



Universiteit  
Leiden  
The Netherlands

## English as a lingua franca: mutual intelligibility of Chinese, Dutch and American speakers of English

Wang, H.

### Citation

Wang, H. (2007, January 10). *English as a lingua franca: mutual intelligibility of Chinese, Dutch and American speakers of English*. LOT dissertation series. LOT, Utrecht. Retrieved from <https://hdl.handle.net/1887/8597>

Version: Not Applicable (or Unknown)

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/8597>

**Note:** To cite this publication please use the final published version (if applicable).

## Chapter seven

# Intelligibility of intervocalic consonants

### 7.1 Introduction

In this chapter I will present the results for intelligibility of intervocalic consonants for three groups of listeners. The results are from the same groups of listeners as in the previous chapter. As we analyze the sound system of the consonants in the three languages, we predict consonants will be more difficult for Chinese than for Dutch English L2 learners. The results we are going to present on the one hand will represent the actual intelligibility of consonants for Chinese and Dutch listeners, which may partially support the predictions in Chapter three derived from models of L2 perception, and on the other hand, the results may raise new questions which cannot be explained from by these theories.

### 7.2 Results

#### 7.2.1 Overall results

The overall results for consonant intelligibility are presented in Figure 7.1, broken down by nationality of the listeners and broken down further by nationality of speakers. As before (§ 6.2.1), the data were submitted to an Analysis of Variance (ANOVA) run on the mean percent correct scores for each listener with nationality of speaker and nationality of listener as fixed factors.

Across speaker groups, the Chinese listeners have the lowest consonant identification scores (47 to 58% correct, mean = 54%). Dutch listeners perform at an intermediate level (67 to 81% correct, mean = 73%), and the American listeners are the best (71 to 83% correct, mean = 78%). The effect of listener group was significant,  $F(2, 315) = 186.7$  ( $p < .001$ ). A post-hoc test (Scheffé procedure with  $\alpha = .05$ ) indicates that all three speaker nationalities were different from each other.

Across listener groups, Chinese and Dutch speakers obtained the lowest vowel identification scores (65%). The American speakers' vowels were correctly identified in 75 percent of the cases. The effect of speaker nationality is significant,  $F(2, 315) = 35.8$  ( $p < .001$ ). The American speakers are significantly better than the other two nationalities, which do not differ from each other. As before, we may note that the effect of listener nationality is much larger, in fact more than five times larger in the present case, than the effect of speaker nationality. Again, the interaction

between listener and speaker nationality also reaches significance,  $F(4, 315) = 8.3$  ( $p < .001$ ), indicating interlanguage or native language benefit (see Chapter six).

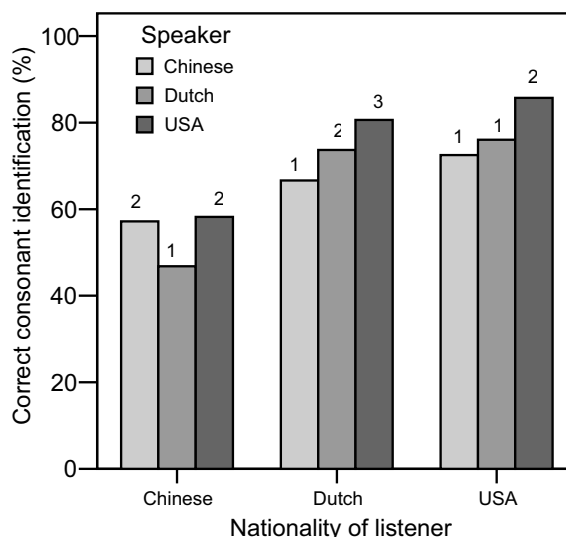


Figure 7.1. Percent correctly identified consonants for Chinese, Dutch and American listeners broken down by accent of speakers. Numbers above the bars indicate the subgroup membership as determined by the Scheffé procedure. Numerical values of means, N, SD and Se are included in Appendix A7.1.

