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Abstract

This is a pilot study on real-time acquisition of English vowel and consonant contrasts by Chinese students in the Netherlands, a country where non-native English is spoken to foreigners. We tested the Chinese learners after 6 months, and a second time of 32 months. Although we assumed that if any effect of length of residence of two years would show up, it would favor the perception of Dutch-accented English, the results show improved vowel and consonant identification regardless of the accent of the speaker (Chinese-accented English, Dutch-accented English, American native English). Also, the gain in vowel identification was significantly better than that in consonant identification. We argue that the discrepancy between vowel and consonant identification can be explained by differences in the vowel and consonant systems of the three languages.

1. Introduction

Learning a second language is never easy. L2 performance will often be suboptimal relative to native language performance. Differences between L2 learners and L1 speakers of the target language may be apparent in any of the linguistics levels (phonemes, words, sentences, text), in language production and perception, in speech and in written language. The native L1 acts as a filter in speech perception for L2 learners, so that the sounds of L2 are typically perceived in terms of the categories of the L1. However, learners may adapt their perceptual system so as to be better tuned to the contrasts that are functional in the new language. It seems common knowledge that young L2 learners ('early bilinguals') adapt to the norms of the target language more successfully than learners who are exposed to L2 input at a later stage in life ('late bilinguals'). It has often been reported that young L2 learners, when given time, will ultimately lose any trace of native language interference and are indistinguishable from native speakers of the target language. Adult learners of the L2 will never be able to shed all traces of their native language background and will always reveal their foreignness if exposed to a sufficiently critical test. This has been taken as evidence for the hypothesis that young L2 learners still have a great deal of plasticity while adult learners suffer from rigidity. We do not wish to take issue with the overall view that adults have less plasticity than young learners. Rather, we aim to test the extent to which adults may still adapt to the perceptual norms of the target language, i.e. we want to determine the limits of perceptual plasticity in foreign language learning adults at the phonetic and/phonological level.

We build on work by Flege and co-workers [1], who studied learning effects as a function of length of residence (LOR) in Chinese immigrants to the USA. Their learners were subdivided into 2 × 2 categories: (i) short (< 3;9 years LOR) versus long (> 3;9 years LOR) and (ii) students versus professionals. Interestingly, LOR had no effect unless the learners were enrolled in a university program; if they were, the long-LOR outperformed the short-LOR group in phoneme identification, listening comprehension and grammatical judgment of written sentences. Of course, this is a comparison of short and long LOR in apparent time. In our research we monitored a group of Chinese immigrants for almost three years and tested their phoneme identification in American English after 6 months LOR and a second time after 32 months LOR, i.e. in a real-time study.

A second issue is the role of the input language during L2 learning. In the present research we study the performance of Chinese learners of English who were trained with an American pronunciation model in China – although the model provided by their teachers is bound to have been strongly Chinese-accented. After taking their degree in China our subjects came to the Netherlands to prepare for some higher degree (MA of PhD) at Leiden University. The language of instruction for our subjects, and in much of their everyday communication, was English. The Dutch pride themselves (unduly) of being excellent speakers of English and generally do not encourage foreigners to speak Dutch to them. Inevitably, therefore, foreigners in their daily communication with Dutch nationals get massive exposure to non-native Dutch-accented English (disparagingly called Dunglish by native speakers of English). Dutch and English are closely related languages, both belonging to the West-Germanic branch of the Indo-European language family. Both languages have rich vowel and consonant inventories, allow complex syllable structures, and boast long, polysyllabic words with a variety of stress patterns. However, in spite of the gross similarities the inventories are very different in their phonological composition and phonetic implementation of contrasts. Chinese, in contrast to the Germanic languages, has a relatively small vowel inventory, uses rather simple CV(N) syllable structures, has a basically monosyllabic vocabulary, and uses lexical tones rather than stress as the word-prosodic system. We were interested in determining how Chinese L2 learners of English would develop over the course of their exposure to Dutch-accented English during their stay in the Netherlands. Several possibilities spring to mind. First, the Chinese learners may adapt their perceptual norms so as to accommodate to the Dutch way of pronouncing the vowels and consonants of English. If so, we predict a change in the perceptual confusion pattern that might emerge from the vowel and consonant identification performance such that it reflects the typical structure of Chinese accented English shortly after their arrival to the Netherlands but changes towards the

confusion structure that is typical of Dutch learners of English. Alternatively, it may be the case that Dutch-accented and native English have so much in common that exposure to Dutch-accented English generalizes to better performance in both Dutch-accented and American native English. What we would not predict, of course, is that prolonged exposure to Dutch English would also be beneficial for the perception of Chinese-accented English (although the perception of this type of English should not be negatively affected either).

