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Second language speech production

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Historical discussion

The study of second langiage (L2) speech production has a long history in second language (SLA) research, both for what it can tell us about the development of the specific skill and how it might illuminate the general processes of SLA. Over time, studies in L2 phonological attainment have become a battleground for perennial issues in SLA research encompassing cognitive, psychological, and socio-cultural factors as varied as age-related constraints on ultimate attainment, and the role of identity in perceptions of accentedness. SLA research has also benefited from the ongoing development of phonological theory which has been consistently applied to L2 production throughout the decades.

The investigation of L2 speech production has been part of second language acquisition research from its beginnings. Following the prevailing linguistic paradigm of the time, researchers employed Contrastive Analysis (CA) (Lado, 1957) and the "difference = difficulty" hypothesis to explain the shape of L2 accents (Weinreich, 1953). Despite this belief that transfer was at the root of non-native accents, it became evident that the prognoses made by CA with regard to L2 phonology, as with other language systems, were not predictive of learner error. Recognizing this difficulty, Eckman supplemented CA with the Markedness Differential Hypothesis (1977) and the Structural Conformity Hypothesis (1991).[1]

Throughout the 1980s, speech researchers followed the shift in the field of SLA away from CA toward a closer investigation of learner language through Error Analysis (Corder, 1967) and the recognition of stable, transitional grammars or interlanguages (ILs) (Selinker, 1972). Major's Ontogeny Model (OM) (1987) for example, proposed a three-part structure underlying IL comprising influences from L1, L2 and universal processes. The OM further stated that these influences would be more salient during different phases of learner development in phonology with L1 transfer initially frequent in the IL and then decreasing as developmental processes increased.[2]

During this time, few had challenged the presumption of a critical period (Lenneberg, 1967) for linguistic development, and Scovel (1988) predicted that post-pubescent L2 learners would retain permanently accented speech. In the early 1980s, however, Flege and his colleagues began to question the role of the CPH as the primary explanatory factor for the differences between the production of L2 phonetic segments by children and adults (see later in this chapter for a detailed discussion of the debate regarding the CPH). Based on an ongoing series of studies (Flege, 1981,

1987; Flege and Eefting, 1986; Flege and Hillenbrand, 1984; among others), they posited a relationship between perception and production that operated differently in L2, not because of an age-based constraint but because adult speaker-hearers already have established phonetic categories in their L1. Flege proposed a mechanism termed Equivalence Classification in which adult learners are more likely to identify new phones appearing in the L2 as equivalent to already existing L1 categories. Equivalence classification predicts that learners are likely to be less effective at successfully distinguishing and producing sounds that are similar to sounds in their L1 than they are with sounds that are novel and have no correlate in the L1 sound system. This may be the result of perceptually similar but phonetically distinct sounds in L2 being assimilated into a single category.[3] Although the hypothesis predicts that missed perceptual cues will render production inaccurate and that changes in perception should lead to changes in production, Flege notes that not all inaccurate production can or should be explained by perception. In a 1995 study, he discusses output constraints on syllable type as a possible cause of production difficulties such as the word-external epenthesis typically shown by Spanish speakers of English. Over time, Flege has formalized his hypotheses in the Speech Learning Model (SLM) which he describes as follows:

> An assumption we make is that the phonetic systems used in the production and perception of vowels and consonants *remain adaptive over the life span*, and that phonetic systems reorganize in response to sounds encountered in an L2 through the addition of new phonetic categories, or through the modification of old ones.
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> (*1995, p. 233*)