Figure 7.1 shows overall correct consonant identification. It does not allow us to identify individual consonants that represent special difficulties. Therefore, we ask, first of all, which are the problematic consonants for each group of listeners? This question will be taken up in the following section (§ 7.2.3). Secondly, if a sound is massively misidentified, then what is it heard as instead? This question will be dealt with later when we examine the confusion structure in the consonant data (§ 7.2.4).

### 7.2.2 Correct consonant identification

In order to get an overview of which consonants are more difficult than others, for each combination of speaker and listener nationality, we present percentages of consonants correctly identified by Chinese, Dutch and American listeners in separate panels for Figure 7.2. In each panel the results have been broken down by nationality of the speakers. In each panel the 24 consonants have been ordered in descending order of correct identification when the speakers are American. Generally we would expect the results for the non-native speakers, i.e. by Chinese and Dutch speakers, to fall below the percent correct of the American speakers. Only in exceptional cases do we expect the non-native vowels to be identified better than the native vowels.

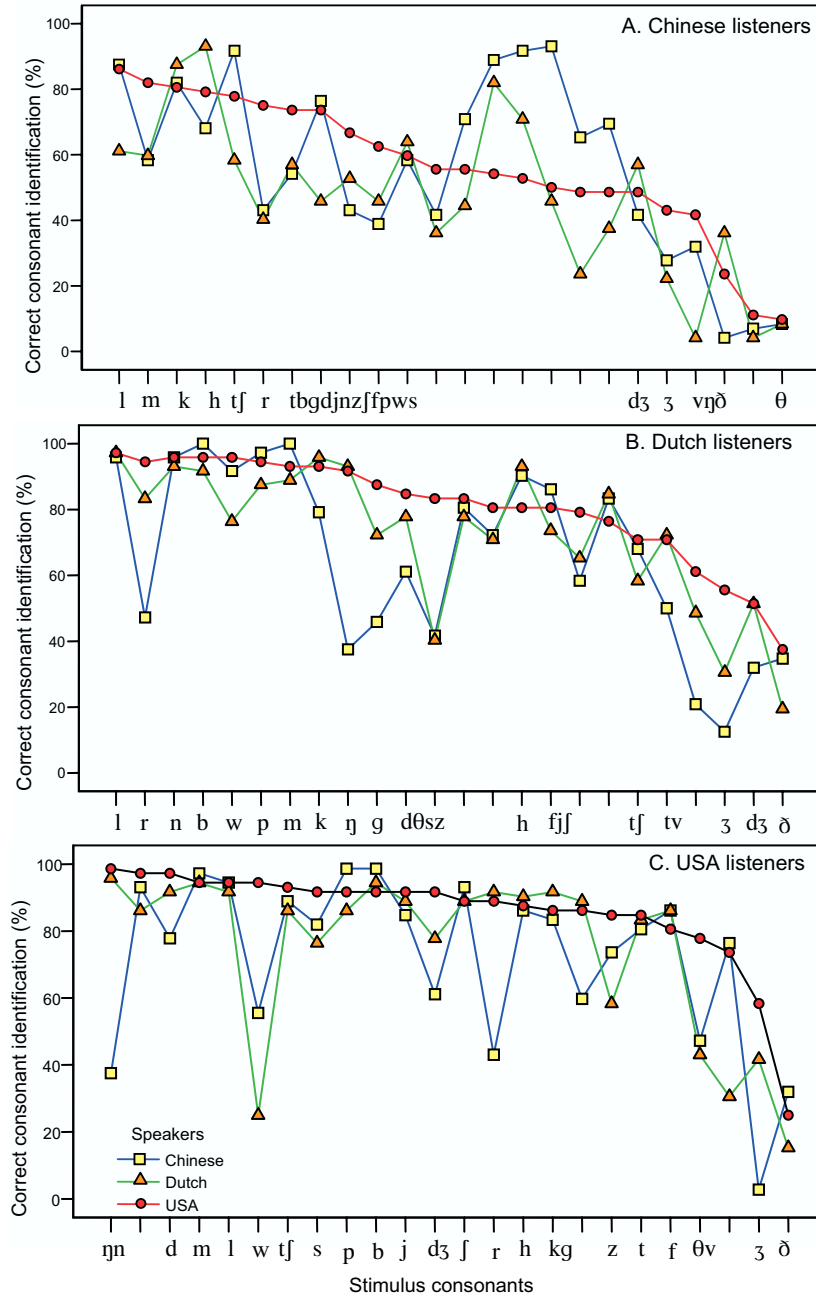


Figure 7.2. Correct identification (%) for all 24 single English consonants produced by Chinese, Dutch and American speakers. Panels A, B and C present the results for Chinese, Dutch and American listeners, respectively.