The aim of our research, then, is to better understand (the extent of) the ability for adult L2 learners to adapt their speech perception to a new language. The present research focuses on adaptation not to the native norm for the target language but to a non-native type of pronunciation which is neither the L1 of the learner nor that of the target language. More specifically, we wished to determine to what extent the Chinese learners of English would become better tuned to Dutch-accented English, and to what extent their perception of (American) native English might still benefit from exposure to Dutch-accented English.

2. Methods

Basic materials. English vowels and consonants were produced, as follows:

1. **Vowel list**: words containing 19 different full vowels and diphthongs (excluding schwa) in identical /hVd/ contexts. This consonant frame is fully productive in English, allowing all the vowels of English to appear in a meaningful utterance, either a word or a short phrase [2]. Yet the listeners will get no lexical information from the consonantal context when they have to identify the vowel. The 19 items were *heed, hid, hayed, head, had, who'd, hood, hoed, hawed, hod, hud, hide, how'd, hoyed, here'd, haired, hoored, hard, heard*.
2. **Consonant list**: nonsense words /aCa/ containing 24 intervocalic English single consonants. The sole purpose of this list was to elicit the 24 English consonants in a symmetrical, identical vowel frame. The use of nonsense items was unavoidable here: *apa, aba, ata, ada, aka, aga, afa, ava, atha, adha, asa, aza, asha, azha, acha, aja, ama, ana, anga, awa, aya, ala, ara, aha*.

Speakers. These materials were recorded by six speakers. These were young adults, students or staff at Leiden University, who had not specialised in English Language at the university level. They did not possess any explicit knowledge of English sound structure. Speakers did not have, or never had in the past, regular contact with English-speaking friends or relatives, nor had they ever lived in an English-speaking country. The Dutch speakers were Dutch nationals who spoke Standard Dutch. The Chinese speakers were students at the Medical Faculty, who had not lived in the Netherlands for more than twelve months at the time the recordings were made. When in the Netherlands, they mostly communicated with Dutch nationals in English, so that the Chinese speakers of English were more acquainted with the Dutch accent in English than with the native (American) English pronunciation. The two American native speakers of English had been in the Netherlands for no more than four months at the time of the recording. They, too, were students at Leiden University. Native American speakers, rather than British – or some other Anglo-Saxon nationality – speakers were used, since the pronunciation norm of English as taught in the Peoples Republic of China is American rather than British. Dutch speakers of English generally adhere to American norms (although most teaching materials used in the secondary school class room are British; apparently the language of the media – which is dominated by American English – prevails, see also [3]).

Speakers read the materials from paper in individual sessions while seated in a sound-insulated recording booth. Each target sound was additionally illustrated by a high-frequency word containing the target in bold face. The speakers were recorded through a Sennheiser MKH-416 microphone on a DAT recorder, and later downsampled (16 KHz, 16 bits) and stored on computer disk.

Materials were then constructed for a listening experiment comprising two parts. Part 1 contained the 19 /hVd/ items for all six speakers in random order (across speakers), preceded by six practice items, yielding a total of 120 items. Part 2 contained the 24 /aCa/ items, again in random order across speakers, yielding 150 items (including 6 precursor practice items). For details see [4, 5].

Listeners. The two test parts (vowels, consonants) were presented to a group of twelve Chinese students living in the Netherlands, six men and six women. Listeners were drawn from the same population that the Chinese speakers of English had been selected from (but different individuals). Although none were English majors, all had had at least four years of college English education in China and passed the Band 4 and Band 6 College English Tests (CET), which are degree requirements for Chinese university students. Listeners volunteered, had no self-reported hearing problems, and were paid 10 Euros. All listeners had been in the Netherlands for less than twelve months when the test was run, with an average length of residence of six months.

Twenty-six months later, seven of the original group of twelve (five women, two men, between 23 and 32 years of age) were still residing in the Netherlands. These took the vowel and consonant identification tests a second time, i.e. at an LOR in the Netherlands of 32 months. Again, they were paid a fee of 10 Euros.

Procedures. During both the first and the second administration of the tests, materials were presented over good-quality headphones to listeners, individually or in small groups. Listeners were instructed to make a single forced choice from the 19 (part 1) or 24 (part 2) response alternatives, which were printed on their answer sheets. Subjects were told to gamble in case of doubt. The response sheets listed the alternatives in conventional English spelling. Also, each alternative was illustrated by a high-frequency word containing the target vowel or consonant in bold face, so that it was absolutely clear to the listener which sound was represented by each alternative. For each part of the test we instructed the listeners to carefully study the response alternatives before signaling to the experimenter that the presentation of audio materials could begin. Each item was presented just once with an inter-stimulus interval (offset to onset) of 7 seconds during the first half of each part, which was reduced to 5 seconds in the second half (when the listeners were highly familiar with the layout of the answer sheet).

