22

Sociophonetics

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22.1 Introduction

Sociophonetics investigates socially conditioned phonetic and morphological variation in speech production and perception, examining the effects of social factors alongside and in interaction with linguistic factors. Work in sociophonetics informs work in phonetics and phonology more generally. For example, work by William Labov was among the first to challenge the idea that linguistic enquiry should focus on homogeneous speech communities and ideal speaker-hearers (cf. Chomsky, 1965). Rather than treating socially conditioned variation as noise, sociophoneticians centre variation, demonstrating how the production and perception of linguistic variation patterns with social factors in systematic ways.

We begin in Section 22.2 by presenting a brief history of work in sociophonetics and, in Section 22.3, introducing current questions of interest. In Section 22.4.1 we step through data-collection methods that focus on production, in Section 22.4.2 we discuss those that focus on perception, and in Section 22.4.3 we discuss methods of analysis. In Section 22.5, we present an approach to teaching a course on sociophonetics and, in Section 22.6, we turn to lesser-used methods.

22.2 Historical Overview

Historically, sociolinguistics has not been treated as a core area within phonetics. However, the benefits of coming from a socially informed perspective are well established thanks to decades of work in variationist sociolinguistics, as well as a growing body of work that investigates sociophonetic variation from a cognitive perspective. For further discussion of sociophonetic work, please see Foulkes and Docherty (2006), Hay and Drager (2007), Foulkes et al. (2010) and Thomas (2011).

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It is worth noting that some sociophonetic work does not use the IPA; an overview of alternatives is presented in Table 22.1. Some sociophoneticians use a system created by Labov (Labov et al., 2006), whereas others use Wells's lexical sets (Wells, 1982), or the adaptation of Wells's lexical sets used by some American scholars in, for example, PADS volumes (Yaeger-Dror & Thomas, 2009). One benefit of the Wells and PADS lexical set labels is that the words serve as reference points that are easily interpretable for scholars outside of linguistics (e.g. anthropology), whereas one benefit of the Labov labels that is missing from the lexical set labels is that they encode the direction of a diphthong's glide. A benefit of the non-IPA alternatives is that they make no claims as to the specific phonetic symbol that should be used to represent a phone. Using IPA to represent phonemic categories requires scholars to make ideologically based decisions about what counts as the norm or the standard, a practice that is particularly problematic when approaching work from a sociophonetic perspective. Indeed, in developing Table 22.1, the authors of this chapter found themselves disagreeing over which IPA symbols were most appropriate, and there was an aura of discomfort ascribing 'standardness' to some realisations and not others. This problem does not arise with the other labelling systems. Further, none of the non-IPA labels in Table 22.1 requires a special font. Despite the advantages of using the non-IPA systems, the use of IPA may sometimes be preferred since it increases sociophoneticians' ability to reach a broader phonetics audience.

Most work in sociophonetics has arisen within the variationist branch of sociolinguistics. Variationists investigate patterns of linguistic variables that can be linked with both macro-social categories across speakers and stylistic shifts of individuals in interaction. Variationist work has largely focused on phonological variation in production due to the high frequency of sociophonetic variables in spontaneously produced speech compared with variables at other levels of the grammar. This focus may also be due to how the indexicality of phonemes is independent of reference, which may allow sounds to be more readily available to accrue social meaning (Eckert & Labov, 2017, p. 469).

Eckert (2012) has identified three 'waves' in the study of linguistic variation. Each wave is associated with a particular set of research questions and methods. With its roots in dialectology (Weinreich, 1954), first-wave studies (e.g. Labov, 2006 [1966]; Wolfram, 1969; Trudgill, 1974) aim to establish links between linguistic variation and predetermined, broad social categories, such as speaker age and region of origin. For example, chapter author Thomas has a fronter and more raised realisation of /æ/ than co-author Katie, which is unsurprising since Thomas is from New York and Katie is from California; we know from first-wave studies that this difference is a general pattern rather than something that is idiosyncratic to these two speakers. To study sound change, work in the first wave often employs an apparent-time approach, which examines variation across different age groups at a single point in

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Table 22.1 *Correspondences between IPA in Southern Standard British English (SSBE) and General American English (GenAm), Wells's lexical set labels, adaptations of lexical sets used in PADS volumes, and Labovian notation*