Again taking the American speakers as the norm, we may observe that there is a wide range of correct consonant identification scores with over 80% correct for /l/ and /m/ going down to less than 20% correct for /θ/ and /ð/. In contradistinction to the vowel data (Chapter 6), there is an overall trend for consonant identification scores to run parallel regardless of the language background of the speakers. As a result, correlation coefficients for correct consonant identification scores for pairs of speaker nationalities are all significant (see Table 7.1).

Table 7.1. Pearson's correlation coefficients for identification of consonants produced by Chinese, Dutch and American speakers broken down by nationality of the listeners.

Listener nationality	Speaker nationalities		
	CN ~ NL	CN ~ US	NL ~ US
CN	$r = 0.679^{**}$	$r = 0.667^{**}$	$r = 0.711^{**}$
NL	$r = 0.744^{**}$	$r = 0.680^{**}$	$r = 0.848^{**}$
US	$r = 0.564^{**}$	$r = 0.565^{**}$	$r = 0.704^{**}$

\*\* :  $p < 0.01$

Figure 7.2-A shows the Chinese listeners' identification of the 24 consonants of Chinese, Dutch and American speakers. The correct identification rate for American speakers runs from more than 80% down to almost 10%. It is not the case that the American speakers' consonant tokens are more intelligible than the non-native tokens. Seven Chinese-accented consonants are clearly better identified by Chinese listeners; although these seven do not form a natural class, the set would appear to comprise labials and fricatives. These, of course are the types of consonants that also occur in the Chinese consonant inventory. Curiously enough, there are also a number of Dutch-accented consonants that are clearly better identified than the native American tokens, viz. /h, ʃ, f/. This is hard to explain, given that Dutch /h/ is often voiced, whilst Chinese listeners would expect /h/ to be voiceless (as it should be both in Chinese and in English), and /ʃ/ is not a phoneme of Dutch at all.

Figure 7.2-B shows the Dutch listeners' identification of the 24 consonants of Chinese, Dutch and American speakers. The correctness of American consonant tokens covers a range from 96% to 38%. In this figure we can see that the American speakers' tokens almost invariably obtain all the highest identification scores, with no significant exceptions. When Dutch listeners listen to their fellow speakers, there are just a few consonants that are identified clearly more poorly than the American counterparts, viz. /w, θ, ʒ, ð/. The latter three are not phonemes of Dutch, so that their difficulty can be explained as cases of negative transfer. The high incidence of /w/ errors may be due to the incorrect labio-dental articulation of this glide, so that it gets confused with /v/ which would not happen in the case of either the Chinese or American tokens of /w/, which would be bilabial. We will consider this explanation later on. Chinese-accented consonants are obviously the most difficult tokens for Dutch listeners. A very substantial loss of consonant identification is incurred for the Chinese-accented consonants /v, ʒ, dʒ, r, ŋ, g/. These are the voiced fricatives, the

voiced nasals and the /r/. Voiced fricatives are absent in the onset inventories of both Chinese and Dutch, which would account for their low identification rates.<sup>1</sup> Chinese /r/ is typically pronounced as a (voiced) fricative, so that it will be confused with /ʒ/.

