguistic focus), or between the family and the community at large, or even within the family.

Through childhood and into adolescence the social role of the peer group begins to take over. Linguistically, the adolescent period is frequently characterized by a shift away from the family model in favor of high usage of nonstandard forms, high usage of forms that are innovative in any ongoing sound change, and homogeneity of usage across the peer group. The Milton Keynes study again illustrates such a shift. Compared with the 4-year-olds, children aged 8 and 12 years showed increasing divergence from their parental models, but increasing focusing of the dialect within the peer group. Minority forms such as rhoticity had disappeared by age 6 (Kerswill & Williams, 2000).

In adulthood, lifestyle may settle again, and the exigencies of career choices may lead to particular language varieties taking on a certain *market value* for the speaker, depending on communicative function. For example, Coupland (1980) discusses the value of both local Cardiff speech and standard varieties for a worker in a travel agency. Pappas (2006) gives an account of stigmatized local pronunciations of /l/ and /n/ in Patra Greek, showing that use of stigmatized variants, and attitudes towards them, correlate with speakers’ orientations towards metropolitan versus provincial lifestyles and their associated employment aspirations (see also Brouwer & van Hout, 1992).

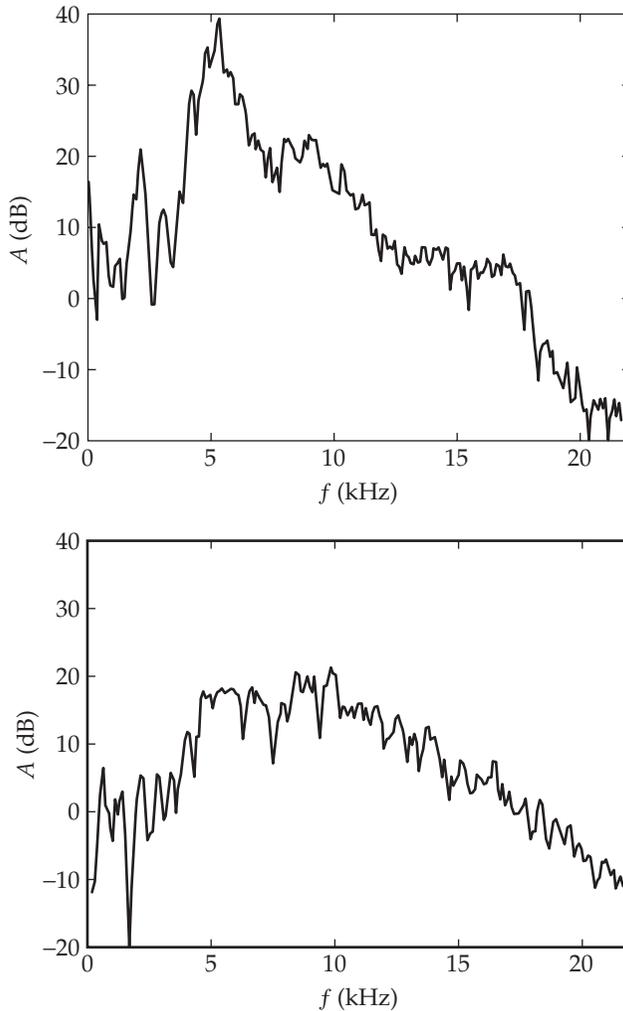
**3.1.3 Sex and gender** Speaker sex has often been investigated in phonetic as well as sociolinguistic studies, perhaps because the biological effects of speaker sex on speech are in many respects obvious and impossible to avoid (for phonetic studies with a particular focus on sex-based differences, see, e.g., Byrd, 1994; Whiteside et al., 2004; Simpson & Ericsson, 2007; Jacewicz et al., 2007). For their part, sociolinguists have come to focus more on the socially constructed and “performed” roles of gender rather than the binary category of biological sex (Butler, 1990; Hall & Bucholtz, 1995; Eckert, 2000; Cheshire, 2002). The importance of gender in understanding language use is grounded on the observation that males and females tend to compete with, and evaluate themselves against, members of their own gender (Eckert, 2000, p. 122). To understand variation in speech it is

therefore important to explore differences *within* gender groups rather than focus on simple male/female comparisons. The specific question for sociophonetics is how these factors of sex and gender interact. The extent to which biological sex differences might directly underpin apparently arbitrary gender differences with respect to sociolinguistic behavior has received less attention, however. Gordon and Heath (1998) attempt to draw explicit links between biological sex and male/female differences in the extent of participation in ongoing sound changes by pointing to “intrinsic” sex-based preferences in the sound symbolic domain. They argue on the basis of synchronic and historical data from a range of languages that women tend to lead vowel changes towards the close front region of the vowel space, while men are predisposed towards changes involving vowel retraction and rounding.

The importance of gender as opposed to sex is illustrated in studies such as that by McConnell-Ginet (1983), Johnson (2006), and Stuart-Smith (2007b). Stuart-Smith, for example, provides a detailed study of [s] production by 32 English speakers from Glasgow. Anatomical differences between males and females predict acoustic differences in [s], such that the smaller vocal tract typical for a woman would produce an [s] with aperiodic energy at a higher overall frequency than the larger male vocal tract (Stevens, 1998, p. 398). However, in Stuart-Smith’s study, the acoustic data from working-class girls patterned with those from males. Figure 19.2 shows the long-term average spectrum (LTAS) for the [s] in the word *ice* as produced by a young working-class female (upper pane) and for a young middle-class female (lower pane). The distribution of energy in the spectrum for the working-class female resembles that typically found for Glaswegian males, with a much lower center of gravity than that found for middle-class women.

Following the reasoning expressed by Eckert (2000) and others adopting a communities of practice framework, Stuart-Smith interprets the girls’ phonetic patterns not as an attempt to sound like males, but to distance themselves from middle-class girls and the social identity they present.

**3.1.4 Regional variation** In addition to the social dimensions of variation we should also comment on studies of regional variation, since speech also indexes a person’s geographical identity. Regional studies have a particularly long history, and in fact, from the perspective of our definition of sociophonetics, it is possible to regard the pioneers of nineteenth-century dialectology as the first sociophoneticians (e.g., Wenker, 1895). Their work not only yielded descriptive documentation of geographical variation, it also showed awareness of the social variation within communities through the predominant focus on older rural males as the harbingers of maximally archaic forms, as well as a recognition that traditional dialects were undergoing change through processes such as standardization (Chambers & Trudgill, 1998). Contemporary analyses of regional variation operate with more complex notions of space which acknowledge “distance” between locations as having social and psychological dimensions rather than being defined solely in terms of geographical proximity (Britain, 2002). Such factors may include



**Figure 19.2** Long-term average spectra (LTAS) for [s] in *ice* spoken by a young working-class Glaswegian female (upper panel) and a young middle-class Glaswegian female (lower panel) (see Stuart-Smith, 2007b).

political boundaries and differing orientations towards larger economic centers (e.g., Boberg, 2000; Woolhiser, 2005; Llamas, 2007).

The wider mobility of some groups, implicit and explicit processes of national and supralocal standardization, and people's exposure to and awareness of other regional varieties have been prime areas of interest for sociophoneticians. Advances in telecommunications, recording, and analysis technologies have facilitated the exploration of interaction and interference between a wide range of subtly different phonetic systems. For an overview of recent studies carried out within this

framework and the development of increasingly sophisticated theoretical models to which they contribute see Auer et al. (2005).

**3.1.5 Ethnicity, race and bilingualism** Ethnicity is a social product as opposed to a biological given (Fought, 2002) (like gender as opposed to sex) and indeed can be entirely nonbiological if based on religion or culture. Both ethnic marking in L1 and the role of ethnicity in creating an L2 variety have been examined. The relationship between linguistic variation and ethnicity has been a prominent focus in sociolinguistics since Labov's earliest works, which included investigations of the phonological patterns of the Portuguese and Wampanoag Native American minorities in Martha's Vineyard (Labov, 1963), and Puerto Ricans and African Americans in New York City (Labov et al., 1968). A great canon of work has since been produced on African American English (AAE), describing its current features and also tracing its development (see, e.g., Wolfram, 1969; Mufwene et al., 1998; Green, 2002; Wolfram & Thomas, 2002). Phonological features have been less studied than other aspects of the grammar, and the bulk of work has concentrated on differences between AAE and other varieties with little attention being paid to variation within AAE (Wolfram & Schilling-Estes, 1998, p. 174). It is often assumed, in fact, that AAE varies relatively little geographically (but see, e.g., Hinton & Pollock, 2007, for counter-evidence), and collectively AAE speakers appear to resist participation in major sound changes such as the Northern Cities Shift (e.g., Wolfram & Schilling-Estes, 1998; Milroy & Gordon, 2003).