The SLM focuses on the production of segments and with a few exceptions, research on the development of suprasegmentals in L2 has traditionally been scarce (see Wenk, 1986 and Juffs, 1990). Taking intonation study as a specific example, Willems (1982) initially reported that Dutch speakers of English demonstrated differences in all aspects of intonation structure including pitch range, pitch prominence, and pitch reset following a boundary. These features have since been confirmed in more recent studies with participants comprising a range of L1s. In investigations of advanced and intermediate Asian and European learners of English, Wennerstrom (1994, 1997) found that speakers did not use pitch variation to signal new or contrastive lexical items, and used less reduction of pitch than L1 speakers on non-prominent words. Japanese, Thai, and Chinese speakers also tended to use low boundary tones between repeated propositions where rising or mid level tones would be anticipated by native speaker (NS) hearers. Pirt (1990) reported similar results in a study of Italian learners, and Pickering (2001) reported equivalent findings for Chinese speakers of English in academic discourse. Hewings (1995) found a preference for the use of falling tones in the discourse of advanced L2 learners from Korea, Greece and Indonesia in contexts where NSs would use rising or level tones. Both Mennen (1998) and Pickering (2004) report demonstrably narrower pitch ranges in L2 learners as compared to NSs.

In addition to studies addressing different aspects of the phonological system, some of the recent approaches taken to L2 speech production have emerged from current models of phonology such as Optimality theory (OT) (Prince and Smolensky, 1993) and Connectionism (Elman *et al.*, 1996). Optimality theory proposes a universal set of violable constraints accessible to all speakers. Each language ranks these constraints differently and these different rankings account for phonological differences among languages (see Archangeli and Langendeon, 1997, for a complete introduction to OT)[4]. As examples of natural language, ILs may also allow novel structures to surface (i.e., structures that are not present in either the L1 or L2) as a result of learners hypothesizing different constraint rankings. Hancin-Bhatt and Bhatt (1997) account for both Japanese and Spanish learners' difficulties with phonotactic structure in English within the OT

framework, and Broselow *et al.* (1998) attribute the preference for Mandarin speakers of English to devoice final obstruents to a specific re-ranking of constraints.

Connectionist frameworks are modeled on computer programming, and propose a network of nodes which have different activation values. Connections between the nodes are weighted, with larger weights indicating stronger connections. A network of connections is built as the learner is exposed to many instances of a given language feature. As an example of its possible application to L2 phonology, Hancin-Bhatt (1992) exemplifies how a connectionist approach to processing may account for the substitution of a dental [t] for the voiceless alveolar fricative by Hindi speakers of English. There continues to be a burgeoning research agenda in the field of L2 speech production with a continued emphasis on model building supplemented by more recent additions such as the investigation of neurological factors in language production (Sereno and Wang, 2007).

Core issues

This part of the chapter discusses the following issues as they relate to L2 speech production: Age-related effects, language-related effects, and socio-affective factors involved in L2 production. The final section reviews research in intelligibility as it pertains to SLA. An additional core area of importance, the relationship between speech production and perception is only briefly addressed, and the reader is referred to the chapter titled "Second-language speech perception" in this volume.

Age-related effects on L2 speech production

Often referred to as the "Conrad phenomenon" after the novelist Joseph Conrad, perhaps the most compelling question in L2 phonology research has been the interaction between the Critical Period Hypothesis (CPH) and degree of accent, i.e., the assumption that after a certain age, L2 learners are biologically incapable of achieving a native accent in their second language[5]:

> In its most succinct and theory neutral formulation, the CPH states that there is a limited developmental period during which it is possible to acquire a language be it L1 or L2 to normal, natively levels. Once this window of opportunity is passed, however, the ability to learn language declines.
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> (*Birdsong, 1999, p. 1*)

With regard to pronunciation specifically, proponents of the CPH have proposed a developmental constraint ranging from 5 to 15 years old. L2 speech production has been one of the primary testing grounds for the CPH, and the controversy is well illustrated in an open debate that began in the journal *Applied Linguistics* between Flege (1987, 1999) and Patkowski (1990, 1994).

As noted above, Flege (1987) questioned a number of the assumptions underlying traditional acceptance of the CPH. He cites studies in which children do not appear to out-perform adults in the production and perception of L2 speech sounds (Snow and Hoefnagel-Höhle, 1978; Winitz, 1981) and argues that studies show a linear relationship between degree of foreign accent and age as opposed to a noticable discontinuity which would be expected at the onset of the end of the critical period (Oyama, 1978). He describes the focus on CPH as reductionistic and suggests that differences between adult and child learners may be the result of a number of factors other than (or in addition to) a critical period. Examples of possible confounding factors include previous linguistic experience, affective factors such as motivation, and social factors such as group identity.