Figure 7.2-C shows American listeners' identification of the 24 consonants of Chinese, Dutch and their own speakers. The percentage is presented in the order of correctness from high to low of every consonant produced and identified by American native speakers. American listeners have the highest identification for the velar nasal /ŋ/ and dental nasal /n/ (99% correct) produced by their own speakers and the lowest identification for the voiced palatal fricative /ʒ/ (59%) and for the voiced dental fricative /ð/ (25%). This indicates that native American listeners have problems with their own speakers for certain consonants. Things are roughly the same when American listeners respond to Dutch speakers with the exception that the bilabial approximant /w/ is now very poorly identified (25% correct). As mentioned before, bilabial /w/ is a new sound for the Dutch learners of English; its Dutch counterpart is a labio-dental approximant /v/, which sounds very much like the English voiced fricative /v/. We will take this matter up below, when we discuss the confusion structure within the consonant set. However, when the American listeners react to Chinese speakers, they seem to have more difficulties in identifying the Chinese-accented English production. Some of the sounds which are no problem when they are produced by American themselves or by Dutch speakers are problems when they are produced by Chinese: /dʒ, w, j, r, g, θ/. Possible reasons for the poor identification of these sounds will be discussed when we review the confusion patterns below.

### 7.2.3 Consonant confusion structure

Full  $24 \times 24$  consonant confusion tables were generated for all nine combinations of speaker and listener nationalities. These have been included in Appendix A7.1, together with hierarchical cluster schemes (dendrograms, Appendix A7.2) computed according to the method of average between-group linkage. In these raw materials it is rather difficult to observe clear confusion structures as relatively few consonants cluster. Just as we did in Chapter six with the vowels, we will therefore present and analyse the confusion structure in the consonants by means of confusion graphs. In these graphs the consonants have been arranged roughly by manner (plosive, fricative, semivowel, liquid, nasal from left to right along the horizontal dimension) and by place (labial, dental, alveolar, palatal, velar from top to bottom). In order not to overly complicate the graphs, the affricates /dʒ/ and /tʃ/ have been entered as plosives with a palatal place of articulation. Within the set of obstruents there is a further split between voiced and voiceless counterparts; these are listed side-by-side nested under manner.

---

<sup>1</sup> Voiced fricatives are completely absent from Chinese phonology. In Dutch they have to be assumed to be present at the abstract phonemic level but the voiced ~ voiceless distinction is neutralised (to voiceless) in the word onset in most varieties of Dutch (e.g. Van de Velde, 1996; Slis and Van Heugten, 1989).

In the confusion graphs arcs have been drawn linking confused consonants. The arrowheads point to the target of the confusion; as before, the number printed at the tip of the arrow indicates the percentage of the cases in which the source sound was confused with the target. In order to be able to clearly identify obvious clusters of confusable consonants, only confusion pairs with a relative frequency  $\geq 20\%$  have been identified. Such clusters are indicated by a darker grey shade.

I will now present nine confusion graphs, one for each combination of speaker and listener nationality. The first three confusion graphs (Figure 7.3A-C) will contain the structures obtained for Chinese listeners, exposed to Chinese, Dutch and American speakers. Then I will repeat the set of three speaker nationalities for Dutch listeners (Figure 7.4A-C), and I will conclude with the three sets obtained for the American speakers (Figure 7.5A-C).

### 7.2.3.1 Confusion structures of Chinese listeners

When Chinese listeners identify the English consonants spoken by fellow **Chinese speakers**, there are 14 pairs of confusions across place and manner. The most frequent confusions are /v > w/ (40%), /d > b/ (43%) and /θ > s/ (43%).

When Chinese listeners listen to **Dutch speakers**, there are fewer confusion pairs but the confusion rates in individual consonant pairs tend to be higher than for the corresponding Chinese-accented tokens. Chinese listeners have six pairs of confusion consonants when responding to Dutch speakers but two of these pairs have higher confusion rates: 50% and 47%. When Chinese listeners identify consonant tokens produced by fellow Chinese speakers, confusion tends to occur across place of articulation rather than across manner. When responding to Dutch speakers of English, all confusion occurs across manner, with just one exception for the pair /θ > f/, which is across place (from dental to labial fricative).

When Chinese listeners respond to **American speakers**, there are eight pairs of confusions, with 35% as the highest percentage. The consonants /v/ and /w/ are strongly and symmetrically confused, also when the speakers are Chinese. In spite of what the figure seems to suggest, Chinese-accented /ŋ/ is very poorly identified irrespective of the language background of the listeners (3, 38 and 38% correct for Chinese, Dutch and American listeners, respectively, see Appendix A7.1). However, confusions are widely scattered for the Chinese listeners (no confusion  $\geq 20\%$ ) but are somewhat more systematic for Dutch and American listeners.