The English of several other ethnic communities has been studied in North America (e.g., Anderson, 1999; Fought, 1999, 2003; Ryback-Soucy & Nagy, 2000; Schilling-Estes, 2000; Thomas, 2000; Boberg, 2004). However, the role of ethnicity in shaping accent differences has been studied relatively rarely elsewhere, or with respect to languages other than English. Exceptions include Māori English (Britain, 1992; Holmes, 1997), ethnic varieties of English in Australia (Clyne et al., 2001), ethnic marking in Israeli Hebrew (Yaeger-Dror, 1994a), and ethnic groups divided on religious grounds in the UK (Milroy, 1987b; McCafferty, 1999, 2001). Heselwood and McChrystal (2000) present a preliminary study of the accent features of Panjabi-English bilinguals in Bradford, revealing marked gender differences in the use of L2-influenced variants. For example, the males used a greater number of retroflexed variants of /t/ and /d/, a feature characteristic of Panjabi itself. It appears that the males may be adapting phonological features of one language for use as markers of ethnicity in the other. This "recycling" of sociolinguistic features is also reported by Dyer (2002) in her study of the English steel town, Corby. The town saw a large influx of Scottish steel workers in the 1960s. Subsequent generations have abandoned most Scottish phonological features, but some have been retained as markers of local Corby identity and a means by which young Corby speakers differentiate themselves from inhabitants of neighboring areas.

Strategic sociolinguistic choices can also be made by second language learners and bilinguals: van der Haagen (1998), for instance, investigated Dutch learners of English and found correlations between their attitudes to American and British varieties and their pronunciation preferences. Choice of language or variety may

contribute to a speaker's social identity. Khattab (2006, 2007, 2009) shows that English–Arabic bilingual children learn and exploit a range of phonetic variants comparable to that of their monolingual peers. Moreover, phonetic interference patterns from English onto Arabic can be interpreted not as imperfect learning (bi-directional interference) but as strategic devices to achieve conversational goals. For example, the children frequently adapted English words to Arabic phonology when attempting to satisfy their parents by speaking Arabic in fieldwork sessions. Scobbie (2005) links such results back to monolingual cross-dialectal variation and the influence of parents with “incomer” accents, while Evans et al. (2007), Lambert et al. (2007), and Hirson and Sohail (2007) focus on the effect of being in a bilingual community. Variability of rhotics in Panjabi-English bilinguals also reflects the growing trend of examining first- and second-generation immigrant variation, further linking topics in acquisition and bilingualism to social and ethnic identity.

**3.1.6 Intra-speaker variation** The sources of sociophonetic variation discussed so far are all important for the observation of inter-speaker differences within a community. Intra-speaker variation, meanwhile, has been investigated mainly through analysis of speech across several modes of communicative setting which collectively can be labeled *style*. In Labov's early work style was viewed as a continuum defined by degree of self-monitoring. Vernacular usage was hypothesized to occur where speakers paid minimal attention to their speech, while it was predicted that increasing formality (accessed, for example, in tasks such as reading aloud) would lead to increased self-consciousness and self-monitoring (Labov, 1972, p. 208).

Labov's original formulation of style has been acknowledged to be simplistic, however. It is now recognized that speakers adjust phonetic parameters in response not only to their own self-monitoring but also in response to a range of external factors including topic, physical setting, and audience. A more standard variety of pronunciation may be used, for example, where a speaker deems it appropriate for the listener (e.g., because of the formality of the setting, or when the speaker judges that the listener might understand a vernacular form less readily than its standard equivalent). Bell (1984) refers to this effect as *audience design*. Lindblom (1986, 1990) conceptualizes within-speaker variation in a similar way in the H&H (hyper- and hypo-speech) framework. Speakers position themselves along a hyper–hypo continuum according to the communicative setting, trading off the demands of limiting articulatory effort against those of ensuring intelligibility for listeners. The hyper end of the continuum is characterized by relatively canonical speech, with shifts to the hypo end permitting incrementally more underarticulation. The hyper–hypo range may align with a standard–vernacular continuum, but need not necessarily do so. Wassink et al. (2007) compare the features of hyper-speech with those of Lombard and child-directed speech. Work in conversation analysis has also shown that fine-grained phonetic cues may be manipulated by participants to manage interaction, for example to delimit speaking turns, highlight repetitions, time interruptions, and indicate (dis)agreement (Local, 2003, 2007; Ogden, 2004). Interactants have been shown to monitor and systematically adapt

details of consonant and vowel pronunciation, loudness, rhythm, timing, intonation, and pitch in their negotiation of conversation.

Intra-speaker variation has furthermore been investigated in a number of longitudinal studies. Such work is relatively commonplace in the acquisition literature, in which children's articulatory development is monitored (Davis, this volume). Sociolinguistic studies have also tracked the emergence of social and stylistic variation among children (e.g., Roberts, 1997; Docherty et al., 2006; Smith et al., 2007). Systematic sociolinguistic variation is present in the input children receive from the beginning, and it appears to be learned in tandem with aspects of the phonological system from the onset of speech production. There is, furthermore, evidence that input from adults is tailored to the developing social identity of children. For example, in a study of Newcastle English, Foulkes et al. (2005) found speech from mothers to girls contained more standard variants of /t/ than speech to boys, thus mirroring the gender-correlated patterns found in the adult community.

Fewer longitudinal studies have been carried out of adult communities or individuals, due both to logistical difficulties in performing such work and also as a result of the widespread assumption that linguistic patterns are essentially fixed once a speaker reaches adulthood. However, evidence from the few available studies suggests this assumption may be erroneous (e.g., Trudgill, 1988; Yaeger-Dror, 1994b; Sankoff et al., 2001; Nahkola & Saanilahti, 2004; Bowie, 2005; Sankoff & Blondeau, 2008). A particularly famous example is the study of Queen Elizabeth II's speech (Harrington et al., 2005). Over a 50-year period, as evidenced by her annual Christmas broadcasts, the Queen's speech has in some respects shifted in tandem with ongoing changes in standard British English, for instance in respect of lowering and retraction of the TRAP vowel (Hawkins & Midgley, 2005; Fabricius, 2007).

**3.1.7 Summary** The research reviewed in this section illustrates the complex range of external factors that exert systematic influence on phonetic and phonological form. It also shows that sources of variation are to a large extent "performed" rather than given: variation in speech is certainly *constrained* by biology, but is not wholly shaped by it. Socially determined factors complement those determined by biology, and interact with them, enabling speakers to use phonetic variation as a resource to achieve a range of social goals. Speaker-hearers are socially situated, and the social situation is rich in structured variation, so even traditional experimental laboratory-based phonetic research cannot afford *not* to exploit the opportunities which are available to experimentally control for variation by using socially structured pools of subjects (Scobbie, 2007a).

In general, inter-speaker differences have received too little focused attention in the phonetics and phonology literature, in which they are frequently treated as undesirable noise in the data. (Exceptions to this pattern include Abbs, 1986; Vaissière, 1988; Johnson et al., 1993; Syrdal, 1996; and Allen et al., 2003.) Similarly, sociolinguistic studies have often tended to gloss over differences between individuals' speech productions by pooling or averaging data for speaker groups (but see, e.g., Mees & Collins, 1999; Mufwene, 2001; Beckett, 2003; Piroth & Janker,

2004). The relevance of individual variation to our understanding of social and communicative aspects of language is, however, being recognized more widely by practitioners in both fields (Docherty, 2007). Neither phoneticians nor sociolinguists have addressed issues of ethnicity to the level of detail given to other factors (but see, e.g., Wolfram & Thomas, 2002; Fridland, 2003). Sociolinguists have also been criticized for the implicit determinism of some of their claims (see, e.g., Coulmas, 2005). However, it is now widely accepted that while factors such as region, class, and gender all have an important influence on speech, they do not determine how people speak (Johnstone & Bean, 1997, p. 236). Instead, the array of structured variation available to an individual, coupled with other factors such as ideology (Coupland, 1980; Woolard & Schieffelin, 1994; Milroy, 2001; Wassink & Dyer, 2004), can be seen as a rich resource from which the individual can choose elements in order to project his or her identity and achieve particular communicative goals.

### 3.2 *Loci of variation*

Segmental variation has been a dominant focus in sociophonetics, but it has become apparent that socially structured variation may be found at all levels of phonetic and phonological structure from subsegmental aspects of timing to suprasegmental properties of larger structural domains.

**3.2.1 Segmental variation** From the segmental point of view, socially influenced variation can be found at various levels: the phonemic system, phonotactic distribution and lexical incidence of phonemes and allophones, and segmental realization (Wells, 1982; Foulkes & Docherty, 2006). Such differences may be evident across dialects of a language, therefore indexing regional background, and they may also contribute to stylistic differences when speakers shift, for instance, from more to less standard varieties. They may also be subject to variation and change within a community, and thus become associated with subgroups.