In his reply to this paper, Patkowski (1990) argues that proponents of the CHP focus on ultimate L2 proficiency rather than rate of acquisition; thus, evidence of adults showing faster *initial* rates than children are not relevant to the debate. With regard to Flege's contention that there is a lack of research evidence verifying the onset of a marked discontinuity which would mirror the end of the critical period, Patkowski both challenges the design of the studies cited by Flege and cites a study of his own (Patkowski, 1980) in which such a discontinuity was in evidence. In summary, Patkowski states that there is no "convincing rationale for entirely discarding the notion of a biologically based age limitation on the ability to acquire second languages with native fluency" (1990, p. 86).

In a follow-up paper in 1994, Patkowski cites a number of review articles and empirical studies (including most notably Long, 1990 and Patkowski, 1990) to support his position that a biologically based sensitive or critical period somewhere between the ages of 12 and 15 years exists for the ultimate attainment of second language phonology. Flege (1999) responds and cites two studies (Flege *et al.*, 1995; Yeni-Komshian *et al.*, 1997) which continue to show a linear relationship between degree of perceived accent and age in subjects between the ages of 2 and 23 years which does not support an abrupt biologically or neurologically based shift in ability.

The debate continues to expand (for an accessible summary see "The whys and why nots of the CPH-L2A" by Birdsong, 1999); Bongaerts (1999) conducted several studies in which some highly advanced late Dutch learners of English and French were rated by judges as indistinct from native speakers suggesting that the CHP could be nullified. Bongaerts submits that this may be the result of high motivation, high levels of input, and training in the perception and production of L2 speech. Birdsong (2007) reports similar results in a study with late Anglophone learners of French. There continues to be no clear resolution to this controversy. In the first chapter of their 2007 volume, Bohn and Munro cite Flege *et al.* (2006) who find that even very young L2 learners exhibit foreign accents and also report Hakuta *et al.* (2003) whose adult learners exhibit success that correlates negatively with age of arrival.

Language-related effects: Transfer and markedness

Early studies that conceived of transfer through the lens of CA sought straightforward explanations of L2 pronunciation errors in a comparative analysis of the different phonological systems of L1 and L2. As more and more empirical evidence came to light that did not support this thesis, a more moderate version of CA (Oller and Ziahosseiny, 1970) became popular. The original hypothesis was revised to include both similarities and differences between phonological systems, and there was a recognition that perceptual saliency may play a crucial role.

Major (2001) suggests that learners may perceive large differences between the L1 and L2 sound systems but have more difficulty noticing smaller differences. Thus, the learner may be more likely to hit a phonological target if that target is unlikely to be substituted by a similar target in the L1 (see also Flege's SLM above). Major further advanced the notion of similarity and dissimilarity by adding the principle of rate (Major and Kim, 1996). The Similarity Differential Rate Hypothesis suggests that dissimilar features will be acquired at faster rates than similar ones but that markedness will slow rate. Major proposed that this combination of underlying factors results in a surface structure in the IL that does not support simplistic notions of transfer.

In an investigation of the relative contribution of markedness and direct L1 transfer, Carlisle (1994) reviews studies in the area of syllable structure. These studies show a clear preference for L2 learners to transfer syllable structure into IL phonology by resyllabifying to match L1 constraints rather than simplifying to produce a universally less marked structure (e.g., an open CV syllable).

With regard to prosodic structure, overall prosodic profiles of certain groups of learners have resulted in similar suggestions of the primacy of transfer over developmental features (for example, Wennerstrom (1998) for Chinese learners of English and Jilka (2007) for English speakers of German.) However, it is also the case that similar errors in L2 intonation structure by learners of very different backgrounds have been reported (see Mennen, 2007 for a summary). As Mennen notes, however, much of this work is inconclusive. The majority of studies report on L2 acquisition of English only, and the lack of a common framework to describe intonation systems cross-linguistically makes it difficult to assess features that may reflect universal tendencies vs. cases of L1 transfer.