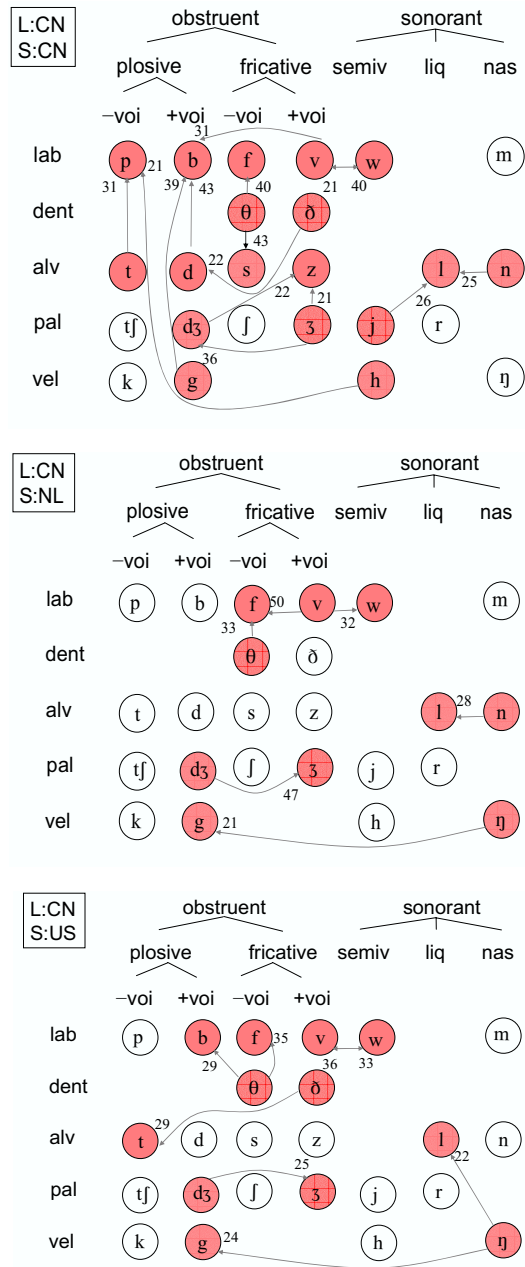


Figure 7.3A-C. Confusion graphs for Chinese listeners, exposed to Chinese (CN), Dutch (NL) and American (US) speakers (from top to bottom). Only confusions  $\geq 20\%$  are indicated by arrows. L = listeners, S = speakers.



### 7.2.3.2 Confusion structures of Dutch listeners

Figure 7.4 presents the confusion structure in the consonants heard by Dutch listeners. When the **speakers are Chinese**, massive consonant confusion is observed. The voiced fricative /v/ is strongly confused with the labial semivowel /w/ (71%). In the ear of the Dutch non-native listeners the velar nasal /ŋ/ remains a problem when it is spoken by Chinese learners. It is insufficiently distinguished from /g/. The pairs /j > dʒ/ and /ʒ > dʒ/ are confused by manner but place is preserved; /r > z/, /t > θ > s/ and /ð > d/ are manner confusions but both place and voicing are preserved. We observed before that Chinese /r/ is pronounced as a voiced fricative. This is also relevant here since Dutch listeners confuse it with /z/. Interestingly, Chinese speakers poorly distinguish the three palatal consonants: both /j/ and /ʒ/ are confused with /dʒ/. The palatal fricative /ʒ/ does not occur in Chinese at all but /dʒ/ does; this would account for the confusion as a speaker error induced by negative transfer. The confusion involving the palatal approximant /j/ is more difficult to explain. Phonetically, /j/ does occur at the beginning of syllables. In the conception of the Chinese language user, however, [j] should be parsed as belonging to the vocalic nucleus rather than to the onset; therefore, Chinese words (or syllables) beginning with [j] would have to be preceded by an empty onset, i.e. a glottal stop to fill the empty onset. If the habit of inserting a stop-like feature before /j/ carries over into English, then we would expect a more stop-like percept, which is compatible with perceived /dʒ/.

