Foreign Accent

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Abstract. This paper investigates how speakers can be classified into native and non-native speakers of a language on the basis of acoustic and perceptually relevant features in their speech. It describes some of the most salient acoustic properties of foreign accent, based on a comparative corpus analysis of native and non-native German and English. These properties include the durational features vowel reduction, consonant cluster reduction and overall speech rate as well as the intonational variables pitch range and pitch movement. The paper further presents an experiment demonstrating that perceptual judgments of foreign accent correlate primarily with the speakers' speech rate.

Keywords: foreign accent, acoustic properties, perceptual judgments and acoustic correlates.

1 Introduction

Speakers are traditionally classified into native and non-native speakers of a language although, at closer inspection, the division line between the two classes is far from clear-cut. "Native" speakers of a language are usually exposed to the language from birth on, acquire it fully and use it throughout their lives. "Non-native" speakers of a language usually come into contact with it at a later stage, for example in formal classroom teaching or by immigration to a foreign country. They often do not acquire the language fully and continue to use other languages in their daily lives. Speech produced by the latter group typically shows properties of a "foreign accent". As yet, among linguists, no exact, comprehensive and universally accepted definition of foreign accent exists. However, there is a broad consensus that the term refers to the deviations in pronunciation of non-native speech compared to the norms of native speech (e.g. Scovel 1969:38). Foreign accent can be measured in two ways: by eliciting global judgments and quality ratings of samples of non-native speech from judges or by carrying out instrumental-acoustic measurements of various phonetic aspects of non-native speech and by comparing them to native speech.

This article examines both the acoustic and perceptual correlates of foreign-accented German and English. In the first part, instrumental-phonetic analyses of the acoustic correlates of foreign accent will be presented and the various segmental and prosodic features of non-native speech that may contribute to a foreign accent are discussed. The second part of the article is concerned with the perceptual correlates of foreign accent. The results of an experiment investigating the correlation between perceptual accent ratings and acoustic properties of non-native speech will be presented.

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2 Acoustic Correlates of Foreign Accent

Foreign accent has been divided into phonological and phonetic accent, the former comprising phonological deviations such as phoneme substitutions, as for example in the pronunciation of *the* as [də], and the latter referring to incorrect pronunciations of otherwise correct phonological representations (Markham 1997). In addition, foreign accent can be divided into segmental deviations, i.e. phoneme substitutions or incorrect pronunciations of individual vowels and consonants, and prosodic deviations such as deviant speech rhythm, intonation and stress patterns. The majority of descriptions of the correlates of foreign accent are based on auditory analyses and manual transcriptions of deviations and often lack in systematization and representativeness. Systematic instrumental analyses of the phonetic properties of non-native speech have shown a number of acoustic deviations in foreign-accented speech. For example, it was found that non-native English produced by Japanese, Spanish-speaking, Jordanian and Brazilian learners differs from native speech in terms of the voice onset time (VOT) of plosives (Riney & Takagi 1999, Flege & Munro 1994, Flege, Frieda, Wally & Randazza 1998, Port & Mitleb 1983, Major 1987a). Likewise, the realization of consonant clusters by Brazilian learners of English is suggested to contribute to their foreign accent (Major 1987b). English produced by native speakers of Polish, French, Tunisian Arabic and Spanish is characterized by a lack of vowel reduction and the non-realization of weak vowels in unstressed syllables (Scheuer 2002, Wenk 1985, Ghazali & Bouchhioua 2003, Mairs 1989, Flege & Bohn 1989). Furthermore, German learners of English produce different vowel qualities for the phonemes /e/ and /æ/ than English native speakers do (Barry 1989), English learners of Thai produce deviant tones (Wayland 1997) and Austrian learners of English show differences from native speakers in the realization of falling pitch movements (Grosser 1997).

The majority of studies concerned with the phonetic correlates of foreign accent carried out so far are restricted to the investigation of a particular combination of native language and target language such as Japanese-accented English. The purpose of the present study, in contrast, is to determine the general properties of foreign accent. The following questions are raised: Is it possible to classify speakers into native and non-native on the basis of some acoustic features of their speech? Which acoustic features distinguish non-native speech from native speech irrespective of the speakers' first language? Which of these acoustic features correlate with human auditory judgments of the strength of foreign accent? The focus of the present study lies on the acoustic characteristics of a foreign accent in both German and English. In particular, three acoustic features of non-native speech will be investigated: general durational features such as speech rate, reduction processes in both vowels and consonant clusters and features of pitch including pitch range and pitch movement.

