

# **Contrastive Analysis Between Japanese and American English Sound Systems: From an Articulatory Setting Perspective**

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## **I. Which phonological features should be taught?**

What should teachers teach and how should they teach English pronunciation to Japanese learners? Celce-Murcia (1996) argues that the realistic pedagogical goal for postpubescent adolescents and adults should be not to train learners to acquire a native-like pronunciation, but to train them to speak with an intelligible pronunciation. If the purpose of learning English is to communicate with people around the world while using English as a common language, the main focus should be to make one's English intelligible in order to avoid misunderstandings.

The area where intelligibility problems could occur can be predicted by finding out where learners have difficulty in English, and the areas of difficulty can be identified by examining what are the differences between English and Japanese through contrastive analysis. We can reduce the possibility of misunderstandings caused by unintelligible pronunciation by overcoming difficulties due to the differences between the two languages. There are research studies that explain difficult areas in English pronunciation for Japanese learners based on contrastive analysis, which teachers can make use of (e.g., Avery & Ehrlich, 1992; Bradford, 1994; Kohmoto, 1969; Ohata, 2004; Riney & Anderson-Hsieh, 1993; Smith, 2012; Yuzawa, 2007) as well as textbooks (e.g., Cook, 2000; Grate, 1974). Teachers can focus on those areas that are suggested to be difficult for Japanese learners without trying to cover

every aspect of English pronunciation.

According to the hierarchy of difficulty simplified by Ellis (1994), the difference described as “split” is considered to create the biggest challenge for learners to overcome. English vowels are perfect examples of the kind of difference that can be labeled as split on the segmental level. In Japanese, there are only five vowels while English has at least 14 stressed vowels. There are more if unstressed vowels are included (Celce-Murcia, 1996). However, differences in vowels have a huge influence on meaning such as “barn” and “burn, and may cause misunderstanding or unintelligibility (Yuzawa, 2007). Therefore, learning at least how to differentiate each vowel can be said to be necessary.

In addition to English vowels, English rhythm is one of the most difficult suprasegmental elements for Japanese learners to acquire. English is a stress-timed language while Japanese is mora-timed. This difference can be categorized as reinterpretation (level 3) or over-differentiation (level 4) according to Ellis’s (1994) hierarchy of difficulty. Moriya (1988) claims “speech rhythm is essential for intelligibility” (p. 4) and Smith’s (2012) research indicated that Japanese learners needs help with their pronunciation especially “in regards to place and manner of articulation as well as understanding how to effectively employ word and sentence stress” (p. 203).

## **II. Teaching Articulatory Settings and Its Validity**

One of the major reasons why articulating English vowels and using English rhythm is difficult for Japanese learners is that Japanese have a different vowel system and different type of rhythm pattern compared to English. It can be assumed that articulatory organs utilized to make Japanese and English vowels and speech rhythm are different. Since the movements of articulatory organs are mainly

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controlled by muscles, it could be logically concluded that Japanese speakers and English speakers use the muscles of their articulatory organs differently, which could imply that they develop their muscles of articulatory organs differently. The fact that English vowels requires a wider range of movements and English speech rhythm requires bigger contrast in pitch, volume and length, could lead one to infer that Japanese learners may not be equipped with sufficient muscles of their articulatory organs in order to produce English sounds precisely and accurately. Also, this may explain why it is often painstakingly time consuming for Japanese learners to acquire English sounds because it should take time to develop strength, flexibility and control over the coordination of articulatory muscles, especially without any training designed specifically for the purpose.

One of the approaches to overcome such difficulty caused by differences in use of articulatory organs can be to learn about English articulatory settings (AS) and train the muscles to be able to smoothly gear in such settings. The importance of raising awareness of how to use their AS in order to improve learners' English pronunciation has been acclaimed by researchers in the field (e.g. Honikman, 1964; Esling, 1982; Esling & Wong, 1983). Moriya (1988) also claims that "speech cannot be taught without the complicated process of making learners use their tongues, lips and vocal cords in a different way" (p. 14).