Social and affective factors

Despite a historical focus on both age- and language-related effects, research suggests that there are additional language independent constraints that may affect L2 phonological attainment. Thus far, studies have investigated task variation (Tarone, 1980), attitudes and motivation (Stokes, 2001); concern for pronunciation accuracy (Elliott, 1995), social markings of identity (Dowd *et al.*, 1990; Lybeck, 2002), and extent of L1 and L2 use (Piske *et al.*, 2001) among other socio-affective variables. Two current studies, Moyer (2004) and Hansen (2006) demonstrate a more recent research agenda in which social factors are at the center of the analysis.

Moyer investigates 25 advanced learners of German as a second language from a range of L1 backgrounds. She considers a number of instructional and social factors including level of motivation, self-perceived accentedness, amount of formal language instruction, and amount and context of use of German on a regular basis. The participants completed four language tasks which were recorded and then judged by three NS judges. Participants also completed a questionnaire and semi-structured interviews in which they talked about their personal language-related experiences. Moyer found that although age exerted some independent influence, psychological variables such as intensity of motivation, satisfaction with attainment, and professional motivational orientation accounted for a larger percentage of the variance than age of onset combined with length of residence. Thus, she determines that "the idea that ultimate attainment is *primarily* a function of age must be reconsidered. Instead, the impact of age should be understood as *indirect* as well as possibly direct" (p. 140).

Hansen (2006) conducted a longitudinal study of the development of syllable margins in the emerging L2 of two adult Vietnamese learners of English and considered both linguistic and social constraints in accounting for acquisition. The participants in the study, a husband and wife in their 40s (Nhi and Anh), arrived in the USA from Vietnam one year before data collection began. Like Moyer, Hansen uses interview data to target socio-affective factors. In her discussion of social constraints, she presents a narrative account spanning 10 months, partially in her own words and partially in the words of her participants. The reader is introduced to the participants' changing social contexts over the length of the study and given insights into each person's personality, motivations, and frustrations. We learn that Anh adapts very slowly to her new surroundings and by the end of the study, she still struggles to communicate in English. Nhi is a more easy-going learner and significantly less anxious than Anh. He prioritizes his relationships with English speakers and engages in his English language environment at work. In her interpretation of these data, Hansen uses both Schumann's Acculturation Model (1986) and Pierce's (1995) concept of investment to explain how social constraints such as perceptions of cultural identity and extended family dynamics may impact Anh and Nhi's individual phonological development. Although emerging production modifications suggest a shift in developmental patterns that will ultimately favor Nhi (and by extension his approach to learning), it remained to be confirmed in terms of overall change.

Intelligibility

Assessment of intelligibility has long been considered a core area of L2 speech research. Although we can use intelligibility in a broad sense to mean "intelligible production and felicitous interpretation of English" (Nelson, 1995, p. 274), more recently there has been a distinction in the literature between "intelligibility" to mean formal recognition of decoding of words and utterances, and "comprehensibility" to mean the listener's ability to understand the meaning of the word or utterance in its given context. Thus, as Field (2003) suggests, a listener may use contextual understanding to compensate for the fact that a message is unable to be precisely decoded.

Comprehensibility or intelligibility judgments of L2 speech tend to rely on NS listener ratings (Anderson-Hsieh *et al.*, 1992; Piske *et al.*, 2001) and are often accompanied by judgments of accentedness (Derwing and Munro, 1997); as yet, however, no clear relationship has been established between accentedness and comprehensibility. Speakers who succeed in reducing the degree of foreignness in their accents (based on expert NS raters) may still be heard as incomprehensible by lay listeners (Munro and Derwing, 1995). Although accentedness in L2 speech may derive from several different sources, Derwing and Munro (1997) conclude that L2 comprehensibility is improved for NS listeners with enhanced prosodic proficiency, and their position is supported by subsequent studies (e.g., Derwing and Rossiter, 2003; Field, 2005). Prosodic characteristics that have been found to be important include speech rate (Derwing, 1990; Derwing and Munro, 2001), mean length of utterance (Kormos and Dénes, 2004), length and placement of pauses (Anderson-Hsieh and Venkatagiri, 1994; Pickering, 1999; Riggenbach, 1991), and non-standard word stress (Field, 2005; Hahn, 2004).