When Dutch listeners respond to **Dutch speakers** of English, the confusions are restricted to just four clusters. The first pair is /v > f/, which is predictable given that Dutch initial /v/ typically loses its voicing. Next, the voiced dental fricative /ð/ is either pronounced without voicing and is heard as /θ/ or with the wrong manner and is heard as /d/. Similarly, the palatal fricative /ʒ/ either loses its voicing and is confused with /f/ or it is weakened to an approximant and shows up as /j/. The approximant /j/, in turn, seems to get strengthened as is often is misperceived as the affricate /dʒ/. This also happened with Chinese-accented tokens of /j/. This time, however, no explanation of the confusion seems possible from the phonology of the source language.

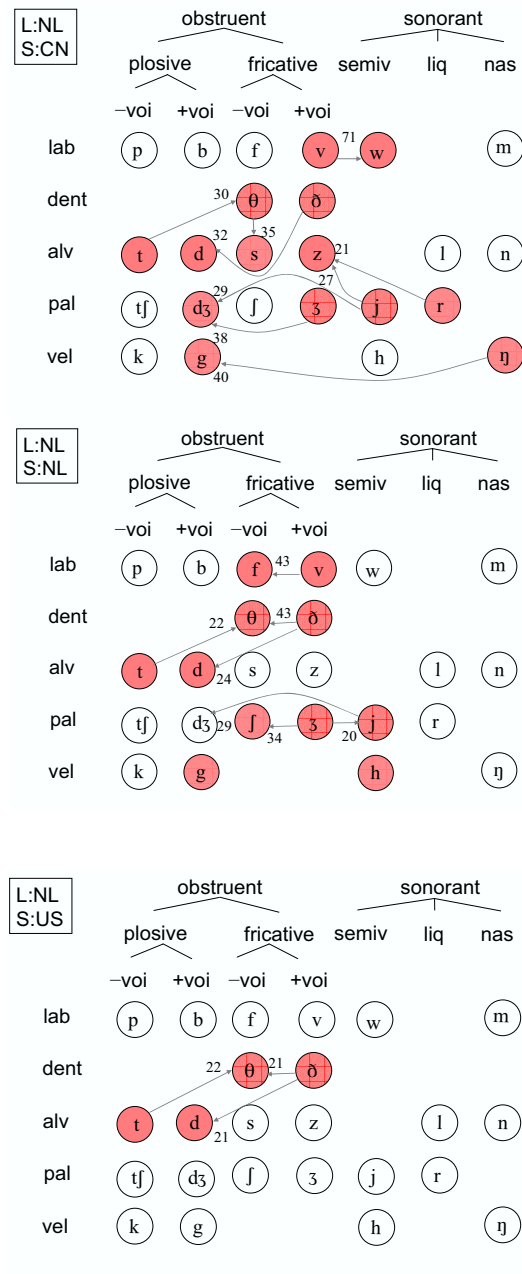


Figure 7.4A-C. Confusion graphs for Dutch listeners, exposed to Chinese (CN), Dutch (NL) and American (US) speakers of English (from top to bottom). Only confusions  $\geq 20\%$  are indicated by arrows. L = listeners, S = speakers.

When the **speakers are American**, the number of confusions is minimal. No more than three confusion pairs occur. Note that the confusions found here are a proper subset of the confusions we found when the speakers were Dutch. Again, /ð/ is misheard as either /θ/ or /d/, and /t/ goes to /θ/. This would seem to suggest that the confusion is at least partly due to perceptual uncertainty on the part of the Dutch listeners.