SSBE	GenAm	Wells	PADS	Labov
/ɪ/	/ɪ/	KIT	BIT	i
/e/ ~ /ɛ/	/ɛ/	DRESS	BET	e
/æ/ ~ /a/	/æ/	TRAP	BAT	æ
/ɒ/	/ɑ/ ~ /ɒ/	LOT	BOT	o
/ʌ/	/ʌ/	STRUT	BUT	ʌ
/ʊ/	/ʊ/	FOOT	BOOK	u
/ɑː/	/æ/	BATH	BAT	æh
/ɔː/ ~ /ɒ/	/ɑ/ ~ /ɒ/	CLOTH	BOUGHT	o/oh
/ɜː/ ~ /əː/	/əɹ/	NURSE	BURT	ʌhr
/iː/	/iː/	FLEECE	BEET	iy
/eɪ/ ~ /ɛɪ/	/eɪ/	FACE	BAIT	ey
/ɑː/	/ɑ/ ~ /ɒ/	PALM	–	ah
/ɔː/	/ɑ/ ~ /ɒ/	THOUGHT	BOUGHT	oh
/əʊ/	/oʊ/	GOAT	BOAT	ow
/uː/ ~ /ʉː/	/uː/ ~ /ʉː/	GOOSE	BOOT	uw
/aɪ/	/aɪ/	PRICE	BITE	ay
/ɔɪ/	/ɔɪ/	CHOICE	BOY	oy
/aʊ/	/aʊ/	MOUTH	BOUT	aw
/ɪə/ ~ /ɪː/	/ɪɹ/	NEAR	BEER	ihr
/ɛə/ ~ /ɛː/	/ɛɹ/	SQUARE	BARE	ehr
/ɑː/	/ɑɹ/	START	BAR	ahr
/ɔː/	/ɔɹ/ ~ /oɹ/	NORTH	BORE	ɔhr
/ɔː/	/ɔɹ/ ~ /oɹ/	FORCE	BORE	ohr
/ʊə/ ~ /ɔː/	/ʊɹ/	CURE	BURR	uhr
/ɪ/ ~ /iː/	/i/	happY	–	–
/ə/	/əɹ/	letteR	–	–
/ə/	/ə/	commA	–	–

time. In contrast, real-time studies using longitudinal data help shed light on how sociophonetic variation changes over time, and can even be used to examine change in the speech of a single individual. The most famous example is Harrington et al. (2000), which investigates the extent to which the vowel space of Queen Elizabeth II changes over time based on her Christmas broadcasts.

Building on work in the first wave, researchers conducting second-wave research have sought correlations between linguistic variables and locally relevant social categories, including social networks (Milroy & Milroy, 1978), high school cliques (Eckert, 2000), and groupings based on the types of animals each family owns (Holmquist, 1985). This work demonstrates how speakers orient to broad social categories within the context of locally relevant groupings, with the goal of understanding the diffusion of linguistic variables from the perspective of speakers' everyday lives. For example, in her study of two cliques (the Jocks and Burnouts) in a suburban

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high school, Eckert (2000) finds that Burnout girls produce the highest rate of STRUT backing and Jock girls produce the lowest rates, with boys from both groups in between (Eckert, 2000, pp. 117–18). This backed realisation is found in speech produced in nearby Detroit, so the use of the more innovative variant by the Burnout girls who align with the city helps explain how the change is diffusing in the region.

Work in the third wave focuses on stylistic variation. Third-wave research (e.g. Coupland, 1980; Eckert, 2008; Podesva, 2011) treats the use of variants and clusters of variants as an agentive choice, investigating how speakers draw on their linguistic repertoires to construct context-dependent *stances* (i.e. 'a person's expression of their relationship' to what they say and who they are talking to (Kiesling, 2009, p. 172)), *styles* (i.e. the process of meaning making in which speakers draw on shared social beliefs (Coupland, 2014, p. 292)), and *personae* (i.e. social types enacted through styling (D'Onofrio, 2016, p. 1)). For example, Podesva's (2011) study on stylistic variation demonstrates how one speaker, Heath, produces relatively more rising contours while at work compared with other contexts, and uses acoustically extreme falling contours at a BBQ with friends. Podesva argues that the relatively high frequency of rising contours helps Heath construct a caring doctor persona while at work, while the acoustically extreme falling contours help him construct a diva persona when with his friends. The link between Heath's phonetic realisations and his personae helps demonstrate the importance of considering context and a speaker's social goals when examining phonetic realisations.

It is important to note that each successive wave has not replaced another, and the waves are not chronological. Instead, each wave adds to the constellation of questions sociolinguists ask and the tools we use to ask them. Sociophonetic investigations today can draw on a combination of first-wave assessments of macro-sociological patterns, second-wave considerations of locally relevant groupings, and third-wave style and stance analyses. These perspectives are complementary, helping us to better understand the factors that structure sociophonetic variation.

22.3 Critical Issues

Although variationist sociolinguistic work on speech production forms the core of sociophonetics, the field has expanded rapidly over the past two decades. In the following sections, we discuss studies that involve a more nuanced treatment of social factors (Section 22.3.1), variation in non-European languages and in the speech of L2 learners and multilingual speakers (Section 22.3.2), consonants and suprasegmental variables (Section 22.3.3), speech perception (Section 22.3.4), and cognitive models of how sounds are stored and processed (Section 22.3.5).