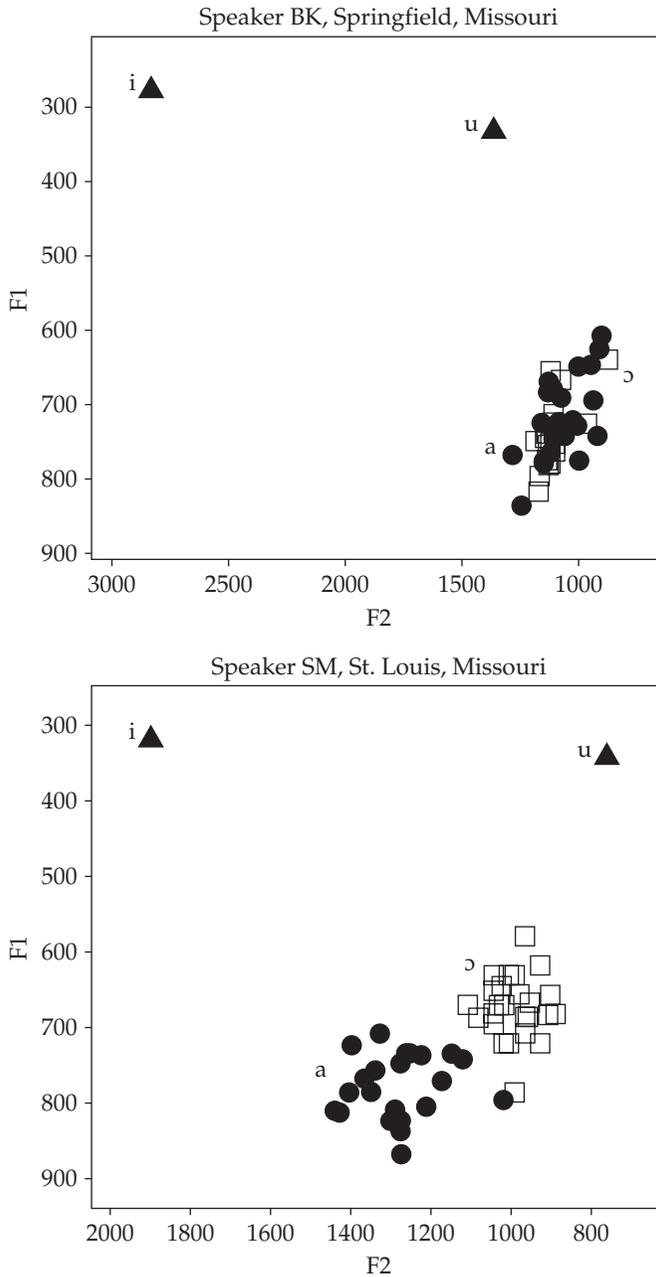
Numerous examples of segmental variation have already been given. However, the importance of acoustic analysis of vowels must be acknowledged, since it forms the core of the highly influential sociolinguistic work of Labov et al. (1972). In a large-scale survey of vocalic variation in American English, individual vowel productions were represented by plotting on  $x$ - $y$  scattergrams the frequencies of the first and second formants of vowels measured from their midpoints, or points of greatest formant displacement. This was an application of a technique already long established in the mainstream phonetics literature (e.g., Joos, 1948; Peterson & Barney, 1952), and has since been employed in (socio)phonetic work on many languages and dialects (see, e.g., Thomas, 2001, for varieties of English; Gordon et al., 2000, for Chickasaw; Kim, 2005 for Finland Swedish; or Cieri, 2005, for Italian dialects). Of particular interest has been the potential of F1/F2 data to be diagnostic of sound change. For instance, overlap of significant numbers of tokens of ostensibly contrastive phonemic categories on the F1/F2 plane may be taken to indicate suspension of phonetic contrast through merger, while changes in a

vowel category's field of dispersion is often interpreted as qualitative drift. A much-studied example is American English /a/ (as in *cot*) versus /ɔ/ (as in *caught*). Figure 19.3 from Majors (2005), to take a random example, appears to indicate for Missouri English that while a contrast is maintained by speakers in St. Louis (lower panel) the vowels are qualitatively nondistinct, as well as backer relative to /u/, in Springfield speech.

Incursion of one vowel's field of dispersion into the area occupied by another may trigger a *chain shift*, whereby movements of neighboring vowels are co-ordinated to preserve the system of contrasts (Docherty & Watt, 2001). A great deal of research has been devoted to the progress of chain shifts in varieties of North American English, in particular the Northern Cities Shift, which is operative in the urban varieties of a large swathe of the north-central United States (Labov et al., 1972). Labov (1994, 2001, forthcoming) has generalized from these studies a number of *principles of linguistic change*, for which he claims both predictive power and robust cross-linguistic validity.

Instrumental phonetic analysis of vowel systems has thus been harnessed both to vindicate theories of sound change first elaborated in structuralist linguistics (e.g., Martinet, 1955; Hockett, 1965) and also as a means of tracking sound changes in progress. The success of this approach has led, however, to a tendency to sideline – or to ignore altogether – many of the more problematic aspects of the methodology. F1/F2 plots are often presented as though they directly represent speakers' vowel productions, despite the fact that they do not incorporate perceptually relevant features such as vowel duration, formant dynamics, formant bandwidth, and contributions to vowel quality made by the third and higher formants. Coincident frequencies of the lowest two formants for two vowel tokens do not necessarily entail their perceptual identity (e.g., Faber & Di Paolo, 1995; Labov et al., 1991; Majors, 2005; Labov & Baranowski, 2006; see also section 4.3 below). Further doubt is cast on the perceptual importance of formant frequencies during the “steady-state” portions of vowels by the results of experiments with silent-center syllables (McLeod & Jongman, 1993; Nittrouer, 2005), which show that formant transitions to and from flanking consonants may carry a good deal of the perceptual load when listeners are asked to identify vowels. Likewise, aspects of vowel production including phonetic quality and gradient phonemicity (Scobbie et al., 1999; Scobbie & Stuart-Smith, 2008), cross-speaker differences in formant transitions (Thomas, 2000; McDougall, 2004) and in formant frequencies (Nolan & Grigoras, 2005) make understanding the complex relationship between vowel production, vowel acoustics, and vowel perception yet more elusive.

One challenge which continues to stimulate research in vowel perception concerns the way(s) in which listeners compensate for formant frequency differences between talkers by normalizing the acoustic consequences of, firstly, vocal tract length (i.e., differences between men, women, and children), and secondly, regional, social, and idiosyncratic accent differences. For sociophonetic purposes, it is clearly desirable to attempt to preserve variation deriving from sources of the second type, while minimizing the effects of variation resulting from vocal tract length differences, since the latter are likely to be of secondary interest. Several reviews



**Figure 19.3** Vowel midpoint “static” F1/F2 plots for two Missouri English speakers (lower plot, St. Louis speaker 1; upper plot Springfield speaker 9), showing values for individual tokens of /a/ and /ɔ/ and mean values for /i/ and /u/. (Adapted from Majors, 2005)

of the performance of various normalization algorithms have been published (e.g., Rosner & Pickering, 1994), but the most recent of these (Adank et al., 2004) approaches the issue from a specifically sociophonetic direction by evaluating the relative merits of a range of “vowel intrinsic” and “vowel extrinsic” normalization methods. Watt and Fabricius (2002) describe a routine which can be used to improve the mapping of male and female speakers’ F1/F2 spaces as estimated by increases in the spaces’ coextensiveness. This is done by rescaling F1 and F2 values relative to the speaker’s “centroid,” which has as its coordinates the grand mean of the mean F1 and F2 values for /i/, /a/ (or whatever is the most open vowel in the variety under investigation), and a point in formant space at which the speaker’s minimum F2 is equivalent to his or her minimum observed F1 value. The last was considered necessary for the routine to be of utility when investigating varieties of British English lacking fully close, back, and rounded vowels. The best means of normalizing other acoustic measures, especially where these have been abstracted from frequency continua (e.g., spectral moments), are less clear.

Consonantal variables have typically been analyzed auditorily rather than acoustically in sociolinguistic work, but recent studies have begun to apply sophisticated analytic techniques to large and heterogeneous data samples. Stuart-Smith’s (2007b) study of Glasgow [s], for example (see section 3.1.3 above), quantified acoustic data in terms of the mean center of gravity, spectral peak, and acoustic slope of the fricative. Kissine et al. (2003) followed similar procedures in a study of devoicing of Dutch fricatives, as did Munson et al. (2006) in their comparison of gay and heterosexual speakers. Formant analysis has also been extended to sonorant consonants such as /r/ (Foulkes & Docherty, 2000) and /l/ (Carter, 2003; Livijn, 2002). Heselwood (2007) utilized a combination of acoustic, laryngographic, and nasoendoscopic techniques in his investigation of productions of the *‘ayn* in a range of varieties of Arabic.

Other investigative techniques used in sociophonetic work include electropalatography (Wright, 1989; Hardcastle & Barry, 1989), MRI (Zhang et al., 2003) and ultrasound (Mielke et al., forthcoming; see further below).

**3.2.2 Subsegmental variation** One of the main contributions of instrumental techniques has been to reveal that systematic variation in speech production can reach down to very fine-grained detail. Phoneticians have regularly and frequently documented subtle differences in articulatory targets across languages. Indeed, Pierrehumbert et al. (2000, p. 285) conclude that “there are no two languages in which the implementation of analogous phonemes is exactly the same . . . even the most common and stereotypical phonetic processes are found to differ in their extent, in their timing, and in their segmental and prosodic conditioning.” Clear exemplifications of this are provided by cross-linguistic research on features such as voice onset time (VOT) (Lisker & Abramson, 1964; Cho & Ladefoged, 1999), the effects of prosodic context (Turk & Shattuck-Hufnagel, 2000; Suomi, 2005), and connected speech processes (Kohler, 1990; Cucchiariini & van den Heuvel, 1999; Nicolaidis, 2001; Farnetani & Recasens this volume).