On the other hand, as Riney (1993) pointed out, "articulatory settings ... may be a category that is too important to ignore but too multifaceted to discuss" (p. 31) and there had been "no empirical studies that attempted to measure Japanese pronunciation of English articulatory setting" (p. 31) due to the lack of methods that allow its mathematic measurement. Moreover, much of the description of articulation features was vulnerable to the criticism saying that they are largely "impressionistic" (Collins & Mees, 1995, p. 422) and that they are arbitrarily defined

rather than compared with other specific languages.

However, with the great advancement of technology such as X-ray and ultrasound systems, it became possible to directly measure general articulatory settings of multiple languages for comparison. For example, Gick, Wilson, Koch and Cook (2004) measured long-term average spectra of English and French and Wilson, Horiguchi and Gick (2007) investigated articulatory settings of inter speech posture for English and Japanese. The result of the study that Gick, Wilson, Koch and Cook (2004) conducted indicated that their findings of relatively high position of tongue body and tip in general American English are consistent with what was previously described by other researchers in the field (i.e. Esling & Wong, 1983; Collins & Mees, 1995). Japanese articulatory settings of inter speech posture is in the progress of data analysis (Wilson, Horiguchi & Gick, 2007), which is being anticipated to give us some insight regarding the validity of previously described differences between Japanese and English AS.

It is hoped that such empirical research on AS will continue to confirm or correct the previously established impressionistic description of AS and give a more detailed and sophisticated description of AS that is scientifically proven so that teachers of English pronunciation can confidently teach AS and use it as a more concrete tool that helps them explain how to articulate English sounds rather than attempting to teach pronunciation through repetition of exaggerated demonstration.

### **III. How should Articulatory Settings be taught?**

Although it is great news that we will soon be able to discover more about AS, the important question of how should we teach AS to learners still needs to be answered. Even though all the description of AS has not been proven valid by empirical research yet, bringing AS to the attention of Japanese learners of English seems very

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reasonable and useful to improve their English pronunciation. It is often the case that Japanese learners are so used to only the Japanese phonemes that they do not even realize their articulators have capacity to create a variety of sounds by moving them in different ways. Therefore, the first thing they may need to learn is the fact that when speaking English, they have to use some other parts of their articulators that they do not use in Japanese very much. The AS models such as the ones that are described by Esling and Wong (1983) can be good as an example to use for the purpose of raising awareness of the different ways to use their articulators to produce English sounds. The features that are suggested are the following: 1) Spread lips 2) Open jaw 3) Palatalized tongue body position 4) Retroflex articulation 5) Nasal voice 6) Lowered larynx 7) Creaky voice.

In addition, Thornbury (1993) suggests that teaching AS should take a form of more self-directed learning approach rather than teacher-centered. It should be focused on “discovery” (p. 131) by learners themselves. Teachers can still help them raise awareness by explicitly describing AS or introducing models of voice setting features so that the learners will notice the differences between the AS of Japanese and English. However, they should mainly rely on learners to explore such differences by themselves by exposing them to a large number of examples so that learners can try out different strategies and decide how best to adjust their own articulators to produce similar English sounds.

Furthermore, it would be useful to encourage learners not only to pay attention to place and manners of their articulators but to do many exercises that can help them build those muscles that need to be strengthened to produce English sounds. Even though there is no empirical evidence to support this, as mentioned above, controlling the muscles of articulatory organs should be the key element in articulating sounds, and therefore, it can be said to be a logical reason that learners

of a languages should build the muscles of their articulatory organs in order to gain better control over them in order to articulate those sounds in the target language that require bigger or different movements than the range of their own native language (Takeuchi, 2012; Walker, 1998).