Before the rerun of the tests, the seven remaining listeners filled out a detailed questionnaire, which asked them to indicate what percentage of the time they used Dutch, English and Chinese in several communicative domains (at home, with partner, with friends, with colleagues, in shops, with administrators, etc.).

3. Results

Fig. 1 plots the percentage of the languages our subjects reported to use in their daily life in the Netherlands. It shows that English was the dominant language (some 60% of the time), with Chinese second, while Dutch was hardly ever used. Unfortunately, our subjects had little intuition about the division between Dutch-accented and American native English input; they seemed largely unaware of the difference between the two types of English input.

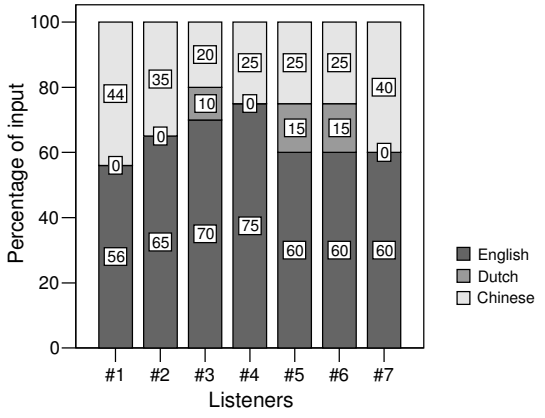

Figure 1. Languages used (English, Dutch, Chinese, in percent) as reported by our seven Chinese listeners.

Fig. 2 plots percent correct vowel (panel A) and consonant (panel B) identification obtained by the same individuals after 6 months against the score after 32 months of residence in the Netherlands, broken down by the language background of the speakers (Chinese, Dutch, American). Data points above the diagonal indicate improved performance with longer LOR. Although there is a general trend towards improved identification performance, there seems to be no interaction with the accent of the speakers. The average gain is roughly the same regardless of the speakers accent (Fig. 3A).

A repeated measures RM-ANOVA was run on the correct identification scores with LOR (short vs. long), type of test (vowel vs. consonant) and nationality of speaker (Chinese, Dutch, American) as fixed within-subject factors. The effect of LOR proved insignificant, $F(1,6) = 2.1$ ($p = .198$). The effects of type of test, $F(1,6) = 71.8$ ($p < .001$) and of nationality of speaker, $F(2,12) = 18.0$ ($p < .001$) were highly significant (all tests Huynh-Feldt corrected). None of the interactions reached significance. The provisional conclusion must be that the prolonged exposure to Dutch-accent English from 6 to 32 months LOR does not lead to a significant improvement of either vowel or consonant identification, regardless of the type of accent the speaker has, whether Chinese, Dutch or American.

Closer inspection of Fig. 2A reveals two listeners who have poorer vowel identification on the retest, while the others benefited from their longer LOR. Interestingly, these two listeners a male-female student couple had moved to the South of the Netherlands half a year after the first test (these speakers are identified in Fig. 1A by ellipses drawn around their data points).

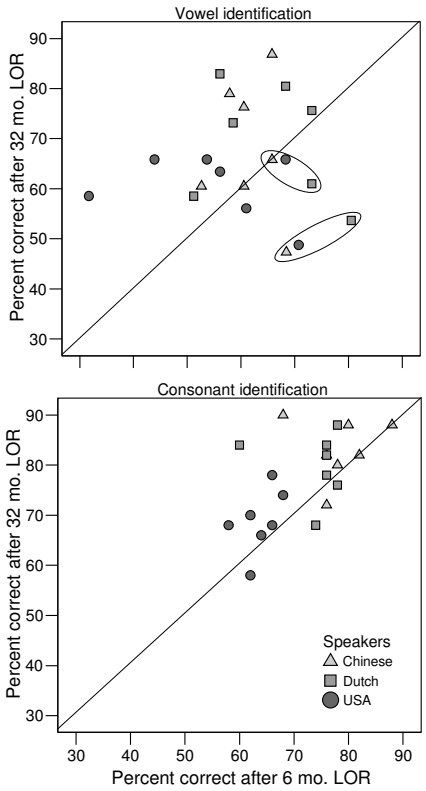

Figure 2: Percent correct vowel (panel A) and consonant (panel B) identification obtained after 6 months or residence in the Netherlands plotted against the score obtained by the same listeners after 32 months LOR.