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22.3.1 Beyond Static Social Categories

Work in the third wave moves away from relying on predetermined, static social categories, focusing instead on how individuals actively position themselves during interactions. For example, work that examines the speech of non-binary and transgender individuals demonstrates how sociophonetic cues can be used to signal disalignment with interlocutors (Gratton, 2017) and how a complex view of gender as a mosaic of assignment, role, identity and presentation provides the best explanation of gendered phonetic patterns (Zimman, 2017). Ethnicity is also performed and constructed in the course of interaction, as speakers align and disalign with each other and the content of the talk (Schilling-Estes, 2004) in sometimes phonetically subtle ways (Holliday, 2016).

This increasingly nuanced treatment of social factors presents a challenge for phoneticians – even those who are not primarily interested in sociolinguistics – because interpreting socially meaningful variation can be more difficult when it is not linked to a neat and tidy category. Practically speaking, this means that, when social factors are gleaned from demographic questionnaires, they should not be interpreted as though they tell the whole story. In addition, social categories (e.g. gender) should not serve as a proxy for physiology (e.g. vocal tract size) unless appropriate caveats are made.

22.3.2 Beyond Monolingual English Speakers

Sociophonetic work often focuses on English and – when not on English – on widely spoken European languages. This severely limits the ability to make generalisations about how sounds pattern, how they are perceived, and how they change. Increasingly, however, sociophoneticians are examining widely spoken non-European languages such as Mandarin (Zhang, 2005) and Korean (Kim & Drager, 2017). In addition, there is a push for more work on smaller and endangered languages (Hildebrandt et al., 2017) and for examining multiple variables while doing so (Meyerhoff, 2017). When conducting (and reading) work on these languages, it is important to recognise the challenges of conducting quantitative work in a community with a small number of speakers.

Likewise, there is growing interest in variation in the speech of second language learners (Mougeon & Nadasdi, 1998) and multilingual speakers (Khattab, 2013). As the variety of language families and linguistic backgrounds investigated in sociophonetic work expands, our understanding of variation will be enriched exponentially.

22.3.3 Beyond Impressionistic Analyses and Vowel Formants

Impressionistic labelling of phonetic data used to be the norm in sociophonetic studies (e.g. Labov, 1963, 2006 [1966]). With the widespread

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availability of free digital acoustic analysis programs like Praat (Boersma & Weenink, 2017), it has become standard for sociophonetic investigations to rely on directly measurable, high-precision quantification of acoustic data (see e.g. Labov et al., 1972; Thomas, 1997; Foulkes & Docherty, 2006; Wassink, 2015). With a goal of compensating for differences across speakers with different vocal tract size while preserving other variation, vocal tract normalisation is conducted when comparing realisations across speakers (Adank et al., 2004). Normalisation can be completed using equations in a spreadsheet, the NORM online normalisation suite (Thomas & Kendall, 2007), or R packages such as phonR (McCloy, 2016). When working with acoustic data such as vowel formants, it is important to bear in mind there is not a direct relationship between F1/F2 space and the vowel's articulation or the perceptual impressions of the vowel's quality (Docherty et al., 2018). In addition to including appropriate caveats, sociophoneticians can analyse additional acoustic cues and collect articulatory and perceptual data that – together – can inform cognitive models of speech production, perception and processing.

Variationist sociolinguists are increasingly turning their attention to analyses of variation in prosody (Podesva, 2011; Yaeger-Dror et al., 2011; Holliday, 2016), voice quality (Szakay, 2012) and the non-categorical realisation of consonants (Foulkes et al., 1999; Baker et al., 2011). This work demonstrates, for example, that phonetic cues work together to construct social meaning (Kirtley, 2015) and that consonants can pattern gradiently in socially meaningful ways (Foulkes et al., 1999). For instance, in addition to word-final /t/ being realised categorically (e.g. plosive vs. glottal stop), the acoustic characteristics (e.g. duration or centre of gravity) of any release that is present could be linked with the speaker's social characteristics or stylistic moves (see e.g. Foulkes et al., 1999).