Most recently, intelligibility studies have expanded to include non-native speaker (NNS) perceptions of comprehensibility in NNS-NNS or learner-learner interactions (for a review of studies within the context of English as a lingua franca see Pickering, 2006). This work suggests that L2 listeners may process phonological features differently from their NS counterparts. While prosodic features appear to be a crucial cue for NS comprehensibility, studies with NNS listeners suggest that they may rely more on segmental features (Deterding, 2005; Field, 2005; Jenkins, 2000). Jenkins suggests that this predominant focus on bottom-up processing (i.e., resorting to acoustic information rather than contextual information) reflects L2 speakers' higher dependency on phonological form as opposed to shared contextual knowledge with their interlocutors.

In addition, L2 speaker-hearers may draw on an "interlanguage speech intelligibility benefit" (Bent and Bradlow, 2003)– an effect resulting from some familiarity with particular non-standard phonological forms. An L2 learner may be better equipped to interpret specific acoustic-phonetic features of a L2 speaker that are matched with her or his own production, and therefore find understanding an L2 speaker from their own L1 background easier than understanding someone from a different L1 background (cf., Major *et al.*, 2002; see also Gass and Varonis, 1984).

Data and common elicitation measures

The types of data utilized and the methods of analysis employed in L2 speech production research reflect the breadth of quantitative and qualitative research possibilities typically found in applied linguistics. Research designs encompass experimental designs comprising a hundred or more participants (Flege *et al.*, 1995) to more naturalistic contexts involving just two participants (Hansen, 2006). Elicitation measures range from native speaker judgments of perceived accent

or intelligibility (Munro and Derwing, 1995) to objective measures of acoustic characteristics such as voice onset time (VOT) (Strange, 1995) or fundamental frequency values (Jilka, 2007; Kang *et al.*, forthcoming). The following discussion addresses issues of data collection and verification in studies of segmental and suprasegmental features of L2 production.

Segmental studies

At the highly experimental end of the research continuum, L2 research focused on segmentals has been dominated by Flege and his colleagues (see earlier discussion). Their goal for the most part has been to find evidence for the claims made by the SLM (1995), namely, that phonetic systems remain adaptive and that L2 learners will be more successful at creating new categories for L2 sounds that are dissimilar from L1 sounds than those that are similar. Thus, studies typically employ late learners who can be exempted a priori from traditional conceptions of the CPH or learners comprising a range of ages. L2 populations have also come from a wide variety of L1 backgrounds including Swedish, Chinese, Spanish, Italian, Dutch, and Japanese speakers. As the focus is on creation of phonetic categories, testing is usually confined to a very small aspect of production such as VOT or vowel duration. In order to limit confounding variables for these heavily statistical designs, spontaneous speech is also eschewed in favor of word lists or utterances read aloud. Certain segmental features have become emblematic of L2 phonological research such as the perception and production of /l/ and /r/ by Japanese learners of English (Bradlow, 2008; Yamada *et al.*, 1996) or the cross-linguistic comparison of formant structures (F1 and F2) or duration in vowels (see Strange, 2007 for a review.) These have allowed researchers to compare findings more easily.

At the opposite end of the continuum, while still focusing on individual elements of L2 phonology, in this case the production of syllable margins, Hansen (2006) adopts a dual design that incorporates both qualitative and quantitative components. Interviews recorded with two participants targeted socio-affective factors and were transcribed and coded for production of syllable onsets and codas. Hansen is able to document detailed production modifications over time that suggest an emerging L2 phonology in which L2 consonants are very gradually acquired by the two learners in similar stages but at different rates. Quantitative findings, however, are difficult to interpret, as there are not enough data to make this kind of analysis work well. At one point, for example, Hansen notes that although it appears that one participant has acquired three-member consonant onsets at 89 per cent accuracy, there are too few tokens for this percentage to be meaningful.