Similar differences have also been observed both across and within dialects of the same language. Fourakis and Port (1986) showed dramatic differences in the occurrence of epenthetic stops in dialects of English. While five American subjects produced epenthetic stops categorically in words such as *dense* and *false*, four South Africans never did. These patterns indicate that epenthesis is not the automatic product of universal vocal tract dynamics on articulatory gestures, but must instead reflect learned patterns of articulation. Docherty and Foulkes (1999, 2005) draw a similar conclusion in a study of voiceless stop realizations in two dialects of English. Tokens in the data varied in terms of the extent of continued voicing from preceding vowels, and the presence or absence of release bursts, formant transitions, and pre-aspiration. The patterns can be interpreted as variation within the co-ordination of articulatory gestures. However, some of these patterns were also associated with particular demographic groups within the dialects, such that certain patterns were indexical of, for example, speaker gender. Using electropalatographic (EPG) techniques, Nolan and Kerswill (1990) examined consonantal place assimilation at word boundaries. Their data showed that participants from lower socio-economic groups produced significantly more assimilated tokens than those from the higher ones.

Sociophonetic data provide a very powerful tool for investigating theoretical models of phonetics because they allow experimental examination of slightly different linguistic systems, while holding many other factors constant, something that is far harder, indeed almost impossible, to achieve in cross-linguistic research (Scobbie, 2007a). A particularly interesting subcase of variation is where the phonetic targets of a group of speakers are scattered in a region of phonetic space that would normally be regarded as extending right through adjacent category spaces. Study of fine variation may be an end in itself, but when the “same” phonological opposition is spread through phonetic space in a socially structured way, we are then able to probe directly the phonetics–phonology interface. For example, Scobbie (2005, 2006a) shows via analysis of VOT and prevoicing that the contrast between “voiced” and “voiceless” stops varies widely among Shetland Islanders with different parental backgrounds. The phonetic targets of VOT, for example, span the range from lead to long lag, without any loss of contrastiveness between “/p/” and “/b/”, or any sense of a categorical shift from one system of voicing (aspiration-based) to another (voicing-based). The finding of an inverse relationship between the extent of aspiration for /p/ and the rate of prevoicing for /b/ is also found in Aberdeen (Watt & Yurkova, 2007), stratified by age. Kissine et al. (2003) have analyzed a number of cues to the Dutch /v/~f/ contrast, and while trading relations between acoustic cues to contrast have been studied extensively (Repp & Liberman, 1987; Hodgson & Miller, 1996), sociophonetic variation seems to provide a natural setting for such research.

**3.2.3 Suprasegmental variation** Suprasegmentals have been studied less frequently in sociolinguistic than phonetic work, largely on account, perhaps, of the difficulty in establishing the functional equivalence of alternate linguistic forms in data samples consisting of uncontrolled materials (see Milroy & Gordon, 2003,

pp. 185ff.). Quantification and comparison of patterns is thus rendered particularly complex. Intonational meanings, for example, comprise several strands of information reflecting (at least) grammatical structure, the pragmatic function of the utterance, and the speaker's stance (Cruttenden, 1997).

Regional and social variability has, nevertheless, been studied in respect of many suprasegmental features. Britain (1992), for example, investigates the development of high rising tone in declaratives among speakers of New Zealand English. The innovative pattern was particularly associated with younger speakers, females, and Māoris. It was also found to play particular discourse roles, serving as a means of monitoring listener attention, and helping the speaker to maintain the conversational turn. Other accounts of regional and social variation in intonation include Fletcher et al. (2005), Grabe et al. (2000), Nolan and Farrar (1999), and van Leyden (2004) for English; Dalton and Ní Chasaide (2003, 2005) for Irish; Bruce and Gårding (1978) for Swedish; Selting (2004) and Bergmann (2006) for German; Heffernan (2006) for Japanese; and Ogden and Routarinne (2005) for Finnish, with a specific focus on the discourse functions of rising intonation. Sociophonetic studies of tone languages include Stanford (2007) on Sui, and Hildebrandt (2007) on Manange and other Bodish languages.

Rhythmic features have frequently been compared across languages, and the development of quantitative analytic methods such as the pairwise variability index has permitted quantification which reflects the traditional categories of stress- and syllable-timing (e.g., Grabe & Low, 2002; see also Ramus et al., 1999). These methods have been applied successfully to dialects of the same language. For example, Carter (2005) presents an analysis of Spanish speakers' acquisition of rhythm in L2 English, while Cedergren and Perreault (1995) discuss age and class effects on syllable timing in Montréal French, and Keane (2006) addresses variation in high and low diglossic varieties of Tamil.

Sociophonetic examinations of vocal setting and voice quality are relatively rare, which may reflect the relative analytic complexity of such features where the descriptive protocol developed by Laver (1980) is applied to large samples of speakers. Stuart-Smith (1999) documents voice quality for 32 speakers of Glasgow English, finding systematic variation related to their age, gender, and social class. More limited studies, involving either impressionistic statements or a focus on the distribution of a particular phonation type, include Henton and Bladon (1988), Esling (1991), and Gobl (1988). Trent (1995) found voice quality differences aided accurate identification of ethnicity when listeners were presented with samples of speech produced by African American and Caucasian speakers, while Podesva (2007) considers the contribution of falsetto phonation to a speaker's construction of a gay identity.

**3.2.4 Summary** It appears that systematic variation can occur in speech production at all levels of phonetic structure that have been studied in detail in a sociophonetic framework. However, it remains an open question whether certain phonetic or phonological parameters are more or less predisposed to bear the burden of indexical meaning. Labov (2006) appears sceptical that sociophonetic

variation can occur in principle in any domain. It has often been noted, for example, that regional variation in English is largely carried by vowel realization (Wells, 1982, p. 178). By contrast, it has been claimed that features such as lexical stress placement appear to vary rather little across English dialects (Wells, 1995). It is of empirical interest to assess whether patterns of sociophonetic variation are constrained by the phonological system of the language, or by other systematic aspects of variation such as those induced by, for example, prosodic structure. Comparing the effects on variation of both internal (grammatical) and external (social) constraints is typical in sociolinguistic studies (Tagliamonte, 2006). However, attempts to assess the *influence* of internal constraints on external ones are relatively rare (Docherty, 2007). Notable examples of such research are Mendoza-Denton et al. (2003), who take account of word frequency, and the extensive survey by Raymond et al. (2006) of factors affecting /t, d/ deletion in English.

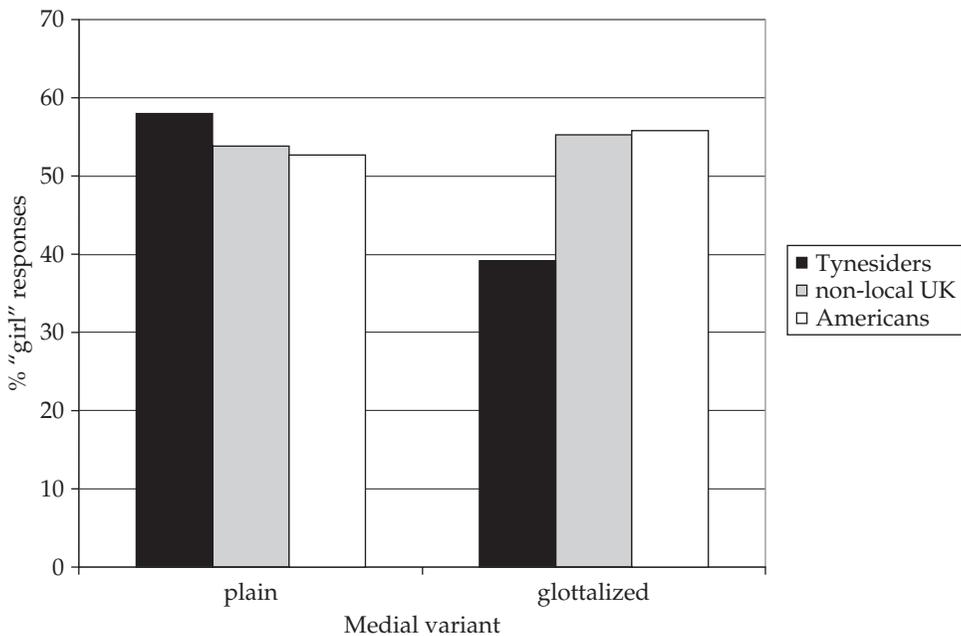
## 4 Sociophonetic Studies and Speech Perception

Although sociophonetic research has been primarily concerned with speech production, attention has increasingly turned to speech perception. Thomas (2002a) provides a detailed review of perceptual studies which are of relevance for sociophonetics. The majority of this work falls into four main categories, each of which is discussed further below.

### 4.1 Identifying indexical features

Many studies have shown that listeners can extract cues to a speaker's social or regional background from the speech signal. Geographical origin has perhaps been tested most frequently (e.g., Bush, 1967; Munro et al., 1999; van Bezooijen & Gooskens, 1999; Clopper & Pisoni, 2004), but there are also examples with a focus on ethnicity (e.g., Trent, 1995; Baugh, 1996), social class (Sebastian & Ryan, 1985), gender/sex (Lass et al., 1979), and sexuality (Munson et al., 2006). Clopper et al. (2006) found a complex interaction of the speaker's gender and regional origin, and "dialect markedness," to influence listeners' judgments of perceptual similarity among four regional dialects of American English.