22.3.4 Beyond Production

Since the turn of the millennium, sociophoneticians have increasingly investigated speech perception. The matched guise technique (see Section 22.4.2.3) has been used extensively to probe language attitudes, to explore what social characteristics are attributed to a talker based on phonetic variants in the signal (Campbell-Kibler, 2011; Levon, 2014), and to test whether listeners can rapidly learn associations between phonetic realisations and indexical information (Docherty et al., 2013). Work using other experimental techniques has investigated the perception of sounds undergoing change (Labov et al., 1972; Bowie, 2000) and how perception varies across regional varieties (Ladefoged & Broadbent, 1957) or other social groupings (Thomas, 2000). This work demonstrates that a combination of region and one's own production is linked with vowel identification (Willis, 1972; Fridland & Kendall, 2012). However, there are also a number of cases in which individuals reliably produce a distinction between phones that

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they are unable to perceive (Costa & Mattingly, 1981; Janson & Schulman, 1983) or can perceive a distinction that they do not produce (Hay et al., 2006). Further, groups known to be leading vowel shifts (e.g. young women) demonstrate perceptual adaptation in the direction of a shift (Janson, 1983; De Decker, 2010), though a lag between the degree of shift in production and perception has also been observed at the individual level (Kettig & Winter, 2017).

Sociophonetic work on intelligibility sheds light on speech processing (Clopper et al., 2010) and demonstrates that a number of factors influence intelligibility, including the talker's age (Jacewicz & Fox, 2012) and regional dialect (Ash, 1992). There is also evidence that social primes, sources of socially linked information that cause a change in participant behaviour, can affect intelligibility (McGowan, 2015). Attitudes, however, appear to play a minimal role (Schüppert et al., 2015).

In addition, there is growing evidence that listeners' interpretations of sounds are influenced by their expectations about the talker (Janson & Schulman, 1983; Niedzielski, 1999) and that social priming can occur even when the listener has no reason to believe that the socially associated prime is linked with the talker (Hay & Drager, 2010). Likewise, sociophonetic variation can affect lexical access (Sumner & Samuel, 2009), even across a bilingual's languages (Szakay et al., 2016). Further, lexical access is faster when there is congruence between the age of the talker and the age of people who tend to use that word (Walker & Hay, 2011), even when talker age is cued only by a single sociophonetic variable (Kim & Drager, 2017).

Sociophonetic work on perception raises interesting questions about how a sound change diffuses through a community. For example, if expectations about a talker influence how the sounds they produce are interpreted – perhaps even further in the direction of a shift than tokens the listeners have actually encountered – what form does the stored representation take and how does that representation affect future productions by that individual? Likewise, if canonical forms have a greater effect on perception than frequent forms, what predictions can we make about the use of these sounds to construct personae and what does this tell us about how sounds are stored and processed?

22.3.5 Beyond Description

Alongside regular sound change and categorical allophony, work in sociophonetics treats variation in both production and perception as a key element in understanding phonology, with scholars proposing variable rules (Labov, 1969; Guy, 1991), exemplar-based models (Pierrehumbert, 2006) and Bayesian models (Kleinschmidt et al., 2018). Indeed, sociophonetic work was among the first to challenge the idea that contextual information is filtered out during speech planning and processing,

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suggesting instead that a great deal of variability is stored and indexed to relevant contextual information. For example, variation in loanword adaptation seems to be affected by indexical information associated with individual words (Lev-Ari & Peperkamp, 2014); borrowed words may be more likely to retain their native phonology when the source language has high prestige among speakers of the host language.

There is growing evidence that phonological patterning is experience-driven. For example, words commonly used by young speakers are more likely to be realised with innovative variants, regardless of who is producing them (Hay & Foulkes, 2016). Since experience with phonetic representations is influenced by a speaker's social background and networks, social factors often play a key role in this work.

There is also evidence that experience within an interaction – even with one's own speech – can affect realisations. What variant is produced appears to depend on a combination of repetition, variable type, and whether the repetition occurs in the same lexical item or not (Tamminga, 2014). The effect appears to decay over time, with a lower likelihood of form repetition in cases when there is a greater duration between the token being analysed and the previous production of that sound in the interaction (Clark, 2014).

How sounds are stored and processed remains a topic of much debate, leaving a great deal of exciting work ahead within sociophonetics.

22.4 Current Research

Sociophoneticians explore a wide range of research questions, and this necessitates a wide range of methods. In Section 22.4.1, we present methods used to examine production, and in Section 22.4.2, we discuss methods used to investigate perception. For each method, participants' demographic information is collected, often using a short questionnaire. Additional methods for work on sociophonetics are presented in DiPaolo and Yaeger-Dror (2011), Mallinson et al. (2013) and Drager (2018) as well as in other contributions to this handbook.

22.4.1 Methods to Examine Production

The methods used to explore the questions outlined in Sections 22.2 and 22.3 vary depending on the specific focus of the study. The methods associated with the first wave include quantitative analysis of linguistic variables from interviews conducted in a community (Section 22.4.1.1) as well as rapid anonymous surveys (Section 22.4.1.2). To gain a better understanding of why certain groups adopt specific variants, the second and third waves often use ethnographic methods (Section 22.4.1.3). To examine how speakers' phonetic realisations vary as a function of who they are

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talking to, researchers can use experimental methods (Section 22.4.1.4) or adaptations of the methods outlined in Sections 22.4.1.1–22.4.1.3. In our presentation of these methods, we focus on data collection, with limited discussion of analysis; for a more in-depth description of phonetic analytical methods, see Baranowski (2013).