For this, a large-scale corpus-based study of the acoustic properties of non-native speech was carried out. It is based on the LeaP corpus, which consists of 359 recordings of non-native and native speech in both German and English comprising 73.941 words and a total amount of recording time of more than 12 hours (Milde & Gut 2002, Pitsch, Gut & Milde 2003). It contains four different speaking styles: free speech in an interview situation (length between 10 and 30 minutes), reading of a passage (length of about two minutes), retellings of a story (length between two and 10 minutes) and

the reading of nonsense word lists (30 to 32 words). During the collection of the corpus data it was aimed to record a representative range of non-native speakers in terms of age, sex, native language/s, level of competence, length of exposure to the target language, age at first exposure to the target language and non-linguistic factors such as motivation to learn the language, musicality and so forth. The non-native English in the corpus was produced by 46 speakers with 17 different native languages, whose age at the time of the recording ranges from 21 to 60. 32 of them are female and 14 are male. Their average age at first contact with English is 12.1 years, ranging from one year to 20 years of age. The age of the 55 non-native speakers of German at the time of recording ranges from 18 to 54 years. 35 of them are female and 20 are male. Altogether, they have 24 different native languages. The average age at first contact with German is 16.68 years, ranging from three years to 33 years of age. The corpus further contains eight recordings with native speakers of (British) English and 10 recordings with native speakers of Standard German.

2.1 Durational Features of Foreign Accent: Speech Rate

The object of the first set of acoustic analyses was to explore differences between native and non-native speech in terms of general durational features. These features include the overall articulation rate as well as the duration of various linguistically meaningful units such as utterances and syllables. Utterances were defined as sequences of words between two pauses of a minimum length; the division of syllables was based on standard phonological criteria (e.g. Giegerich 1992). Syllables were further divided into stressed and unstressed since the difference between these two types of syllables is correlated with significant differences in duration in both native English and native German (e.g. Hoequist 1983, Campbell 1989, Gut 2003). The story retellings and the reading passages in the LeaP corpus were analyzed with the following quantitative measurements:

- **artrate:** articulation rate (total number of syllables divided by total duration of speech)
- **mlu:** mean length of utterance (in syllables)
- **mls:** mean length of stressed syllables
- **mlr:** mean length of reduced syllables (unstressed syllables with reduced or deleted vowel)

A total of 40.274 syllables produced by the non-native speakers of German, 3.261 syllables produced by the native speakers of German, 30.871 syllables produced by the non-native speakers of English and 2.492 syllables produced by the English native speakers were analyzed.

Table 1 shows that non-native English differs significantly from native English in all aspects of general speech rate. Non-native retellings, on average, show a slower articulation rate and a shorter mean length of utterance than story retellings by native speakers. Moreover, the mean length of syllables, both stressed and unstressed, is significantly longer in non-native speech. When reading the story, the non-native speakers produce a slower articulation rate as well as a shorter mean length of utterance and longer syllables of both types.

Table 1. Mean values of artrate, mlu, mls and mlr for the non-native and the native speakers of English in the retellings and reading passage style. (*** equals significance at $p<0.001$, ** equals significance at $p<0.01$, * equals significance at $p<0.05$).

		artrate	**mlu**	**mls**	**mlr**
retellings	non-native English	2.3	3.8	280.7	155.4
	native English	4.1	7.5	209.3	90.2
		***	***	***	***
reading passage style	non-native English	3.25	5.9	258.6	140.4
	native English	4.1	8.9	212.25	101.3
		*	**	*	*

A comparison of non-native German with native German gives similar results (Table 2). On average, native story retellings have a longer mean length of utterance, shorter stressed syllables and a higher articulation rate than their non-native counterparts. The readings of the story by the non-native speakers differ from the native readings in three acoustic variables: non-native readings have a slower articulation rate and have, on average, longer syllables. No significant difference was found between the non-native and native mean length of utterance in reading passage style.