Suprasegmental studies

Studies of the suprasegmental characteristics of L2 speech tend to look quite different from work in segmentals. Most notably, they are usually smaller in terms of numbers of participants. Following a review of studies on L2 prosody in major journals over the past 25 years, Gut (2007, p. 145) finds that research on intonation is conducted with an average number of 22.6 participants and research on word stress is based on an average of 7.7 participants. In addition, she notes that most studies comprise artificial speech tasks such as reading aloud and are undertaken in laboratory settings. There is growing evidence that such data are problematic for assessing suprasegmental features such as intonation and rhythm. Tao (1996, p. 34), for example, argues that the proposed pitch register differences suggested between interrogatives and declaratives in Mandarin may be an artifact of studying isolated sentences as opposed to natural discourse. He finds that the theory of register does not account for a large portion of the intonation patterns

that may be present in natural speech. Similarly, with regard to rhythmic characteristics, Lai (2002) proposes that misconceptions about the stress patterns of Cantonese derive in part at least from a reliance on experimental production of the language which alters its natural prosodic patterns. Finally, Brazil (1992) recognizes a number of different levels of engagement in reading aloud by a speaker which result in different prosodic compositions depending on the type of reading (i.e., text versus isolated sentences), and the degree of engagement by the speaker with text and listener.

Despite their disadvantages, these research designs often reflect necessary compromises if we want to compare apples to apples; two issues are particularly salient. First, differences between L1 and L2 production of intonational features such as use of contrastive prominence or tonal structure are difficult to assess if participants are saying different things. To address this difficulty, Hewings (1995) asked L2 learners to read scripted dialogues and then compared these readings to NS performances. Wennerstrom (1994) asked all her participants to read the same passage that had been constructed to exemplify specific intonational features. The second issue is the increased use of instrumental data to support findings regarding L2 prosodic structure through programs such as WASP (Huckvale, 2003) and PRAAT (Boersma and Weenick, 2002) which are freely downloadable, as well as commercially available programs (see Schuetze-Coburn *et al.*, 1991, for a comparison of auditory and instrumental analysis.) These tools allow researchers to measure a variety of acoustic features; however, they also demand audio data of a high quality that is difficult to obtain outside of a controlled environment (although see Pickering (1999) and Wennerstrom (1997) for the recording of naturally occurring data.)

An alternative approach to data collection lies in recent developments in corpus construction. Currently there are at least two learner corpora that include some annotation of prosodic features of L2 speakers. The LeaP (Learning Prosody in a Foreign Language) corpus comprises more than 12 hours of recording time of second language learners of German and English and includes six manually annotated and two automatically annotated tiers. The Hong Kong corpus of Spoken English has approximately one million words prosodically transcribed (manually) using Brazil's (1997) discourse model. Both corpora have generated studies of L2 speech production (e.g., Cheng *et al.*, 2005; Gut, 2007) which benefit from the large datasets that they are based on.

Applications

There has been a consistent interplay between L2 speech production research and pedagogy throughout the history of this area, most particularly in the teaching of EFL/ESL. English pronunciation materials such as *Drills and Exercises in English Pronunciation* (1967) which focuses on stress and intonation and *English Pronunciation Illustrated* (Trim, 1965) which practices phonemes and minimal pairs reflect the tenets of CA and the belief that practice will instill the good habits needed to conquer L2 pronunciation (O'Connor, 1967). With the onset of research in L2 interlanguage and the recognition of the complexity underlying L1 transfer, some attempts were made to introduce notions of markedness and universal processes to language instruction. For example, Yavas (1994) addressed the finding of a universal tendency toward final devoicing with a set of graded teaching materials for English in which presentation and instruction of bilabial final stops (e.g., tub, cab) precedes more difficult stops and consonant clusters.

During the 1980s, the popularity of the communicative approach encouraged development of pedagogical materials that embraced the full scope of the L2 phonological system including suprasegmentals (Chun, 2002.) Materials often explicitly addressed the changing ideologies in SLA. In their introduction to *Teaching American English Pronunciation* for example, Avery and Ehrlich (1992) go beyond linguistic factors in pronunciation instruction to discuss the roles of

socio-cultural and personality variables. They further note that teachers should be concerned with comprehensibility rather than accuracy when correcting student pronunciation.