Regardless of which data-collection method is used, a high-quality recording is necessary for conducting phonetic analysis. This can be especially challenging in fieldwork contexts, where background noise and multiple talkers can hinder recording quality. For discussions on best practices for creating high-quality recordings, see De Decker and Nycz (2013) and Hall-Lew and Plichta (2013).

22.4.1.1 Corpus-based Variationist Sociolinguistics

Following Labov (1963, 1972), variationist sociolinguists have focused much of their analysis on spontaneously produced speech, and on informal interview data in particular. Questions, such as the Danger of Death question (i.e. *Have you ever been in a situation where you were in serious danger of getting killed—where you thought to yourself 'This is it'?* Labov 1972, p. 93), are used to engage participants so that they are less likely to monitor their speech as they talk. Corpora of interviews can then be mined to investigate patterns of linguistic variation. Notable corpora used by sociophoneticians include the Sociolinguistic Archive and Analysis Project (Kendall, 2013), Heritage Language Variation and Change in Toronto (Nagy, 2017), and the Buckeye Corpus (Pitt et al., 2007).

With a corpus that contains data from the same population collected at different times, observations can be made in real time, shedding light on how sound change spreads through a community. For instance, the Philadelphia Neighborhood Corpus (Labov et al., 2013) has been used to analyse sociolinguistic variation and change within Philadelphia English, and the Origins of New Zealand English project demonstrates how the sounds of present-day New Zealand English emerged from settlers' input varieties (Gordon et al., 2004).

Increasingly, researchers are asking speakers to self-record in a variety of different interactional contexts (Podesva, 2007, 2011; Kirtley, 2015; Van Hofwegen, 2017) so that a range of styles produced by the speaker can be analysed. Such a comprehensive data set is ideal for exploring the relationship between intra- and inter-speaker variation.

When using a corpus to analyse a sociophonetic variable, researchers first identify the variable in the data and then code its phonetic characteristics. Other characteristics (e.g. phonological environment) are also coded. If the number of tokens for some speakers or environments is restricted in order to achieve a more balanced sample, care should be taken to avoid developing a strategy that could influence the outcome of the analysis.

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22.4.1.2 Surveys

Surveys have a long history of use within sociolinguistics and, relatedly, within linguistic geography. Surveys collect data more quickly and cheaply than conducting in-person interviews, and they allow researchers to reach participants farther afield and with minimal interaction. Surveys used by sociophoneticians include rapid and anonymous surveys (Labov, 2006 [1966]), telephone surveys (Labov et al., 2006) and online surveys (Vaux & Golder, 2003).

The Atlas of North American English (Labov et al., 2006) uses a large number of instrumental acoustic measurements of data from the TELSUR corpus (Labov et al., 2006, pp. 21–35), a collection of phone conversations involving the elicitation of word lists and metalinguistic judgements. Although the 762 speakers in the TELSUR corpus make up only a tiny proportion of the general population, analysis of the data confirms the existence of large-scale vowel shifts previously reported in the US and Canada.

Linguists have recently been taking advantage of crowdsourcing techniques to increase sample sizes. Smartphone apps that predict a user's dialect based on answers to a survey allow participants representing a wide range of ages and locales to submit their answers and voice data (Leemann et al., 2016). Leemann (2017), for instance, used speech data from nearly 3,000 *DialäktÄpp* users across German-speaking Switzerland to map regional differences in articulation rate, finding the fastest speech rates around Zurich and the slowest around Bern.

While efficient, surveys often provide little control over who participates and the environment in which they are completed. Likewise, biases may arise depending on what recruitment and distribution methods are used. Researchers must therefore be careful to interpret their results accordingly and can triangulate with other methods, such as targeted laboratory investigations. When done well, large-scale surveys can be valuable tools for identifying and analysing macro-level change and variation.

22.4.1.3 Ethnography

Ethnography, a qualitative method of data collection, analysis and presentation that involves participant observation, has been increasingly used by sociophoneticians working in the second and third waves of variationist studies (discussed in Section 22.2). Sociophoneticians have used ethnography to study linguistic variation across different communities of practice (Eckert, 2000), across individuals within select communities of practice (Mendoza-Denton, 2008; Clark, 2009), and within the speech of individual speakers (Podesva, 2011; Kirtley, 2015). Ethnography can also be combined with experimental methods, including those that examine perception (Drager, 2010; Maegaard, 2010).

Compared with other methods, sociophonetic ethnography is time-consuming, and it is difficult to make and test specific hypotheses.