Foulkes et al. (in press) tested whether listeners could use differences in voiceless stop realization as a cue to speaker gender, using child talkers aged 2–4 years from Tyneside, UK. Their predictions were based on observations of gender-correlated differences in studies of adult Tynesiders' speech. For example, in word-medial intervocalic position (*butter, happy, baker*), plain oral variants are statistically more frequent for females, while males prefer glottalized forms (Docherty & Foulkes, 1999). In the experiment by Foulkes et al., a group of listeners from Tyneside heard a set of single word stimuli containing voiceless stops and were asked to identify the sex of the child. Control groups of Americans and British listeners from other regions were also recruited. Results showed differences across the groups in the predicted directions (Figure 19.4). The Tyneside listener group (but



**Figure 19.4** Percentage of “girl” responses to word-medial tokens by listener group and variant. (Adapted from Foulkes et al., in press)

not the control groups) gave significantly fewer “girl” responses to stimuli with glottalized stops than they did to stimuli with a plain variant, and they also gave fewer “girl” responses to glottalized tokens than either control group did. The results support the conclusion that local listeners display tacit knowledge of statistical associations between phonetic variants and socially defined categories of speaker.

The main aim of studies such as these has usually been to identify which features listeners use in the identification process, and whether these coincide with indexical features observed in studies of speech production in the communities concerned. However, it has also been found that listeners vary in their ability to perform these tasks, and furthermore that there is variability in the weight of perceptual cues across speakers, listeners, and situations. Some of the variability is no doubt the result of differences in experimental designs: studies have differed, for example, in the length and type of stimuli used, from extended extracts to single vowels (Walton & Orlikoff, 1994), and natural, filtered (Lass et al., 1980) or resynthesized speech (Graff et al., 1986). Understanding this variability in listener performance relative to speech input is of particular relevance in the forensic domain when lay listeners may be called upon to give evidence about a voice they have heard in a criminal context (Bull & Clifford, 1984; Blatchford & Foulkes, 2006).

Research categorized under the label *perceptual dialectology* (Preston 1999; Long & Preston, 2002) can also be considered sociophonetic, although its experimental methods typically do not involve the presentation of recorded samples to listeners. Rather, they assess listeners' awareness and memory of regional and social varieties through tasks such as identifying dialect boundaries on maps.

## 4.2 *Evaluating indexical features*

Listeners' subjective evaluations of indexical features have been investigated in a number of studies. As Thomas (2002a) notes, formal assessment of listeners' interpretations of linguistic variation dates back at least to Pear (1931). Choice of language or variety, alternative pronunciations, and variation in acoustic and phonetic parameters of voice may all affect the way listeners judge the personality of a speaker. Various techniques have been employed including the matched guise paradigm (Giles & Powesland, 1975; Cargile et al., 1994) and experimentally modified stimuli. Some studies have linked listener attitudes to particular aspects of speech. For example, van Bezooijen (1988) suggests that her Dutch listeners drew upon prosodic differences in their evaluation of "strong" personality, but social status and intelligence were linked more to segmental features. This remains, however, an under-researched area and one in which judgments and social evaluations are perhaps more likely to be locally determined rather than based on universal associations of phonetic features with character traits. Coupland and Bishop (2007) show that evaluations of regional accents of English vary in respect of the speaker's gender and the listener's own background. Moreover, many judgments differed by age of listener, indicating that attitudes may change over time. Standard accents, for example, were rated less highly by young listeners, who by contrast gave much more favorable ratings than older listeners did to London, Australian, and West Indian accents.

Understanding attitudinal responses to linguistic variation is particularly important in studies of inter-ethnic communication (Lambert et al., 1960; Gumperz, 1982; Purnell et al., 1999). Attitudes have also been discussed in relation to issues such as the impact of the media on children (Lippi-Green, 1997), success in the job market (Milroy & Milroy, 1998), the likelihood that a jury will convict or acquit (Dixon et al., 2002), and the transmission of linguistic change (van Bezooijen, 2005).

## 4.3 *Perception of ongoing change*

A number of investigations have assessed whether listeners are able to perceive sound changes in progress such as phonemic mergers (e.g., Hay, Warren et al., 2006). Presumably, the diffusion of changes throughout a population depends upon listeners' abilities to detect others' innovatory usages before they can adopt them in their own speech, even if those differences are apparently indistinguishable by outside observers, including phoneticians using a conventional battery of analytical methods (see section 3.2.1). The presence and persistence of marginal

contrasts (e.g., near-mergers) in phonological systems also have implications for principles such as maintenance of perceptual distance that underpin models of the cognitive representation of speech and language.

The results of these studies are, however, somewhat mixed. It has been argued that listeners lose the ability to perceive contrasts that are disappearing, even if they retain the contrast in production (e.g., Janson & Schulman, 1983, on a vowel merger in Swedish). However, Labov et al. (1991) argue that such results may reflect the artificiality of the test scenarios (listeners being asked to label isolated vowels, or synthetic stimuli). Labov et al. used more natural stimuli to test Philadelphians' ability to discriminate pairs such as *merry* and *Murray*, which are near-homophonous or indeed fully merged for many speakers in Philadelphia. Their results suggested that listeners could recover distinctions, albeit with difficulty. Similar findings are reported by Di Paolo and Faber (1990).

#### **4.4 Impact of social and regional variation on perception and processing**

The perceptual studies reviewed above have primarily been carried out to test listeners' reactions to features of interest from a sociolinguistic perspective. Parallel developments have seen researchers in experimental speech perception consider the impact of social, regional, and inter-speaker variation on tasks such as lexical access and phoneme identification.

Gender differences in speech have received relatively scant attention in the perception literature. Strand (1999) found that her subjects' perception of the category boundary between /s/ and /ʃ/ was influenced by the gender of a person in a picture they were shown while performing the listening task. Similar findings are reported for vowel categorization by Johnson et al. (1999). In experiments by Niedzielski (1999), listeners were exposed to voice samples they were told were either Canadian or Michigan English. From a set of synthesized vowels they were then asked to choose exemplars most appropriate to the variety they had heard earlier. Their decisions differed according to the variety they believed they had been listening to. Sociolinguistically distributed cues present in the acoustic signal and inferred social factors interact, for example in the perception of Vietnamese tone (Brunelle & Jannedy, 2007). It appears, then, that sociolinguistic expectations may influence basic speech perception to quite a marked degree, with increasing evidence of the implicitness of the expectations (see also Elman et al., 1977; Janson, 1983; Hay, Warren, & Drager, 2006; Warren et al., 2007).

Previous exposure to particular accents or to the voices of individual talkers may also have an impact upon processes such as word recognition, making this an active area of research where phonetic, sociolinguistic, and psycholinguistic concerns are converging (e.g., Delvaux & Soquet, 2007). Nathan et al. (1998) found better word recognition rates by children who were familiar with the talker's accent. Evans and Iverson (2007) report similar results, with speakers of southern English accents proving better at identifying southern-accented words embedded in noise than were speakers of northern accents. With respect to individual voices,

Nygaard et al. (1994) found that subjects performed better at word recognition tasks than control subjects who had not previously heard the talkers' voices. This implies that information about the features of individual voices is retained by listeners and can be drawn upon if necessary. Nygaard and her colleagues argue on this basis that lexical representations of words must contain speaker-specific details alongside the more abstract information that permits lexical access when listening to novel talkers (see also Hawkins & Smith, 2001; Lachs et al., 2002; Hawkins, 2003; Nygaard, 2005; Docherty, 2007; and Mitterer & Ernestus, 2008 for a contrary view).

#### 4.5 Summary

These perceptual studies reviewed above show that listeners can and do access indexical information in the course of listening to speech. Thus there must be some cognitive storage and processing of that information. The question remains as to what form this representation takes, and how it is stored and processed relative to more traditional conceptions of "linguistic" knowledge (see further section 6 below).

### 5 Methodological Issues

It is clear from the disparate lines of work we have reviewed that one of the defining features of sociophonetics is that it draws upon a particularly wide array of methodologies that have generally been developed in other, longer-established disciplines. We do not propose to provide a critique of all methods which have been used in sociophonetic studies. However, it is worth drawing attention to major differences between the methods typically employed in sociophonetic studies of speech production compared with those of laboratory phonetics and phonology. We also take the opportunity to highlight some of the newer methodologies currently being applied to sociophonetic work.

#### 5.1 Data collection

Data collection methods are perhaps the most obvious point of disparity, reflecting differences in the prevailing research questions of sociolinguistics on the one hand and phonetics/phonology on the other.

In Labovian sociolinguistics the vernacular has always been regarded as the most prized speech style. The focus of such research on establishing variation within and across communities has furthermore meant that data are usually collected from a heterogeneous speaker sample, and often involve a range of speech styles. These emphases lead sociolinguistics and sociophonetics into a position of conflict with most other empirical fields, including experimental phonetics, phonology, and acquisition, which have usually been most concerned with citation forms and (implicitly) standard varieties. Experimental studies in these fields have, moreover,

generally used heavily controlled and/or artificial materials and experimental tasks. Materials are often elicited through randomized word-lists, sometimes consisting of nonsense words which conform to the phonotactics of the language in question. Data are usually gathered in ideal acoustic conditions, often from relatively small and homogeneous groups of speakers of standard dialects, often colleagues or university students, speaking in isolation.

The contrasting approaches naturally have both strengths and weaknesses. The control exercised over laboratory materials facilitates analysis and comparison of spoken material across languages, contexts, or speakers, with, in principle, all factors held constant except for the features under scrutiny. Materials gathered in the field, on the other hand, can be difficult because of impaired technical quality, the unpredictable returns of spontaneous data (overlapping speech, the lack of sufficient tokens of the features of interest), and because analysis needs to cater for many potential factors which may influence phonetic forms. Duration studies, for example those of vowel length or VOT, are exceptionally hard to perform on uncontrolled data because of the effects of factors such as phonological context and overall speech rate. More generally, acoustic images of data from spontaneous interaction do not always reduce easily to the neat templates provided in acoustics textbooks.

