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Applications of Articulatory Phonetic Theory
——A Practical Approach to Speech Clinics——

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1. Introduction

One of my students went to the United States to stay with an American family during her summer vacation. After she made the observation,"Bad weather,"a member of the host family took a bottle of Budweiser from the refrigerator,and said,"Here you are."

Why can't we Japanese make ourselves understood in English? It may be partly due to the misuse of grammar, partly due to improper collocation, or partly due to cultural differences. The episode above, however,shows us thet one of the big problems thet causes miscommunication is mispronunciation. From a phonetic point of view, the student made three mistakes. She confused the vowels /æ/ for /ə/ and /ɛ/ for /ay/, and the consonants /z/ and /ð/.

At Jumonji Junior College, we offer a speech class *(Aural Skills II)* conducted by Japanese teacthers. This speaking class is designed to help students acquire a proper basis for speaking English, that is, correct pronunciation, pitch, intonation, and abdominal breathing. Students are offered another speech class *(Oral Communication)* conducted by native speakers of English for developing usual free conversational ability. In Aural Skills II, students are required to imitate a native speaker. After long experience teaching speaking skills to college students, I have become familiar with many of the problems thet Japanese students have when they pronounce English. I will discuss what kinds of mispronunciation lead to miscommunication, why this happens, and how to remedy these errors. I will examine the issue with respect to two groups: errors related to consonants and those related to vowels.

2. Consonants

2.1 Insufficient Pulmonary Air Pressure

When I monitor Japanese students speaking English, I often find that /t/ is pronounced

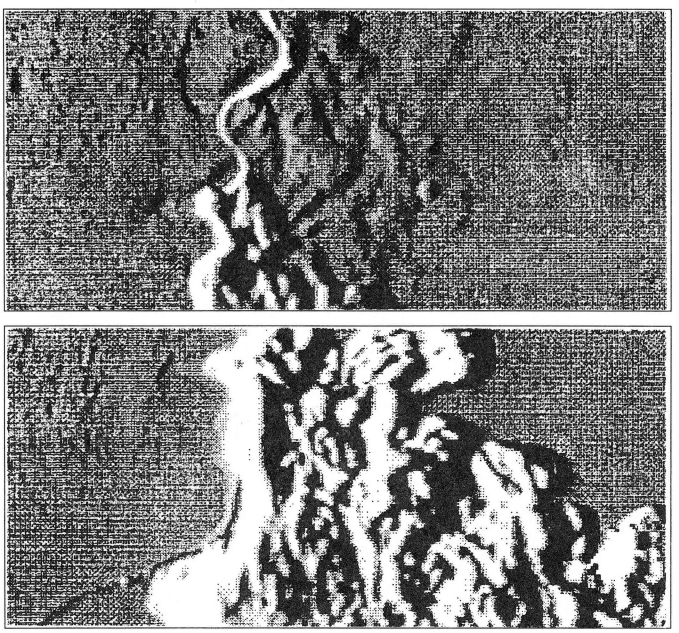
as a /d/ sound. Sometimes I only perceive the vowel after the /t/ sound. Why does this happen? Let's take a look at the mechanisms used to create /t/ and /d/ souds.

When we make a voiced sound, the vocal cords are close together, thus enabling them to vibrate. Vocal cords are folds of tough, flexible tissue that extend from the back to the front of the larynx. The space between the vocal cords is called the "glottis." When we breathe or make a voiceless sound, the glottis is opened to allow air to rush in and out. It takes some time for the wide-open glottis to become narrow enough to vibrate the vocal cords, thus making the required vowel sound after a voiceless consonant. Until the glottis closes and the vocal cords begin to vibrate, pressured air from the lungs, rushes out through the glottis. This voiceless puff of breath is known as "aspiration."

Japanese ESL learners are not accustomed to pronouncing consonants with pulmonary pressure energetically enough to make voiceless consonants in English, as they don't have to do in this in their native lenguage. This is a problem typical of a first language transfer. Although, Japanese sounds are made using the pulmonary airstream mechanism as in other languages, Figure 1 shows that in Japanese, consonants are pronounced using relatively little air pressure.

Figure 1.

A.