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However, ethnography is an excellent way to gather data that is rich in social information.

22.4.1.4 Techniques for Studying Speech Accommodation

Speech accommodation is when speakers converge on or diverge from the speech of an interlocutor. One common method for examining accommodation involves participants talking with someone who speaks a different variety than them (Rickford & McNair-Knox, 1994; Llamas et al., 2009; Scanlon & Wassink, 2010). In some cases, social primes are used (Drager et al., 2010) or participants' attitudes toward their interlocutor are manipulated (Babel, 2010). Researchers can also test for a corresponding shift in perception (Walker et al., 2017). Studies on second dialect acquisition (cf. Nycz, 2015) and reality TV shows (Sonderegger et al., 2017) provide a window on longer-term effects.

Other sociophonetic work on accommodation uses imitation tasks in which participants hear and repeat an auditory stimulus (Babel, 2012; Pardo, 2012). To determine the amount of shift, realisations in the repeated words are compared to tokens from a pre-test. Participants in imitation tasks can be instructed to try to sound like the talker (German et al., 2013), or can be explicitly told not to (Walker & Campbell-Kibler, 2015). Since some accommodation is observed regardless of explicit instruction to do otherwise, Walker and Campbell-Kibler (2015) suggest that accommodation is an automatic process that does not require speaker agency. Other work exploring the automaticity of accommodation has used virtual reality (Staum Casasanto et al., 2010) and robots (Beckner et al., 2016), with mixed results.

One option for analysing data from an accommodation study is to compare pre- and post-prime realisations using acoustic-phonetic analysis. Alternatively, an AXB task (where A and B are the participant's productions and X is the prime talker's production) could be used, or an AXB task could be combined with acoustic-phonetic analysis. Future studies could test shifts in realisations over the course of an experiment as a function of frequency of exposure and duration between the prime and target.

22.4.2 Methods to Examine Perception

While early work included investigations of perception (e.g. Labov, 1972), research in sociophonetics has overwhelmingly focused on production. However, increased interest in the intersection between sociolinguistics, social psychology and experimental phonology has resulted in a growing body of sociophonetic work on perception. In this section, we introduce three commonly used methods to investigate perception: identification tasks (Section 22.4.2.1), lexical decision tasks (Section 22.4.2.2) and rating tasks that use the matched guise technique (Section 22.4.2.3).

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22.4.2.1 Identification Tasks

Identification tasks allow a researcher to determine how listeners interpret sounds. In an identification task, listeners are played an auditory token and are asked to identify what they heard. Often, the token is a word, but it can also be a sound, syllable or sentence. For ease of analysis, participants are often asked to choose between two forced-choice answers (e.g. Strand & Johnson, 1996; Hay et al., 2006; Fridland & Kendall, 2012). However, some scholars have opted for a larger number of forced-choice answers (e.g. Jacewicz & Fox, 2012; Kettig & Winter, 2017) or open-ended transcription (e.g. Labov et al., 1972, p. 137; Gooskens et al., 2008; Clopper et al., 2010). During analysis, open-ended transcription is frequently treated as binary (accurate vs. inaccurate), but scores based on the percentage of words correct have also been used (Gooskens et al., 2008). In all cases, a high level of control is necessary across conditions, especially if analysing reaction times.

Identification tasks can be used to investigate cross-dialectal differences in perception (Labov et al., 1972, ch. 6; Costa & Mattingly, 1981; Janson & Schulman, 1983; Fridland & Kendall, 2012) or to examine intelligibility across language varieties (Ash, 1992; Jacewicz & Fox, 2012). They can also be used to probe the effect of social primes on sound perception, investigating effects of talker gender (Strand & Johnson, 1996; Munson, 2011) and age (Hay et al., 2006; Drager, 2011).

22.4.2.2 Lexical Decision Tasks

In a lexical decision task, participants are exposed to both real words and pseudowords and are asked to identify which are the real words. Reaction time is typically treated as the dependent variable, though accuracy can also be investigated when enough variability is observed. Analysis of reaction times is restricted to items for which there is a correct response. For some research questions, prime words are presented prior to the target word, often with phonetic realisations that vary across conditions. The primes are often lexically identical or semantically related to the target (Sumner & Samuel, 2009), but they can also be semantically unrelated words (Kim & Drager, 2017). (See also Chapter 17, this volume.)

Researchers have used lexical decision tasks to investigate the processing costs associated with perceiving unfamiliar dialects (Floccia et al., 2006), the role of prior experience in processing variants from a dialect other than one's own (Sumner & Samuel, 2009; Llompart & Simonet, 2018), and the extent to which lexical access is influenced by a sociophonetic variable (Kim & Drager, 2017).