2.2 Durational Features of Foreign Accent: Reduction

The second line of investigation was concerned with reduction processes in native and non-native speech. In both German and English, vowel reduction and vowel deletion occur regularly in specific contexts. Reduced vowels in German and English are shorter than full vowels and change their quality (e.g. Delattre 1981, Gut 2006). For example, reduction is illustrated in the production of the schwa /ə/ as the first vowel in the

Table 2. Mean values of artrate, mlu, mls and mlr for the non-native and the native speakers of German in the retellings and reading passage style. (**=significant at $p<0.01$, *=significant at $p<0.05$).

		artrate	**mlu**	**mls**	**mlr**
retellings	non-native German	2.4	4.4	254.9	189.2
	native German	3.3	7.2	212.7	159.7
		*	**	*	n.s.
reading passage style	non-native German	3.3	6.5	232.7	178.4
	native German	4.1	7.9	198.7	137.2
		*	n.s.	**	**

English word *alike* [əlaɪk] or the second vowel in the German word *diesem* [dizəm]. Vowel deletion often occurs in the realization of the second syllable in the German word *laufen* as [fn] and in the second syllable of the English word *nation* [neɪʃn]. Likewise, in both languages word-final consonant clusters, i.e. sequences of two or more consonants, are regularly reduced in connected speech. This means that for example in the words *jumped* and *hast* one or more consonants of the cluster are deleted so that they are realized as [jʌmt] and [has] (e.g. Neu 1980, Kohler 1995). In the LeaP corpus, the following measurements of reduction processes were taken:

- **percentage reduced/deleted vowels (prv):** percentage of all syllables with reduced or deleted vowel of all syllables
- **ratio full/red:** mean durational ratio of all syllable pairs in which a syllable with a full vowel is followed by a syllable with a reduced or a deleted vowel
- **2consclus:** retention rate (i.e. no deletion) of all word-final consonant clusters in words with phonologically underlying two-consonant clusters
- **3consclus:** retention rate of all word-final three-consonant clusters and four-consonant clusters
- **content words:** retention rate of all word-final two-, three- and four-consonant clusters in content words (nouns, verbs, adjectives and adverbs)
- **function words:** retention rate of all word-final two-, three- and four-consonant clusters in function words (prepositions, conjunctions and auxiliary verbs)

A total of 40.274 syllables produced by the non-native speakers of German, 3.261 syllables produced by the native speakers of German, 30.871 syllables produced by the non-native speakers of English and 2.492 syllables produced by the English native speakers were analyzed in terms of vowel reduction. In addition, a total of 3.965 words with underlying word-final clusters produced by the non-native speakers of English and a total of 229 such words produced by the native English speakers were analyzed. 4.045 potential word-final coda clusters were analyzed in the speech of the non-native speakers of German. The native German speakers produced a total of 232 words with underlying word-final consonant clusters.

Table 3 illustrates various significant differences in vowel reduction and consonant-cluster reduction between the non-native and the native speakers of English. The non-native speakers produce, on average, fewer syllables with reduced and deleted vowels and a smaller durational difference between neighboring syllables with a full vowel and a reduced or deleted vowel. Non-native and native speakers of English do not differ in the retention rate of two-consonant clusters. Conversely, the native speakers reduce three-consonant clusters significantly more frequently than the non-native speakers. Word-final clusters in content words are retained more often than in function words in both types of speech, but the retention rate of clusters in function words is significantly higher in non-native English than in native English.

Table 4 illustrates the that there are fewer differences in vowel and consonant cluster reduction between non-native German and native German. The overall percentage of syllables with reduced and deleted vowels does not differ between non-native German and native German. In contrast, in non-native German, the durational difference between adjacent syllables with full vowels on the one hand and reduced or deleted

Table 3. Percentage of syllables with reduced and deleted vowel of all syllables, mean durational ratio of adjacent syllable pairs with the first syllable containing a full and the second a reduced or deleted vowel (ratio full/red), overall retention rate of word-final two-consonant and three-consonant clusters and retention rate of word-final clusters in content words and function words produced by the non-native and the native speakers of English. (***=significant at $p<0.001$; **=significant at $p<0.01$).

	prv	**ratio full/red**	**2consclus**	**3consclus**	**content wors**	**function words**
non-native English	24.01	1.98:1	80.2	37.12	70.8	44.2
native English	30.65	2.45:1	82.5	4.77	73.3	20.5
	**	**	n.s.	***	n.s.	***

vowels on the other is lower. For word-final consonant clusters in German, the overall retention rate is not significantly different between the two speaker groups, neither in two- or three-consonant clusters nor in content words and function words.