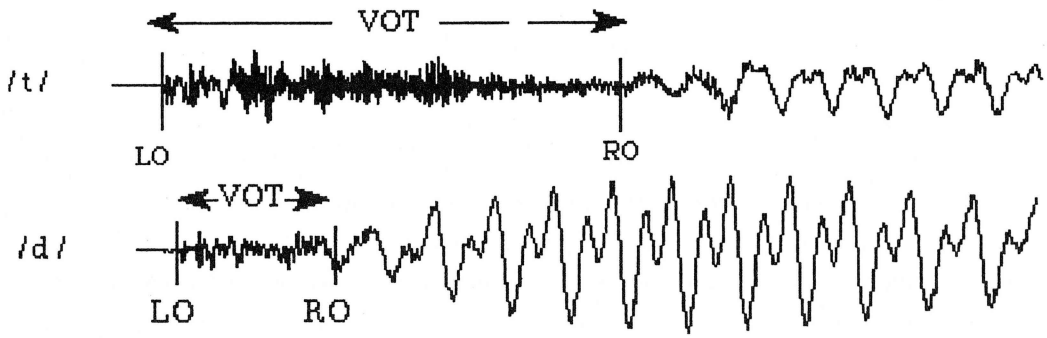


B.

Figure 1 shows the airstream coming out of a mouth when pronouncing the word "key." Figure 1-A shows what happens when a Japanese male pronounces the word "key," and Figure 1-B shows the same thing for an English male. The amount of exhaled air from the English male is much larger and the force is much stronger than with the Japanese male.

But why are unaspirated voiceless stop consonants likely to be perceived as their voiced counterparts, for example, /t/ instead of /d/ ? In pronouncing /t,d/, air pressure is built up while the front part of the tongue touches the alveolus. When the closure is released, the air escapes forcefully. Figure 2 is an example of the voise onset -time(VOT) of stop consonsnt /t,d/. VOT is defined as the interval between the release of an oral constriction and the start of glottal pulsing (Lisker and Abramson, 1964).

Figure 2



Vocal tract(alveolar) closure is released at the point LO. The vocal cords begin to vibrate at the point RO. Figure 2 shows that the VOT of voiced consonant /d/ is much shorter than that of voiceless consonent /t/. The time lag is usually 20-40 msc. Liebermend and Blumstein refer to the fact that the lag in VOT determines whether humans will perceive a consonant as /t/ or /d/. In many langeuages, stimuli with VOTs shorter than 20-40 msec are heard as voiced (e.g., [da]), while stimuli with longer VOTs are heard as unvoiced (e.g., [ta]) (Abramson and Lisker, 1970).

Japanese students need to learn to produce VOT when pronouncing a voiceless stop. It is necessary for them to learn to pronounce stressed stop consonants with a strong puff of breath, since their glottis does not open wide enough to generate aspiration. If initial voiceless stops /p, t, k/are pronounced without aspiretion, they are likely to be perceived as voiced /b,d,g/. As I mentioned before, this phenomena is typical of a first language transfer. Flege(1980) analyzes the performance of two Saudis learning English and that of a native speaker of English.

They were asked to pronounce stop consonants in a CVC (consonant-vowel -consonant) structure. One of the Saudis had been staying in the United States for less than one year, while the other had been staying there for more than two years. Flege examines differences in their VOT performance.

Figure3. VOT of stop consonants

msec

	Am	Ar 2	Ar 1
Voice-onset time			
/p/in pat	46(4)	21(11)	14(10)
/t/in tab	62(11)	29(14)	32(10)
/k/in cab	67(12)	47(11)	41(7)

Am American
Ar 1 Saudi staying in US less than 1 year
Ar 2 Saudi staying in US more than 2 year
( )=SD

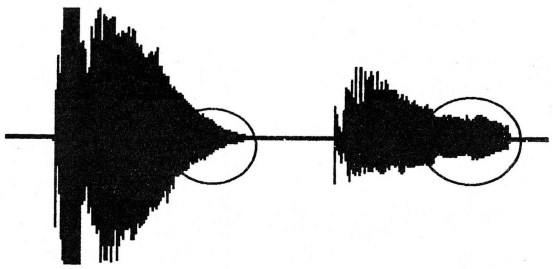
Whereas the VOT of the native Spearker was 46 msec, that of Ar 2 was 21 msec. Although subject Ar 2 was an advanced learner, the index for Ar 2 was closer to that found in Arabic. Toshiaki Ozawa (1983) points out that the results show that the first language transfer has a strong impact on phonological performance. This finding should also hold true for Japanese.

In summary, teachers should teach how to pronounce voiceless consonants taking into account the following facts: (1) voiceless stop consonants are pronounced with a longer VOT than voiced stop consonants; (2) in order to produce a longer VOT, you need a noticeable burst of air followed by a noisy airflow that lasts for a considerable amount of time; (3) to acquire a native-sounding VOT, students must overcome the effects of first language transfer.