### 7.2.3.3 Confusion structures of American listeners

When American listeners respond to **Chinese speakers**, confusions are limited to consonant pairs within the set of voiced plosives (/d, d<sub>3</sub>, g/) and voiced fricatives (/v, ð, ʒ/). There is no systematic confusion along the voicing dimension. Chinese (unlike Dutch) has clearly voiced affricates, and the tense~lax contrast in stops uses the same phonetic parameters as in English, viz. aspiration for the tense stops (positive VOT) and absence of prevoicing in the lax counterparts (0 VOT). These findings largely reflect the observations made by Zhao (1995), which were summarized in Table 3.10. However, counter to Zhao we find no indications that /p, t, k/ are pronounced with insufficient aspiration. The systematic confusion of /r/ with /ʒ/ indicates that Chinese /r/ is pronounced as a fricative. This confusion was also mentioned by Zhao (see Table 3.10). The strongest confusions are /ʒ/ > /d<sub>3</sub>/ (75%) and /ð/ > /d/ (40%). These errors were also observed by Zhao. Neither /ʒ/ nor /ð/ occur in Chinese; it seems that these targets are realized with stop-like characteristics. On the basis of this, one would expect the third voiced fricative that is absent from Chinese, i.e. /v/, to be systematically confused with its stop counterpart /b/. However, Chinese-accented /v/ is primarily confused with /w/ (33%); the predicted confusion with /b/ is the second-most frequent confusion (10%). As was observed in Chapter three, Chinese has no voiced fricatives but does use voiced affricates. The systematic confusion of stop/affricate manner for voiced fricatives may then be accounted for as negative transfer from the source language. We have no clear explanation, finally, for the confusion of the velar nasal /ŋ/ with its oral counterpart /g/. The problematic nature of onset /ŋ/ was noted by Zhao, but she never explicitly stated what confusion would arise. The problem may have its origin in the use of /ŋ/ in onset position. This is not impossible for Dutch and American speakers as /ŋ/ may surface intervocalically in the onset after lax vowels (as in *singing*, *longing*, *hanging*). In the sound system of Chinese, however, /ŋ/ is strictly limited to the coda position; possibly, when a Chinese learner is forced to pronounce /ŋ/ in onset position, there is a tendency to substitute the most similar sound that is allowed in the onset, which would be /g/.

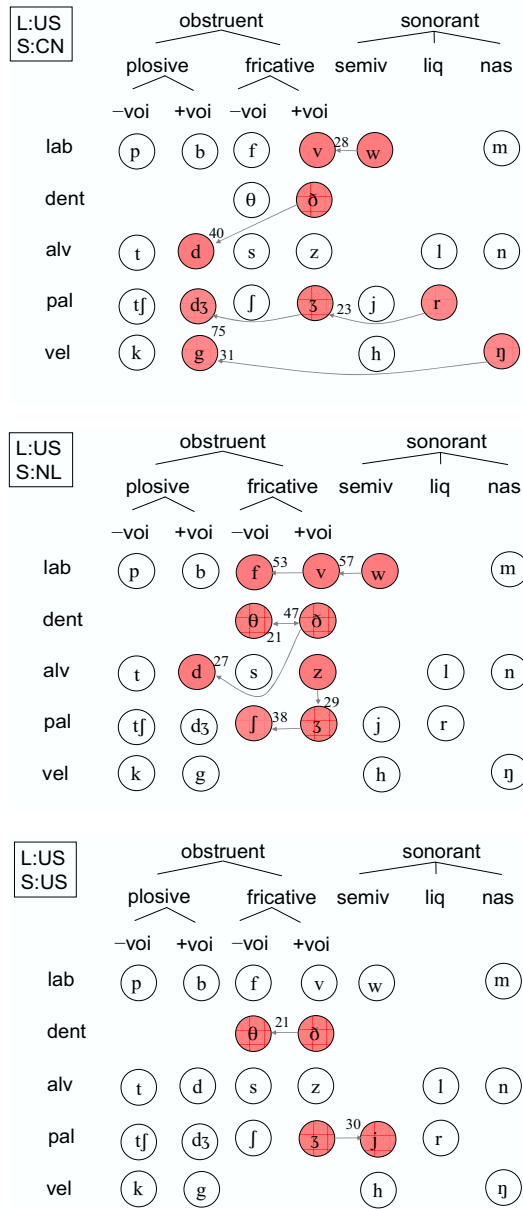


Figure 7.5A-C. Confusion graphs for American listeners, exposed to Chinese (CN), Dutch (NL) and American (US) speakers (from top to bottom). Only confusions  $\geq 20\%$  are indicated by arrows. L = listeners, S = speakers.