Analysis may therefore need to begin with an assessment of the phonetic categories apparent in the data, even if these do not conform to prior expectations based on, for instance, the IPA definition of a sound. For example, in an analysis of voiceless stop realizations in Newcastle English, Docherty and Foulkes (1999, 2005) constructed an acoustic profile of each token, describing the presence or absence of acoustic features as well as quantifying key parameters. This detailed record allowed tokens to be categorized for the purposes of discussing patterns of social distribution. The same technique was applied to children's speech in a subsequent study (Docherty et al., 2006). Examining phonetic tokens in such detail permitted an essential degree of refinement in the consideration of whether children were mastering the acquisition of the stops. The analysis was able to take into account the full range of variant forms found in the ambient language, and thus also circumvented a potentially misleading reliance on standard or citation forms as the putative targets for acquisition. Khattab (2006, 2007, 2009) followed a similar approach in her study of Arabic-English bilingual acquisition, showing the importance of establishing targets for acquisition that take account both of local norms and of variation in the community's speech patterns.

While laboratory materials are very useful in many ways, they are problematic in others. They only scratch the surface of the informants' phonetic repertoire and thus limit the theoretical inferences that can be drawn with respect to speech planning or phonological knowledge. It may be easy to elicit particular strings of phonemes through nonsense materials, but extremely difficult to ensure that the pronunciation of these high-level units approaches in any way the forms that are observed in natural use. Laboratory materials may also lack severely in naturalness. Elicitation using read materials, for example, has often been criticized by sociolinguists.

If the spoken vernacular differs markedly from the standard written form, reading aloud may represent a discrete linguistic task rather than a point towards the formal or hyper end of a style continuum (Milroy & Gordon, 2003, p. 201). This is perhaps clearest in the case of diglossic communities such as those of the Arabic-speaking world, but the same issue can be raised in any community. We should also bear in mind that reading tasks may be threatening, inappropriate, or unworkable for many speakers such as young children or members of nonliterate communities, and materials tailored to provide minimal pairs for segmental phonological or phonetic analysis may result in speech which is too narrow for prosodic analysis. University-educated adults make convenient and sophisticated research subjects, and phoneticians are well aware that many competent language users from other groups present methodological difficulties. Elicitation methods may therefore need creative adaptation, such as the use of picture-based tasks (Khattab, 2006, 2007, 2009), and interactive or distracting activities such as map tasks (e.g., Grabe, 2004) or spot-the-difference tasks (Bradlow et al., 2007). In any case, it is essential that the experimental method and materials are appropriately paired, and interpreted with respect to the situation.

Sociolinguistic methods present different problems. Collecting suitable data entails the consideration of many sampling and fieldwork issues, including how to define the speech community and the relevant social or demographic divisions, how to elicit appropriate linguistic styles, and how to obtain adequate material in field settings. Ladefoged (2003), Milroy and Gordon (2003), and Tagliamonte (2006) provide excellent overviews of such issues. The necessity of sampling from different speaker groups means that corpora collected in sociophonetic fieldwork can become particularly large, and thus time-consuming both to collect and analyze.

In light of the various decisions that must be made, and the need to tailor fieldwork and analysis to the speech community as well as the potentially diverse research questions at stake, there can be no fixed protocol for sociophonetic data collection. However, a common base for research in the Labovian variationist tradition would be to collect a combination of spoken materials, some relatively well controlled and some to reflect the natural repertoire of the language users being studied. Speaker samples are often constructed around broad social categories such as age, class, and sex/gender, and clearly contrasting groups are selected rather than attempting to sample the whole community along demographic continua. For example, in studies of "class," speakers may be selected from markedly different neighborhoods, judged via local knowledge of typical housing and work types, rather than through the application of complex systems to quantify the relevant demographic factors that contribute to an individual's social class (e.g., Watt & Milroy, 1999; Stuart-Smith, 1999).

Depending on their aims, other types of sociophonetic work may present stark contrasts in terms of the amount and range of data collected, and the size and range of speaker samples. Work on the phonetics of conversation, for instance, may involve intricate analysis of small sets of conversational fragments, with no specific interest in the social background of the speaker (e.g., Local, 2003; Plug,

2005). More ethnographically informed research may be based on coarser analysis of extensive speech samples from relatively few people (e.g., Mendoza-Denton, 1996, 1999; Hay & Drager, 2007). Surveys of the geographical distribution of phonetic forms may involve large speaker samples, but trade this requirement against a relatively small quantity of material (Labov et al., 2006).

## 5.2 Data analysis

Acoustic analysis is now more widespread and much easier to perform than ever before thanks to the availability of free analysis packages such as Praat and Wavesurfer, and specialized additions for analysis, storage, and presentation of data (e.g., Akustyk). However, it is important to bear in mind that acoustic data are not inherently superior to data derived from careful auditory analysis. While the latter may be coarser, it has the advantages of being faster, and processed through the best normalization mechanism yet developed: the human ear and perceptual system. Although auditory analysis may be argued to run the risks of human error and subjectivity, acoustic analysis can be subject to similar problems. Acoustic data, and thus the theoretical claims made on the basis of the data, are all affected by the analyst's choice of recording equipment, software package, analysis settings, measurement criteria, and location of measurement for a given token. Differences generated by such decisions may be far from trivial. Illustrations of striking variation in acoustic data include Harrison's (2004) comparison of formant measurements using different software systems and settings, and the effects on formant data of both telephone transmission (Künzel, 2001; Byrne & Foulkes, 2004), and microphone types (Plichta, 2004). For a summary of best practices in handling acoustic data see the regularly updated reviews on Plichta's website (<http://bartus.org/akustyk>).

Instrumental articulatory phonetics has had a limited impact in sociophonetics. Research projects conducted in Cambridge by Kerswill, Nolan, and Wright in the late 1980s used EPG (Stone, this volume), and convincingly showed the value of articulatory data (Kerswill, 1985; Kerswill & Wright, 1990; Wright & Kerswill, 1989). Standard arguments that instrumental analysis can be more powerful and reliable than transcription were extended through study of an important sociolinguistic variable, namely /l/ vocalization, which is difficult to analyze acoustically. Acoustically subtle aspects of articulation can be explored with EPG or other techniques, but this approach was not subsequently adopted in sociolinguistics, not least perhaps due to issues of cost and convenience. In more recent work, Scobbie and Wrench (2003) and Scobbie et al. (2007) have undertaken fairly standard lab-based phonetic studies which, by focusing on broad dialectal and subtle inter-speaker variation in /l/ vocalization, again make a case for sociophonetic articulatory research.

It is possible to gather some types of data about articulation as simply as making an audio recording, for example with a camera, but quantitative and intra-oral data constitute a more difficult proposition. A priori, articulatory data are equivalent to acoustic data as a means to a sociolinguistic end, and are merely problematic

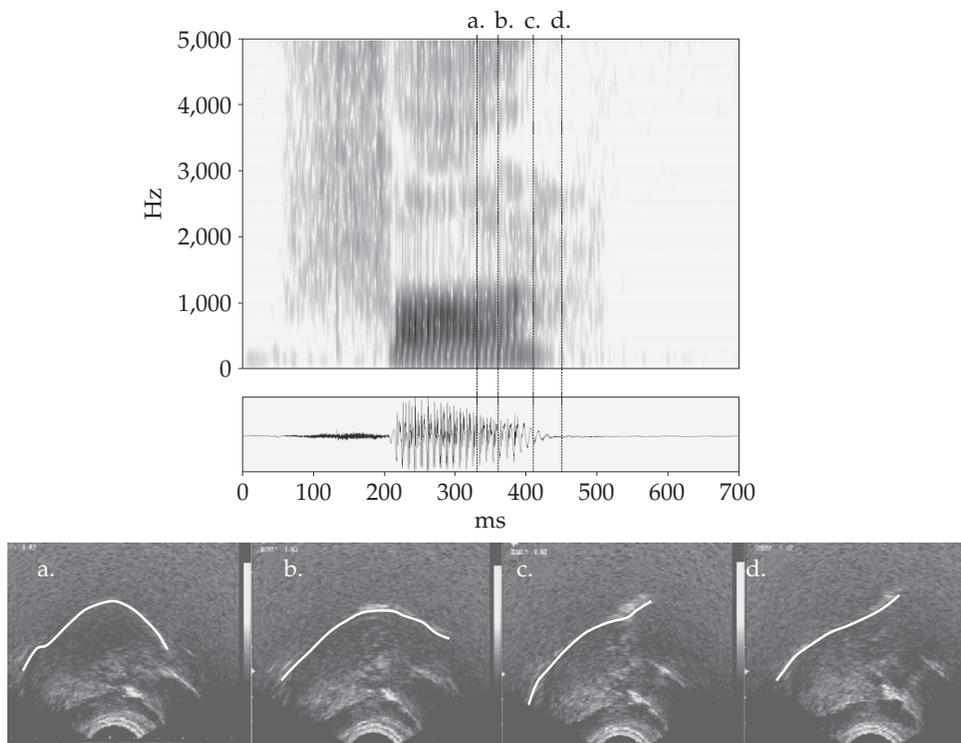
for two main logistical reasons. First, equipment to collect such data (and the expertise to use them meaningfully) is not as available as audio-recording equipment. Second, the relative invasiveness of the data collection process may be expected to interfere with speaker behavior, especially if speakers have to be recorded in laboratories. On the other hand, articulatory data can make a novel and important contribution to the analysis both of the complex and unpredictable relationship that exists between the sounds of speech and the vocal tract configurations that generate them, and also to the social variables which shape interaction. It is debatable whether any model of the speaker in his/her social context can be complete without articulatory data. One view (Thomas, 2002b, p. 168), explicitly relating to the variable (r), holds that only *acoustic* instrumental analysis is relevant. Such a view adopts a listener-oriented theory of variation, in which it is only what people hear that matters. The alternative view holds that there is also a pressing need to investigate how speakers physically create sounds in a social context, in order to examine the role of the speaker as a sociolinguistic *agent*. The aim of speakers may indeed be to reproduce in acoustic space the sociolinguistic variants which they themselves hear around them in order to convey social meaning appropriately, but their speech production strategies to achieve this goal may well differ from those used by other people.