22.4.2.3 The Matched Guise Technique

Matched guise tests are used to probe listeners' linguistic attitudes indirectly through exposing participants to the same talker in two or more guises. When this technique was originally developed for cross-language

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attitude research, talkers were asked to intentionally vary their speech across guises (Lambert et al., 1960). Today, researchers interested in within-language differences usually create guises using digital resynthesis to control all linguistic variation except for the variable under investigation (see e.g. Campbell-Kibler, 2007, 2011; Levon, 2007, 2014). This is advantageous because it offers a higher level of control, but it can be insufficient for researchers interested in studying the perception of entire ethnolects (Purnell et al., 1999) or styles (Hardeman Guthrie, 2016).

Stimuli are often created using read speech, though spontaneous speech from interview data can also be used (Tamminga, 2017). In a within-subjects design, fillers should be used so that participants are unaware that they are evaluating the same talkers in different guises.

Following exposure to a stimulus, participants are asked to identify characteristics of the talker, often via a rating task in which they either indicate level of agreement with a statement (1a) or rate participants along a continuum (1b). Open response questions (1c) can also be used in order to avoid leading a participant and to elicit more nuanced social meanings.

(1)

a. I would be friends with this person.
   strongly agree agree neutral disagree strongly disagree
b. This person sounds:
   not at all friendly friendly
   1 2 3 4 5 6 7 8 9 10
c. What do you imagine this person looks like?

Work using the matched guise technique demonstrates how the social meanings associated with a phonetic variant depend on what other linguistic variants are present in the signal (Levon, 2014; Pharao et al., 2014) and what broad social characteristics are attributed to the talker (Campbell-Kibler, 2007). When varying the number of times a realisation is present in the signal, the technique can also be used to explore the 'sociolinguistic monitor' (Labov et al., 2011), which posits that listeners monitor the frequency of a variant, continually updating the social characteristics they attribute to talkers. Future work along these lines could examine the sociolinguistic monitor in real time (see Watson & Clark, 2015).

22.4.3 Statistics for Sociophonetics

Traditionally, sociophoneticians used multinomial logistic regression (implemented through e.g. VARBRUL 2, Sankoff, 1975) to analyse variable patterns in speech, and sociophoneticians have since led the way in using regression models with random effects. Scholars working on sound change are increasingly adopting Generalised Additive Mixed Models (GAMMS), which allow for analysis of dynamic phonetic variables such as vowel trajectories. (See Sóskuthy, 2017, for an excellent introductory tutorial on

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GAMMS.) Likewise, those who study perception are increasingly using inferential Bayesian statistics (Kim & Drager, 2018). Which statistical method is most appropriate depends on the method of data collection.

22.5 Best Practice for Teaching and Learning

Sociophonetics is extremely fun to teach. Classes can provide opportunities for hands-on experience, helping students master methodologies and connect with phonetic, phonological and sociolinguistic theory while also pushing the boundaries of our knowledge in these areas. The large number of unanswered sociophonetic research questions means that even a relatively small student project can make a meaningful contribution. In this section, we describe our approach to teaching an advanced graduate-level class dedicated entirely to sociophonetics, where students have prior training in both phonetics and sociolinguistics.

During the first half of the semester, students learn about experimental design, data collection, and analysis using an instructor-designed experiment so that students gain the necessary expertise to later design and complete their own projects. With a class of at least five students, there is a high likelihood of encountering at least some of the pitfalls that arise during data collection (e.g. equipment failure) as well as analysis (e.g. outliers), which allows students to navigate such challenges under the guidance of an instructor. In order for all students to contribute to and benefit from the experience, a sufficient amount of class time should be left available for discussion.

A collaborative approach aids both class discussions and the potential impact of the study: with multiple students working on the same instructor-designed project, a larger amount of data can be collected within a single semester and, in some cases, results from a collaborative class study can be presented at conferences or written up for publication (co-authored with the instructor and any interested students who contributed), provided that appropriate ethics approvals are acquired prior to data collection.

Concurrently with data collection and analysis for the group project, students are assigned seminal readings as well as newer related work to be discussed in class. Some suggested readings are shown in Table 22.2.