2.2 Consonants and Unnecessary Vowels

If a word ends with a consonant, Japanese students tend to place an unnecessary vowel after it. For example, many Japanese students pronounce "I am" as /ay amu:/. This is also result of first language transfer. In Japanese, nearly all syllables end with a vowel, whereas in English, words tend to end with a consnant.

Figure 4 Sound wave of the word "time"



A. Spoken by an American B. Spoken by a Japanese

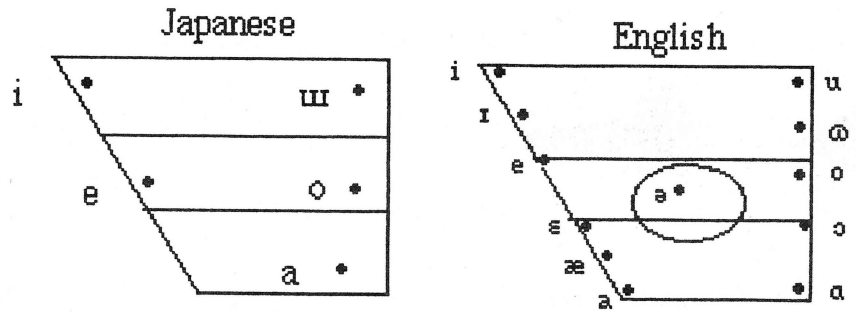
Figure 4 clealy illustrates the contrast that exists among final sounds. Whereas A ends with /m/, B ends with a syllable/mu/. Japanese speakers must be careful to avoid the habit of adding an unnecessary vowel after a final consonant. One recent teaching method that seems to aggravate this habit is teaching English pronunciation using katakana. Since not everyone understands a phonetic alphabet easily, this method has become quite prevalent of late. Katakana, however, cannot represent consonants alone, but only CV (consonant plus vowel) patterns. Therefore, students who learn English pronunciation using katakana acquire the habit of adding an unnecessary vowel after a consonant. Furthermore, as I have mentioned before, Japanese pronounce consonants using little pulmonic pressure. It is impossible for katakana to indicate the importance of air pressure. It is better to think of even those consonants that English and Japanese have in common, for example, /p, t, k/, as completely different sounds.

2. Vowels

2.1 /a//æ//ə/

There are twice as many English vowel types as there are Japanese vowel types. If each language's vowel system is compared to a musical scale, the Japanese vowel system could be likened to a whole-note scale, and the English vowel system to a half-note scale. We can assume that native speakers of Japanese who are learning English may have some difficulty distinguishing between English vowels that fall in between two Japanese vowels (Nonaka, 1993).

Figure 5 Japanese and English vowels



There are at least four English vowels /a,æ,ə,ɑ/ in the vicinity of the Japanese /a/. The students I mentioned in the Introduction could not distinguish the difference between these four vowels. Frequently, misunderstandings result from these minute differences in pronunciation. For example, if we can't tell the difference between /æ/ and /ə/, we won't be able to understand the difference in meaning between the following sentences:"Look at the woman carrying a /bəg/(bug)" and "Look at the woman carrying a /bæg/ (bag)."

Furthermore, the inability to distinguish between /a, æ, ə , ɑ / can lead to another problem. When we move the stress in English, we often change the vowel quality. When <e> in "men" is stressed, it is pronounced / ɛ /, but when <e> in "women" is unstressed, it is pronunced / I /. This change in vowel quality from a stressed full vowel to a short central vowel is called "reduction." Non-native apeakers are often not aware of when a vowel reduction is beinhg used.

2.2 /ɔ// ɑ /

Another error that Japanese students also tend to confuse the following three vowels: /ɔ// ɑ / and /ow/. When we represent the English / ɑ / sound in katakana, the Japanese read it as /ɔ/. For example, the word "doctor" is represented as /dɔkuta/ in katakana. Further examples of such words are bottle, calm, box, lot, shock, shot, stop, and block.

2.3 Diphthongs

When I heard the word "robot" for the first time, I thought it was "Robert." The word was pronounced /roubɑt/, and I believed "robot" should be pronounced /rɔbɔt/. When I monitor Japanese students speaking English, I find that many of them use the single vowel /ɔ/ instead of the diphthong/ou/. The following words are diphthongs that Japanese students frequently mistake for single vowels: won't/wount/, only /ounli:/, both /bouθ/, phone /foun/, don't /dount/.

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