When American listeners respond to **Dutch speakers**, consonants are confused within three groups only, viz. /f, v, w/, /θ, ð, d/ and /z, ʒ, ʒ/. American listeners confuse Dutch speakers' /w/ with /v/ (57%) and /v/ with /f/ (53%). These confusions can be accounted for as negative transfer. Dutch /w/ is a labio-dental and therefore resembles English /v/ rather closely. Also, Dutch /v/ is very often devoiced and therefore identical to /f/. The dental fricatives /θ/ and /ð/ are confused symmetrically and also with the alveolar plosive /d/. Dutch has no dental fricatives and the voicing contrast is often lost. Dutch speakers of English have a tendency to replace /ð/ by its stop counterpart. In the last confusion cluster, the voiced alveolar fricative /z/ is confused with the palatal fricatives /ʒ/ and /ʒ/. It has been observed before that the Dutch alveolar fricatives lack the characteristic high-frequency noise components of English /s/ and /z/.<sup>2</sup>

The above results largely follow the observations found in the pedagogical literature on the pronunciation problems of Dutch learners of English, which were summarized in Table 3.9.

The last confusion graph shows the errors American listeners make when exposed to fellow **American speakers**. There are only two pairs of confusions: /ð/ > /θ/ (21%) and /ʒ/ > /j/ (30%). No other consonants are systematically confused, if at all.

### 7.3 Summary

Table 7.2 lists the number of problematic consonants in the data. A problematic consonant is defined as a consonant which in any speaker-hearer combination is identified correctly in less than 75%. The numbers are broken down for the nine combinations of speaker and listener language background.

Table 7.2. Number of problematic consonants (see text) broken down by nationality of speaker (down) and of listener (across).

speaker	listener			
	Chinese	Dutch	USA	Total
Chinese	<b>18</b>	13	8	39
Dutch	21	<b>11</b>	6	38
USA	18	6	<b>2</b>	26
Total number	57	30	16	103

<sup>2</sup> Flege (1984) lists English /s/ as a 'similar sound' for Dutch learners, indicating that the difference between Dutch and English /s/ escapes the Dutch listener but contributes to the perception of foreign accent by native English listeners. Pre-palatal fricatives /ʒ/ and /ʒ/ do not occur in the phonology of Dutch (they only occur in loanwords or surface as a result of coalescence of either /s/ of /z/ with /j/), which may be a reason that Dutch /s/ and /z/ are realized with less emphasis on the high-frequency components: there is no risk of confusion with /ʒ/ and /ʒ/.

Table 7.2 shows that, overall, native American listeners have fewer problems with the English consonants than L2 listeners. Dutch listeners are a good second, and Chinese listeners clearly have problems. More generally, the language background of the listener exerts a stronger influence on the number of problematic consonants than the L1 of the speaker. This matter will be discussed at greater length in Chapter ten.

#### **7.4 Conclusions and discussion**

We hypothesized that English consonants would be more difficult to identify as the sound system of the L2 speaker's native language deviates more from English. The differences between the Dutch and Chinese consonant inventories are relatively small, and both languages have roughly the same number of consonants that would be reasonable substitutes for English targets. In this respect the prediction is rather different than in the case of the vowel systems. The results show two things. First, Chinese and Dutch accented consonants are relatively well identified by all groups of listeners, and certainly better than the vowels (Chapter six). Moreover, the difference in intelligibility between Chinese and Dutch accented consonants is very small, which would seem in line with the above hypothesis.

In spite of the overall high level of intelligibility of the non-native consonants, we observed that there are a number of consonants that are clearly less intelligible than their native American counterparts. Most of these cases could be accounted for in terms of negative transfer from the mother tongue. In several of these cases, however, the account could only be given in retrospect – there seems no reasonable way to predict the intelligibility problem a priori.

Importantly, we also found a number of non-native consonants that were identified better as the intended targets than was the case for native American tokens of these consonants. This situation, however, was encountered only when the listeners had the same language background as the speakers. These cases, then, are concrete instances of interlanguage benefit in intelligibility.

Rather than drawing more, and more detailed, conclusions, we will now first present and analyze the intelligibility of English consonant clusters in Chapter seven, and then discuss the intelligibility of consonants in more general terms.