Table 4. Percentage of syllables with reduced and deleted vowel of all syllables, mean durational ratio of adjacent syllable pairs with the first syllable containing a full and the second a reduced or deleted vowel (ratio full/red), overall retention rate of word-final two-consonant and three-consonant clusters and retention rate of word-final clusters in content words and function words produced by the non-native and the native speakers of German. (***=significant at $p<0.001$).

	prv	**ratio full/red**	**2consclus**	**3consclus**	**content wors**	**function words**
non-native German	28.66	1.49:1	65.1	41.4	65.9	59.5
native German	29.2	1.76:1	74.8	70	82.8	66.6
	n.s.	***	n.s.	n.s.	n.s.	n.s.

2.3 Pitch Range and Pitch Movement in Foreign-Accented Speech

The third acoustic feature investigated as a possible correlate of foreign accent was pitch. The height of pitch changes continuously across an utterance, but the linguistically most important pitch movement is the utterance-final pitch movement, often referred to as the nucleus. In both English and German, nuclear pitch movements can have the form of falls or rises or combinations of the two (e.g. Grabe 1998). Another linguistically relevant aspect of pitch is the pitch range, which expresses the difference

between the maximum and the minimum pitch height in an utterance or sequence of utterances (e.g. Patterson 2000). Two different measurements were taken for the retellings and story readings in the LeaP corpus:

- **pitch range:** average difference between the highest and lowest pitch in the entire recording (in semitones)
- **falls:** average extent of pitch movement in falling nuclear tones in semitones
- **rise:** average extent of pitch movement in rising nuclear tones in semitones

In total, 910 falling and 803 rising nuclear tones were produced by the non-native speakers of English and 86 falls and 30 rises were produced by the native English speakers. The non-native speakers of German produced a total of 1.208 falling and 1.379 rising pitch movements, however, many of them were realized as steps up or down and not as continuous pitch movements. The native speakers produced 112 falling and 61 rising pitch movements, also including steps up and down.

Distinct differences in pitch range exist between native and non-native speakers in both languages. Table 5 illustrates that, although for both speaker groups the average pitch range is smaller in the retellings than in the readings, the average pitch range in native English is greater than that in non-native English in both speaking styles.

Table 5. Mean pitch range in the reading passages and the retellings and average extent of falling and rising nuclear pitch movements in non-native and native English. (***=significant at $p<0.001$; **=significant at $p<0.01$).

	pitch range reading	**pitch range retelling**	**fall**	**rise**
non-native English	12	10.3	3.64	4.129
native English	17	12.7	7.81	3.8
	**	***	**	n.s.

Table 5 further illustrates that the nuclear falls in non-native English, on average, are significantly smaller than the nuclear falls produced by the native speakers of English. On average, native speakers' falling pitch movements extend over 7.81 semitones, which is more than twice as much as in the falls produced by the non-native speakers. In contrast to non-native English, in native English, nuclear rises, on average, are much smaller than falling nuclear pitch movements.

Native German also has a wider average pitch range than non-native German in both reading passage style and the retellings. Similarly, in native German, falls have a more pronounced slope than in non-native German. They extend over an average of 5.67 semitones in native German, but only 3.8 semitones in non-native German. The slope of rises in native German is, on average, smaller than that of falls, which is a further difference from non-native German.

Table 6. Mean pitch range in the reading passages and the retellings and average extent of falling and rising nuclear pitch movements in non-native and native German. (*=significant at $p<0.05$).

	pitch range reading	**pitch range retelling**	**fall**	**rise**
non-native German	12.7	13.12	3.8	4.98
native German	15.3	16.7	5.67	4.19
	*	*	*	n.s.

3 Perceptual Correlates of Foreign Accent

Studies in which the degree of foreign accent is rated by judges differ greatly in terms of the procedures used to elicit and evaluate non-native speech. For example, raters are presented with different scales comprising a varying number of equal-appearing intervals, often labeled as ranging from "very strong foreign accent" to "no accent, native-like" and the type of non-native speech judged by the raters varies from readings of single sentences to samples of spontaneous speech. In addition, the number and professional background of judges in foreign accent rating tasks varies considerably. Nevertheless, a number of studies have shown that native speakers as raters of foreign accent agree to an acceptable degree in their judgments (Cunningham-Andersson & Engstrand 1989, Thompson 1991, Munro & Derwing 1999, Piske, MacKay & Flege 2001, Moyer 1999).