During the second half of the semester, students read work related to a specific area of interest and design an experiment, writing a research proposal for their final assessment. The group project precedes the proposal so that students gain experience with data collection and analysis and have time to read relevant work prior to designing a study of their own. Students should be encouraged to identify a paper that inspires them, which they can replicate while adding their own twist. For example, students might examine a well-known sociophonetic variable

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Table 22.2 *Example topics and readings for a course on sociophonetics*

Topic	Key reading(s)	Reading(s) with current issues
sociophonetic variation ≠ free variation	Labov (2006 [1966]); Guy (1991)	Podesva (2011); Holliday (2017)
social factors and sound change	Labov (1963)	Hall-Lew (2013); Eckert & Labov (2017)
speech accommodation	Rickford & McNair-Knox (1994)	Walker & Campbell-Kibler (2015)*
phonetics and language attitudes	Rubin (1992)	Llamas & Watt (2014)
attributing social information to talkers	Purnell et al. (1999)*	Labov et al. (2011); Levon (2014)*
social information affecting processing of sounds	Strand & Johnson (1996); Niedzielski (1999)*	Hay & Drager (2010)*
production–perception link	Janson & Schulman (1983)	Fridland & Kendall (2012); Kettig & Winter (2017)
methods		Docherty et al. (2018)

* For readings marked with an asterisk, stimuli and other materials are available for free download from: www.bloomsbury.com/cw/experimental-research-methods-in-sociolinguistics/

in an as-yet-undescribed dialect. The instructor should guide students to identify the appropriate size of the project within the context of the student's goals, programme requirements and timeframe. Including a written proposal as the final assessment fosters the skills associated with project design and also encourages students to do a 'deep dive' into the background literature that is relevant for work they find especially inspiring.

22.6 Future Directions

Sociophoneticians have a long history of adopting methods from other (sub)disciplines. In this section, we outline previous work examining articulation (Section 22.6.1) and eye movements (Section 22.6.2) using methods that we anticipate will be increasingly used in future work. We direct readers interested in the role of phonetic detail in discourse to Ogden (Chapter 26, this volume).

22.6.1 Articulatory Measurement Techniques

An increasing number of sociophonetic studies use ultrasound to examine sociophonetic variation in articulation (Lawson et al., 2011; De Decker & Nycz, 2012; Mielke et al., 2017), often using video produced by a medical ultrasound machine paired with an audio signal from a microphone. This is especially useful when focusing on sounds such as liquid consonants (Mielke, 2015; De Decker & Mackenzie, 2017), for which identifying

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associations between acoustic information and articulation is notoriously difficult (Thomas, 2002, p. 168) and for which auditory analysis is unreliable (Hall-Lew & Fix, 2012). See other chapters in this volume, such as those by Wrench and Beck (Chapter 1) and Lin (Chapter 14), for more information on using ultrasound for phonetic research.

Electropalatography (EPG), which measures pressure between the tongue and the hard palate, has also been used. Using EPG, Corneau (2000) finds that, despite large acoustic differences between dialectal variants (e.g. affricated /ti/ as [tsi] in Québec and [tʃi] in Belgium), similar anticipatory palatalisation underlies both productions. Some drawbacks of EPG are that it can only be used for sounds in which the tongue touches the palate and that costly custom-made palates are required for each participant.

An alternative is electromagnetic articulometry (EMA), which collects measurements of the position and movements of coils attached to points along the upper anterior tongue surface and/or lips. Using this technique, Wieling et al. (2016) observe differences in articulatory settings across two dialects of Dutch, and Blackwood Ximenes et al. (2017) find that North American and Australian English have equally centralised and rounded /u/ and /ʊ/, even though Americans exhibit lower F2 in these vowels. While EMA has well-established methodologies and is suitable to long data-collection sessions, ultrasound may allow for a better qualitative overview of the tongue, including the tongue root (Scobbie et al., 2012, p. 110). See Lin (Chapter 14, this volume) for more information.

22.6.2 Visual-World Paradigm

The visual-world paradigm involves tracking visual attention in order to investigate language processing. The technique, also known as eye-tracking, is commonly used by psycholinguists (cf. Huettig et al., 2011). In sociophonetics, this technique has been used to investigate the extent to which speech perception is influenced by primes involving age (Koops et al., 2008), ethnicity (McGowan, 2011) and personae (D'Onofrio, 2015; Chapter 17, this volume). Much more work along these lines is necessary in order to interpret what appear to be conflicting results. We also need simpler eye-tracking experiments to investigate how visual attention is influenced by sociophonetic cues in an auditory stimulus and, for experiments that use real-word stimuli, by the words' socially indexed associations.

An inexpensive alternative to the visual-world paradigm is mouse-tracking, where hand movements are tracked via a mouse or other hand-held device. Mouse-tracking does not offer the same level of sensitivity provided by eye-tracking, but it can be used to examine the salience of sociolinguistic variables (Watson & Clark, 2015) and listeners' response confidence when interpreting intonation contours (Warren, 2014). It may

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also prove useful in exploring the sociolinguistic monitor and questions about when and how social primes influence speech perception.

The rapid expansion of methods within sociophonetics combined with the increasing popularity of usage-based models in linguistics has resulted in a quickly changing subfield, one that informs phonetic and phonological theory. A number of exciting questions addressed herein remain unanswered. We encourage you to join us in investigating them, and we hope you find the body of research they are built upon to be as fascinating as we do.

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