The type of Dutch spoken in the Southern part of the Netherlands differs substantially from Western Dutch [6]. The differences are concentrated in the vowels; there is only one striking difference in the consonant system, but this concerns the pronunciation of the velar fricative, a type of sound that does not even occur in English. We argue that the drop in vowel identification with these two listeners is not accidental but may well be due to their exposure to the different type of Dutch-accented English which is spoken in their new environment. This may have negatively affected their perceptual norms for English vowels across the board, i.e., not just for Dutch-accented English but also for American native stimuli and even for stimuli spoken with a Chinese accent. [1]

[1] This may not be the only explanation for the deviant behavior of the two subjects. They were also the two individuals who used Dutch more than any of the other Chinese listeners (Fig. 1), and they took the retest in a different environment than the others. Given the overall insensitivity of our learners to accent-specific English input, these extralinguistic differences may have been more influential than the accent-specific input.

Crucially, the five listeners who improved both their vowel and consonant identification performance, had remained in Leiden, i.e., in the West of the Netherlands.

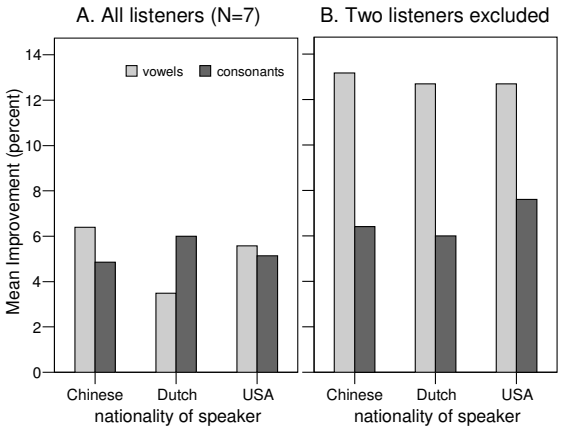

Figure 3: Gain in percent correct vowel and consonant identification between 6 and 32 months LOR, broken down by accent of speakers. Panel A: all listeners included (N=7); panel B: two listeners who moved excluded (N=5, see text).

A re-analysis of the data, after eliminating the two speakers who had moved to the South of the country, shows that the overall effect of LOR is significant, $F(1,4) = 11.4$ ($p = .028$). The effects of accent of speaker, $F(2,8) = 11.5$ ($p = .004$) and of type of test (vowels vs. consonants) remain significant, $F(1,4) = 66.0$ ($p = .001$), but crucially now also the interaction between LOR and test type reaches significance, $F(1,4) = 11.2$ ($p = .029$). Vowel identification improves by 13% against 7% consonant improvement (Fig. 3B). No other interactions were significant.

5. Conclusions

Our results show that a relatively short stay of roughly two years in an English-speaking environment leads to an improvement in the perception of English sound contrasts. This finding suggests that even within a short period after arrival in the new language environment adult learners may develop better perceptual norms for sound contrasts in the L2 – even when they receive no formal instruction in the new language. This finding is all the more remarkable since the language-learning environment in the Netherlands – with a predominance of non-native English input – is less favorable than in a country where English is spoken as the first language.

Perception of vowel contrasts improved twice as much as perception of consonant contrasts. There are at least two reasons why this may be so. First, as is shown by Fig. 2, our listeners were better at identifying consonants (60-90% correct) than vowels (30-80%) even when the tests were first administered, so that there is more room for improvement for vowel perception. Second, we would argue that the consonant system of English is easier for Chinese learners than the vowel system. The consonant inventories are of comparable size, both Chinese and English (unlike Dutch) have aspirated onset stops and 0-ms voice onset time in the voiced stops. The notorious /r/~/l/ contrast should benefit as much from Dutch-accented as from American-accented input. Problematic consonants would be the fricatives /v, θ, ð, ʒ/ only. The differences between Chinese and English are substantially larger in the vowel system (6 versus 12 contrastive monophthongs, not counting diphthongs and /r/-colored vowels, [7, 8]), with a tense~lax dimension that is not used in Chinese, and a three versus four-level height dimension. Although the details in the vowel systems differ between Dutch and English (see [5] for details and references), the dimensional structure with the tense~lax feature and a four-level height distinction are the same. Possibly, then, exposure to a rich vowel system such as that of Dutch-accented English yields positive transfer to the perception of American native English.

A final point to consider is that the identification of English phonemes improved regardless of the language of the speaker (Chinese-accented, Dutch-accented, American native accent). Counter to what we expected, then, the data do not reflect input-specific effects of LOR on the Chinese learners' task performance. We had not expected this undifferentiated improvement, on the assumption that the Chinese learners of English would predominantly get attuned to Dutch-accented English. There are good reasons, in hindsight, to believe that our Chinese late bilinguals got as much exposure to Dutch-accented English as they got to Chinese-accented and native English. Our learners indicated that they spent considerable time watching English-spoken television programs (BBC, CNN, and numerous films, which are never dubbed in the Netherlands). Also, Chinese students often live in small groups and tend to stick together when taking classes. As a result the often hear each other speak English.

6. References

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