A small number of studies has been concerned with the relationship between foreign accent ratings and specific linguistic parameters of non-native speech. Consonantal features that have been identified to correlate with perceived foreign accent are the voice onset time (VOT) of plosives in non-native English produced by Japanese and by Brazilian speakers (Riney & Takagi 1999, Major 1987a) and the realization of consonant clusters by Brazilian speakers of English (Major 1987b). Scheuer (2002) reports that the non-realization of reduced vowels in unstressed syllables and other vocalic errors correlate most strongly with negative evaluations of Polish speakers' foreign accent ratings. Cunningham-Andersson & Engstrand (1989) list 25 different phonological and phonetic errors that contribute to the impression of a foreign accent in Swedish. Tajima, Port & Dalby (1997) report that the intelligibility of Chinese-accented English sentences was improved by changing the durational patterns of segments to native values. Finally, Anderson-Hsieh, Johnson & Koehler (1992) found that accent ratings correlate with syllable-errors and phoneme substitutions as well as the rated quality of the overall prosody.

The present paper investigates the relationship between foreign accent ratings and those acoustic properties of non-native speech identified as relevant for speaker classification in the previous section. For each speaker in the LeaP corpus, an accent rating was obtained. Seven native speakers of German, four female and three male, with a mean age of 23.8 years and without a professional background in language teaching or assessment rated speech samples by the 55 non-native speakers in the German sub-corpus. The material consisted of an extract from the interview of about 30 seconds'

length. The raters were informed that they were to rate the quality of the foreign accent without reference to the speaker's morphosyntactic abilities or possible idiosyncrasies in the use of vocabulary. Prior to the experiment, the raters were provided with three anchor recordings representing a speaker with a very strong accent, a native-like speaker and one with an average foreign accent each. The raters were given a 9-point scale ranging from "very strong accent" to "native-like". The experiment was web-based and gave the raters the opportunity to listen to each of the recordings as often and as long as they wanted.

For the English sub-corpus, only recordings with those non-native speakers aiming at a British English pronunciation, as established in the interviews, were included. They were rated by four male native speakers of British English (mean age 34.5 years) without a professional background in language teaching or assessment, following the same procedure as for the German experiment.

The following acoustic correlates of foreign accent were selected in the free speech recordings and correlated with the foreign accent ratings:

- **mls:** mean length of stressed syllables
- **mlr:** mean length of reduced syllables (unstressed syllables with reduced or deleted vowel)
- **ratio full/red:** mean durational ratio of all syllable pairs in which a syllable with a full vowel is followed by a syllable with a reduced or a deleted vowel
- **3consclus:** retention rate of all word-final three-consonant clusters and four-consonant clusters
- **artrate:** articulation rate (total number of syllables divided by total duration of speech)
- **pitch range:** average difference between the highest and lowest pitch in the entire recording (in semitones)

Table 7 illustrates which of the acoustic properties of non-native speech correlate with the mean accent ratings. It can be seen that only those properties of non-native speech that have to do with speed of delivery correlate with the mean accent ratings for the non-native speakers of German: the mean length of stressed syllables, the mean length of reduced syllables and the articulation rate. Pitch range, cluster reduction and vowel reduction measured in the ratio between adjacent full-vowelled and reduced syllables do not correlate significantly with ratings of foreign accent. None of the acoustic

Table 7. Correlation of acoustic features with the mean accent rating for the non-native speakers of German and the non-native speakers of English

	mls	**mlr**	**ratio full/red**	**3consclus**	**artrate**	**pitch range**
German	.46**	.38*	-.12	-.15	.-38*	-.18
English	.31	.27	-.3	.32	-.28	-.18

measurements listed in Table 7 correlate with the accent ratings received by the non-native speakers of English. It seems that raters base their judgments on other acoustic cues than those listed in Table 7, although these were found to constitute areas of systematic divergence between native and non-native speech.

4 Summary and Conclusion

The objectives of the present paper were to examine whether and how speakers can be classified into native and non-native speakers on the basis of the acoustic features of their speech. In particular, it was investigated which acoustic features distinguish non-native from native speech irrespective of the speakers' first language and which of these acoustic features correlate with human auditory judgments of the strength of foreign accent. A comparative corpus analysis of native and non-native English and German was carried out that focused on the acoustic properties of the general durational features in speech rate, vowel reduction and consonant cluster reduction and on the intonational parameters pitch range and pitch movement.