Despite this progress toward a focus on language use, the phonological system still tended to be taught in pieces rather than in a realistic context. This applied particularly to the intonation structure in English where priority was still given to grammatical contrasts of attitudinal effects (Levis, 1999) despite growing recognition that intonation formed part of a speaker's discourse and pragmatic competence (Brazil, 1997; Grosz and Sidner, 1986) and that isolated contours form part of a larger organizational structure through which they acquire their full significance (Pierrehumbert and Hirschberg, 1990). In the past several years, interactive teaching materials such as *Streaming Speech* (Cauldwell, 2003) have begun to incorporate examples of naturally occurring discourse that introduce the characteristics of conversational English. The 1980s also saw the more widespread use of speech visualization technology in prosodic instruction (de Bot, 1980; de Bot and Mailfert, 1982; Weltens and de Bot, 1984). Results suggested that learners who received audio-visual feedback demonstrated improved perception and production of intonational contrasts in the L2. More recently, Levis and Pickering (2004) discuss these applications and expand pedagogical applications to a discourse context.

Instruction in English as a foreign language has also been at the forefront of the paradigm shift prompted by the precipitate growth of English as a global lingua franca (Jenkins, 2002). Traditional conceptions of intelligibility that prioritize the speaker are giving way to those that more explicitly consider the listener, and a review of recent research suggests that we may want to promote very different strategies in L2 learners if they intend to remain in an international context (Pickering, 2006). There is also ongoing debate regarding pedagogical practices that privilege certain varieties of English as exemplified by Walker (2001) who discusses proposals that reconsider traditional target models and move toward pronunciation for international intelligibility.

Most recently, there has been a heartening trend in volumes addressing L2 phonological acquisition to include not only research but instructional implications and practice (see Hansen Edwards and Zampini, 2008; and Trouvain and Gut, 2007, for examples). In their preface, Trouvain and Gut describe their hope for what this kind of cross-pollination may achieve:

> The first part [of the volume] contains contributions by SLA researchers and experts in prosody … This includes overviews of current theoretical models as well as findings from empirical investigations. In the second part, some of the leading teaching practitioners and developers of phonological learning materials present a variety of methods and exercises in the area of prosody … On the one hand, research on non-native prosody can help teachers to interpret and make sense of their classroom experiences and to provide them with a broad range of pedagogic options. On the other hand, researchers may be encouraged to investigate aspects of non-native prosody that have shown to be of primary importance in language classrooms.
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> (*pp. v–vi*)

This synergy between laboratory and classroom will be critical to the continued evolution of L2 speech production research and practice.

Future directions

The future agenda of this area is robust as the extent of the work discussed in this chapter suggests. In this section I identify three areas of particular interest for researchers and teachers:

(1) Perhaps the most promising area of growth is in the new technologies being used to investigate the processes of language production such as fMRI scans (Sereno and Wang, 2007) or ultrasound imaging techniques (Gick *et al.*, 2008). It remains to be seen how much this work will impact our current understanding of L2 acquisition of speech; however, it is likely that increased understanding of neurological factors will illuminate differences between L1 and L2 phonological experience.
(2) Some of the most recent expansions in this area have been as a result of a shift in the research terrain toward an interrogation of what constitutes intelligibility, the native speaker, and possible influences on speech production. We need to continue to fill in these gaps. They include both investigations of language learning outside of an English context, and as Leather (1999) suggests, a broadening of our learner base to include multilingual speaker-hearers in non-Western environments.
(3) Speech production research continues to benefit from methodological innovation. Most recently, the development of learner corpora offer a new and largely untapped resource for researchers to access data which may previously have been unattainable due to limited resources.

Notes

1 For a complete discussion of these hypotheses see Eckman's chapter in this volume.
2 For the current revision of this model see Major (2001).
3 Readers are referred to Hardison in this volume for a full discussion of the relationship between perception and production in the L2.
4 Also see Eckman's chapter in this volume for a more detailed discussion of OT.
5 See also chapters by Byrnes and DeKesyer in this volume.

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