A technique which appears particularly promising for articulatory sociophonetic research is Ultrasound Tongue Imaging (UTI) (Gick & Wilson, 2006; Stone, this volume), which has some advantages over EPG in immediacy of use, especially for obtaining qualitative articulatory information on the location, shape, and movement of a large part of the mid-sagittal section of the tongue. Its main disadvantages are that it is hard to obtain good acoustic-articulatory temporal alignment and accurate spatial images of the tongue (Wrench & Scobbie, 2006) and to ensure stability of the probe (Scobbie et al., 2008), and it is not agreed how to quantify the tongue images for statistical analysis. This last point may be a particular problem for sociophonetic work in that data are required from relatively large samples of speakers. EPG is excellent for the study of anterior constrictions, while UTI seems ideal for looking at secondary articulations like velarization or pharyngealization, because the articulations are slow-moving open constrictions. Perhaps ultimately both techniques will be used simultaneously for sociophonetic research (Wrench & Scobbie, 2003).

To evaluate the approach, Scobbie et al. (2008) have explored the methodological ramifications of the use of UTI within an otherwise standard sociophonetic design, with subjects aged 12–13. Initial results indicate that word-list style speech differs little if UTI measurement is introduced in a field setting. Perhaps these speakers are more likely to be influenced by the presence of a conversational partner who is a friend than by the experiment and the equipment per se. Moreover, while it might seem obvious that an observer effect could be greater when the speaker is aware that their speech is being measured articulatorily than where the measurement is merely acoustic (through an audio recording), we suspect that participants do not strongly associate the measurement of their oro-facial physiology to speech and accent. The implications of speaking into a microphone

are far more obvious: a researcher is going to listen and make judgments based on the sound of the voice. For the lay person, articulatory data from inside the mouth are esoteric, physical, and removed from normal linguistic experience.

The resulting ECB08 corpus, undertaken in schools and in the laboratory, confirms findings from purely laboratory-situated pilot studies (Scobbie & Stuart-Smith, 2005): some speakers attain the acoustic goal of sounding derhoticized (hence young and vernacular) using articulatory routines which nevertheless contain persistent strong rhotic-like gestures. As well as the more predictable gestural reduction, UTI reveals that in some cases, *covert* rhotic-like lingual articulations such as retroflexion may be masked by devoicing and temporal delay into post-utterance silence, so that they generate little or no rhotic auditory/acoustic effect (Figure 19.5). Thus, for reasons that are not yet clear, and in contexts and styles that are not yet understood, speakers can aim for a derhoticized acoustic target (which carries a particular sociolinguistic meaning) using an articulation which reveals a strong but relatively inaudible reflex of the diachronically previous and apparently still “underlying” affiliation. Similar behavior may also occur in Dutch (Scobbie et al., in preparation).



**Figure 19.5** Four ultrasound images showing tongue-tip raising late in a pre-pausal derhoticized token of citation “for” from a Scottish English speaker. Anterior to right. The third formant remains high throughout the token [f<sub>3</sub>].

Finally, statistical analysis is generally essential in sociophonetic work, especially given the likelihood that complex sources of variation in the design and the focus on spontaneous speech may yield some messy data. Appropriate techniques must therefore be chosen carefully. Sociolinguists have generally been content to identify variable patterns with the Varbrul program (Rand & Sankoff, 1990). However, this program is not without its limitations (being restricted to categorical data, for example) and it enjoys little popularity in other fields (Pierrehumbert, 2006). Generic tools such as regression and analysis of variance find more favor in experimental phonetics, where the researcher has more control over the number of tokens per cell. Cluster analysis is also used in case studies where several variables are examined simultaneously (Horvath, 1985; Stuart-Smith et al., 2007). For a general survey of statistical techniques see Rietveld and van Hout (1993).

### 5.3 Outlook

While sociophonetics is characterized by its eclecticism with respect to data and methods, it is apparent that its techniques have so far been applied to relatively few languages. Work on English is especially dominant (as testified by the bias in examples cited in this chapter). However, sociophonetic studies of other languages are increasing in number, with recent work including studies of Albanian (Moosmüller & Granser, 2006), Arabic (Khattab et al., 2006), Irish (Dalton & Ní Chasaide, 2003, 2005), Latvian (Bond et al., 2006), and Shoshoni (Elzinga & Di Paolo, forthcoming).

Sociophoneticians are furthermore coming together to share good practice in analytic techniques, especially those that can be applied to spontaneous speech. The annual NWAV conferences in North America have staged workshops on sociophonetic techniques applied to speech production since 2004, and a first textbook is to appear (Yaeger-Dror & Di Paolo, 2010). Sociophonetics still needs phonetic scientists to develop better techniques for processing large quantities of data, often spontaneous speech, and for normalizing across different speakers (Van de Velde, 2007).

## 6 Theoretical Implications of Sociophonetic Studies

It will be apparent from the foregoing that sociophonetic data have been harvested to address a wide range of theoretical issues, reflecting the range of disciplines that have contributed to the development of sociophonetics as a field. We offer here a brief summary of the main theoretical areas of concern to sociophoneticians.

Given the historical origin of sociophonetics within sociolinguistics it is no surprise to find considerable overlap in their theoretical interests. Labov's work has always been principally concerned with providing explanations for language change: how changes originate and how they spread through grammars and communities (Labov, 1994, 2001, forthcoming; Milroy, 1992). Sociophoneticians have naturally focused on aspects of sound change. The contribution of sociolinguistic

work in general to historical linguistics has been to complement the theoretical predictions of earlier schools, especially those of the neogrammarians and structuralists. The claims of such schools were largely based on concepts relating to the grammatical system, such as functional load and symmetry (McMahon, 1994). Sociolinguists have agreed that such factors may indeed contribute to determining which changes are more likely to occur, and what paths they might take. Indeed, as noted in section 3.2.1, Labov's chain shift model draws explicitly on structuralist notions of the phonological system.

However, sociolinguists have demonstrated that it is essential to make reference to human communities and human interaction in order to fully understand how and why changes take place where and when they do. Changes operate because communities are heterogeneous, and because speaker-listeners *evaluate* competing linguistic forms. They recognize that variants have indexical meanings and thus that their use may be more or less attractive, appropriate or valuable in particular social circumstances. Positively evaluated variants (such as coda /r/ in American English) generally spread at the expense of their less positively evaluated rivals. The contribution of theoretical tools from sociology, social psychology, and other neighboring disciplines cannot be underestimated in this regard. Frameworks such as social networks and communities of practice have both been imported into linguistics and have led to significant advances in our understanding of the structure of human interaction and its effects on language.

Experimental phonetics has itself made considerable advances in respect of the *actuation* problem, or the question of where and why a change begins. Experimental studies explain how phonetic innovations may arise as a result of the dynamic actions of the articulatory system, the effects of aerodynamic principles operating within the vocal tract, and the properties of the perceptual system. It has been shown, for example, that contrastive systems of high and low tones arise through reanalysis of fundamental frequency differences originally associated with consonant voicing (Hombert et al., 1979), while affrication of stops is most likely to develop adjacent to close vowels because of the likelihood that vocal tract narrowing will create turbulent airflow (Ohala 1983, 1989). Such explanations are limited, however, to phonetically transparent and cross-linguistically recurrent changes. They do not explain the more arbitrary developments found in abundance in sociolinguistic studies, such as the change in English /r/ which has taken opposite paths in different parts of the English-speaking world. Labov has attempted to make sense of the apparent arbitrariness of many changes by appealing to degrees of conscious awareness of variable forms on the part of speaker-listeners. Variables may be ranked as stereotypes, markers, or indicators, in decreasing order of awareness. Different types of change may affect the different types of variable. It remains a moot point whether phonetic forms can be shown to have universal degrees of *salience*, equally noticeable no matter what the community or language concerned (Docherty, 2007). Frequency effects may interact with those of social evaluation to determine the outcome of change (Bybee, 2001), as in the case of dialect leveling changes and new dialect formation (Kerswill & Williams, 2000; Trudgill et al., 2000; Trudgill, 2004). The features of new dialects, as in the case

of New Zealand English, tend to be drawn from the common shared features of the contributing dialects, with minority forms becoming lost.