The results show that non-native speech varies systematically from native speech with respect to general durational properties. In both English and German, native speakers produce a significantly higher articulation rate and longer mean length of utterance than non-native speakers. Overall, both stressed and unstressed syllables are longer in non-native speech, which makes it slower than native speech. It was further found that the non-native speakers' speech rate varies with speaking style. In reading passage style articulation rate is significantly faster than in the story retellings and the mean length of utterance is longer. This constitutes another area of difference between non-native and native speech, as differences in speech rate between speaking styles are far less pronounced in native speech.

The second prominent difference between native and non-native speech lies in the realization of vowel reduction and deletion. In particular, this concerns the lack of durational difference between syllable pairs in which a syllable with a full vowel precedes a syllable with a reduced or deleted vowel. Only in about a third of the recordings contained in the LeaP corpus, the durational difference between those two types of syllables equals that of native speech. Lack of vowel reduction is especially evident in non-native English. Whereas the non-native speakers of German produce the same overall amount of reduced or deleted vowels than the German native speakers, non-native speakers of English do not succeed in a relatively sufficient reduction or deletion of vowels.

The third line of research concerned the reduction of consonant clusters in non-native speech. On the whole, word-final consonant clusters in non-native English are likelier to be retained, i.e. to be produced faithfully, than to be simplified by reduction. The greatest difference between word-final cluster reduction in native and non-native English lies in the reduction of three-consonant clusters, which are nearly always reduced in native speech but produced faithfully in about a third of all cases by the non-native speakers. Furthermore, in native English, the reduction rate of consonant clusters in function words is much greater than in non-native English. Non-native German does not differ from native German in terms of word-final cluster reduction.

The fourth acoustic feature analyzed in non-native speech was pitch range. Pitch range in non-native speech is, on the whole, narrower than in native speech. However, the analysis of native pitch range in the LeaP corpus showed distinct differences with speaking style in English. Reading passage style is characterized by a pitch range that is on average five semitones wider than that of the retellings. This is mirrored in non-native English where pitch range, on average, is also wider in reading passage style than in the semi-spontaneous speech in the retellings. No such variation of pitch range with speaking style was found for either native or non-native German. Another significant difference between native and non-native speech lies in the phonetic realization of utterance-final falling tones, which are shorter in non-native speech. A comparison of nuclear falls and rises shows that the non-native speakers' falls tend to be shorter than their rises, that is the pitch movement stretches over fewer semitones. In native speech, in contrast, the pitch movement of falls is distinctly greater than that of rises.

The second aim of the present paper was to find acoustic correlates of human foreign accent ratings. Of those acoustic features of non-native speech that had proven to vary systematically between native and non-native speakers in the previous analyses, however, only the general durational properties such as articulation rate and mean length of syllables correlated with native speaker ratings of the degree of foreign accent. Vowel reduction, consonant cluster reduction and pitch range did not seem to influence the accent ratings given by native speaker judges. This finding replicates results described by Neumeyer, Franco, Weintraub & Price (1996). They investigated a number of acoustic properties such as segmental accuracy and timing scores of non-native French and their correlation with native speakers' pronunciation ratings and found the only reliable relationship between durational properties and accent ratings. Yet, the present paper did not include an analysis of segmental deviances in non-native speech. It is likely that apart from durational values other acoustic cues guide the decision of native judges of foreign accent, for example phonemic substitutions and other segmental processes. This was shown by Cunningham-Andersson & Engstrand (1989), who isolated various phonetic and phonological features in Swedish that were reliably identified as "foreign accented" by native speaker judges and by Moyer (2004), whose native speaker judges listed a number of phoneme substitution errors as criteria for their ratings of accent in German.

In conclusion, the present paper showed that there are a number of general acoustic features of non-native speech that differ significantly from native speech. The most valid of them are features of speech rate as demonstrated in the correlation with human judgments of foreign accent. However, before these findings can be applied directly for an (automatic) speaker classification one needs to consider that the method of a quantitative corpus analysis has the drawback that it cannot do justice to the speech of individual non-native speakers. Not every non-native speaker has a foreign accent as many studies have shown: some speakers who acquire a language as late as in their twenties are indistinguishable from native speakers even in strict experimental conditions (e.g. Bongaerts et al. 1997, Moyer 1999). Qualitative analyses of individual speakers' speech properties thus need to complement quantitative corpus analyses. The group values presented here, for example, disguise that of the 46 non-native speakers of English, 12 produce a pitch range similar to that of the native speakers and 14 produce falls and rises with a slope

equal to that of the native speakers. Likewise, 12 of the German non-native speakers produce falls and rises that are phonetically identical to those of the native speakers.

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