Sociophonetic data have made less of an impact on the main theoretical developments in phonetics and phonology. Following the pattern of Chomskyan linguistics in general, phonology and phonetics have largely pursued an active strategy of eliminating many aspects of variation, including socially structured variation, from their purview. Theories of speech production and perception (Elman & McClelland, 1986; Levelt, 1989; Löfqvist this volume) have certainly made reference to variation in spoken form, but in general this has been variation connected to prosodic context, segmental environment, speech rate, etc. Phonology has likewise tended to be concerned with aspects of variation that can be considered allophonic or the subject of phonological rules or processes (depending on the terminology used in the particular model).

As a consequence, there has been rather limited communication so far between sociophonetics on the one side and phonological and phonetic theory on the other. Sociophoneticians have not yet tested the full range of predictions made by theoretical models, while theoreticians have been slow to take account of sociophonetic data and the challenging testing ground that they provide. Some collaborative progress has been made, however, as the following examples illustrate. First, adjustments have been made to the machinery of several phonological models in response to the findings of sociophonetic work, including Optimality Theory (e.g., Nagy & Reynolds, 1997; Anttila, 1997; Coetzee, 2006). Second, work on the phonetics of conversation has established that many aspects of speech planning are mutually negotiated by partners in interaction, and that listeners orient to fine-grained aspects of phonetic detail in the construction of conversation. Findings such as these raise some serious challenges to many of the fundamental assumptions of modern linguistic theories, including segmental structures, the core role of the lexicon, and the emphasis on speech planning being the product of one party (Local, 2003, 2007). Finally, data from sociophonetic studies of speech production by adults and children are contributing to the refinement of exemplar models of phonological knowledge, first applied to language in speech perception research (Foulkes & Docherty, 2006; Hay, Nolan, & Drager, 2006; Johnson, 2006; and for a critique, Labov, 2006). Exemplar models are prime candidates to accommodate sociophonetic data, since they depart from tradition in taking aspects of variation as central facts to be accounted for and explained (Pisoni, 1997; Pierrehumbert, 2002). They also implicitly acknowledge that socially conditioned variation may overlap with aspects of variation which result from reflexes of the phonological system, being manifested in the same phonetic materials (Docherty et al., 2006).

## 7 Wider Applications of Sociophonetics

As well as contributing to linguistics, sociophonetic studies provide valuable resources for a range of applied fields.

Variation poses a perennial problem for speech technology. Natural variation must be catered for in speech and speaker recognition systems to ensure robust performance (Hoequist & Nolan, 1991; Laver, 1995; Bates et al., 2007). Descriptive sociophonetic accounts can contribute to such systems, identifying the loci and parameters of variation for speakers, dialects, and contexts. They may assist in refining speech synthesis programs, rendering them more natural-sounding and acceptable to listeners. Synthesis systems are also being developed which permit options for regional dialect and other indexical features of the speaker's voice (Fitt & Isard, 1999; Carlson & Granström, this volume). Sociophoneticians and speech technologists have furthermore often shared corpora of recordings in the pursuit of their respective goals (e.g., Glenn & Strassel, 2006).

In speech and language therapy, sociophonetic research provides a baseline of normal patterns of within-speaker and within-community variation. This can assist the speech and language therapist in distinguishing genuine pathology from nonstandardness in children's speech and language development (Howard & Heselwood, 2002; Oetting, 2005), and can also be used to inform appropriate diagnosis and treatment in adults (Milroy, 1987a, pp. 208 ff.; Docherty & Khattab, 2008). The close resemblance of certain innovatory speech forms to infantile and/or pathological pronunciations (e.g., labiodental /r/ or (th)-fronting and -stopping in English) can make this difficult. It increases the likelihood that non-disordered early adopters of such sound changes are more likely to be misidentified as phonologically delayed or disordered than their peers, with obvious repercussions in terms of workload and commitment of resources, and potential distress to the child and his/her caregivers. The sociophonetic literature can therefore be a valuable aid to speech and language therapists whose task it is to decide whether or not to recommend treatment, a consideration explicitly recognized by a number of contributions to McLeod (2006). Among other things it may help them to identify the point at which intervention becomes unnecessary or self-defeating in cases where the change has been adopted by a critical mass of speakers of the variety (see further Watt & Smith, 2005).

A refined assessment of normal patterns of spoken variation may further assist in pedagogical issues. Educationalists are better equipped to assess educational needs in particular communities as a result, for example, of understanding the differences between standard written forms and the local pronunciation norms. A striking example where this issue came to public attention was in the United States in 1979, when the presiding judge upheld a suit brought against the School District Board of Ann Arbor, Michigan, by black parents claiming that the school system had violated their children's rights by failing to teach them standard English or to take their spoken dialect into account during their education (Freeman, 1982; Wolfram & Schilling-Estes, 1998, pp. 169 ff.).

Many sectors of commerce plan their business strategies with reference to linguistic factors, including assessments of the impact of spoken variation on their markets (Bell, 1991, pp. 135 ff.). For instance, the locations for telephone call centers may be chosen in part because the local speech variety is deemed to

be attractive or acceptable to clients. Advertising campaigns may select specific regional accents or individual voices to maximize the appeal of the product to customers. Linguistic researchers are also coming to study the effects of language choices on workers as well as businesses, for example with reference to the use in call centers of written texts, explicit training in conversational style, and the forced choice of sociolinguistic forms (Mirchandani, 2004; Orr, 2007).

Finally, sociophonetics plays a central role in the growing field of forensic phonetics. Understanding cross-speaker and within-speaker variation is essential in the process of speaker comparison, in which the recorded voice of a criminal is compared with that of a suspect. Of particular importance are the establishment of the distribution of features across populations and the parameters of variation in different settings (for example, assessing the impact of speaking on a telephone, and the effects on the voice of emotion and intoxicants). The effects of aging may also be important in cases where there is a long delay between the recording of the crime and that of the suspect. In another forensic task, speaker profiling, the analyst is asked to describe the likely source of a voice in order to narrow the field of potential suspects, for example in cases where a telephone call or tape recording may be delivered by a kidnapper. The strength of conclusions that can be drawn depends largely on the documentary record of how linguistic features are distributed (for an example, see Ellis, 1994; French et al., 2006).

## 8 Conclusion

As this review has illustrated, sociophonetics is a diffuse research field, but one which is beginning to lay claim to be a core phonetic science. Its unifying characteristic is that it is born of a cross-fertilization of methods and theories, drawn especially from phonetics and sociolinguistics but increasingly grafting itself to the principles of other disciplines. The strength of this pedigree is that it enables sociophonetics to address some of the weaknesses in its component parts (Thomas, 2002b). The source materials of sociophonetics include not only standard dialects and citation speech, but a range of speech styles and they display a particular emphasis on spontaneous interaction. Data samples are typically large and elicited from heterogeneous samples. The methodologies employed by sociophoneticians range from controlled experimentation to ethnographically informed observation of speaking and listening in different situations. The analytic methods used in sociophonetics span a wide range of techniques, both instrumental and auditory. Sociophonetics is also informed by a variety of different theoretical models, and its results are in turn being used to address a wide range of theoretical issues.

The array of materials, methods, and models testifies to the recognition by sociophoneticians that speech is a multifaceted signal, replete with systematic variation resulting from many sources, and fulfilling a wide range of functions.

Placing the social complexity of speech center stage offers a strenuous challenge in explaining how aspects of variation are learned, stored, and processed. In particular, it remains to be seen whether sociophonetic variation and “pure linguistic” knowledge are best handled as discrete cognitive modules (Docherty & Foulkes, 2000; Docherty et al., 2006; Scobbie 2007b).

Labov has famously noted that he long resisted the term “sociolinguistics” because of its implication that there might be a successful linguistic theory which is not social (Labov, 1972, p. xiii). By the same token, many researchers in phonetics are now coming to the view that abstraction of speech from its social context limits the power of phonetic research. Thus, socially structured variation is both a topic of undeniable theoretical importance for the phonetic sciences, and a phenomenon that can be exploited by phoneticians of all types in the pursuit of the very widest range of research interests. Fine differences in the phonetic systems of individuals that are not merely physiological are part of the grammar, and should not be marginalized as “variation-as-noise,” because they can be used to explore the fundamental bases of sound systems in far more subtlety than cross-linguistic differences. Subtle and otherwise, many speech phenomena are learned and used as part of the construction of social identity, making sociophonetics one of the key phonetic sciences.

## NOTES

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- 1 Although sociophonetics does not yet appear in published versions of the *Oxford English Dictionary*, the *OED* archives provide one instance of “socio-phonetic” which predates Deshaies-Lafontaine. The term is used by Halle (1963, p. 10) in a translation of a Russian text by Gvozdev from 1949. However, its sense there is metalinguistic and does not concur with modern usage. Our thanks to Gillian Evans of the *OED* and Mike MacMahon for drawing this to our attention.
- 2 We acknowledge that the authors of the works we cite may not themselves use the term sociophonetic to describe their research.
- 3 A number of sociolinguists utilize Silverstein’s (2003) distinction between “first-order” and “second-order” indexicality in accounting for differences in functional aspects of linguistic variation. First-order indexicality refers to the (objective) association of particular patterns of linguistic behavior with globally or locally meaningful social groups, while second-order indexicality pertains to speakers’ subjective metalinguistic knowledge of the social and communicative roles played by variable linguistic forms.
- 4 The use of the symbol /r/ here is intended to cover a range of possible phonetic forms. See, e.g., Stuart-Smith (2003) for discussion of variants in Scottish English.

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