#### **IV. Major differences between English and Japanese: Vowel articulation and English Rhythm (Word and Sentence Stress)**

I would like to point out some of the English phonological features that make vowel articulation and word and sentence stress difficult for Japanese learners to produce and how such difficulties are connected to the differences in the place and manners of articulators. I would also suggest what part of articulators should be trained in order to make it easier for Japanese learners to articulate such different English sounds and rhythm.

##### **1. Vowel Articulation:**

###### **Differences from Phonological and articulatory perspective**

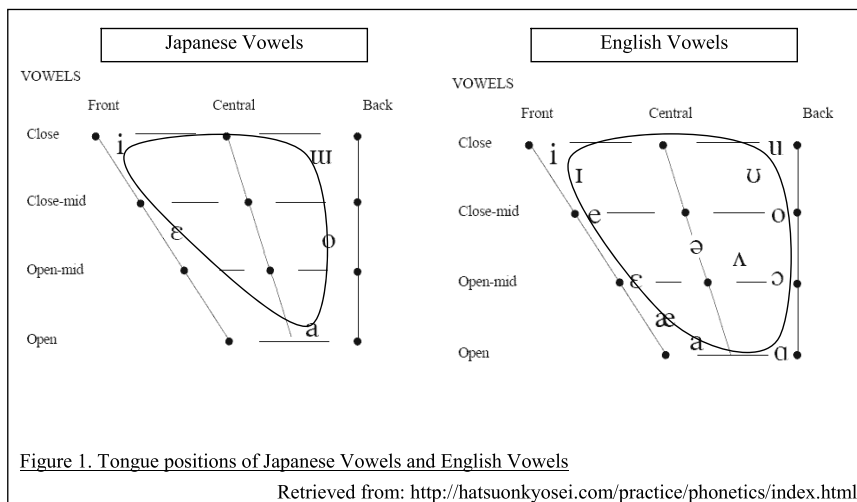
Ohata (2004) points out the two major differences in English vowels that make it difficult for Japanese learners to acquire the vowels: 1) the number of vowels and 2) tense / lax distinctions. As mentioned earlier, English have approximately 14 different vowels and diphthongs whereas Japanese has 5 vowels. Also, there is the differentiation between tense and lax vowels in English that is made with muscle tension or movement in the mouth whereas such difference of muscle tension will not differentiate vowels in Japanese.

In addition to such phonological differences, there are differences in usage of articulators. As shown in the two charts below (Figure 1.), which simply demonstrate the highest tongue position of the individual vowels in each language, it can be easily

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seen that English not only has more vowels but many of those that are produced out of the range of Japanese vowels.

In Todaka (1995)'s study on voice quality differences between Japanese and American English, he found that all the subjects utilized wider vowel space in English than in Japanese. He states that "the high tense vowel in English - /i/ - the low back vowel -/a/ - and the high back vowel /u/ describe a greater range of articulatory settings than the common range of Japanese vowels."



The existence of tense and lax vowels and those vowels that require wider movement of muscles in English imply that Japanese speakers need to improve their strength, flexibility, and coordination of their articulator organs in order to produce English vowels.

The major articulators that make vowel sounds are normally regarded to be 1) Lips, 2) Tongue, 3) Jaws and 4) Pharynx. In this section, the differences between

English and Japanese in terms of each articulator will be discussed.

**Lips:** Lip rounding and spreading

In order to produce Japanese phonemes, lip rounding does not play an important role. For example, in the Japanese pronunciation book for learners of Japanese as a second language written by Kawase and Sugihara (1978), it is suggested that lips should not be rounded or protruded in order to produce Japanese /u/, which is one of the sounds that requires the most unspread lips in Japanese. The lips can be weakly rounded to produce Japanese /u/ sound but they are not as round as English counterparts such as /uw/ or /o/. Moreover, since rounding lips generally does not have a good connotation in Japanese communication scheme, Japanese people may hesitate to do this. Thus, Japanese learners of English need to make extra effort to practice and get used to making their lips round and protruding. Building the lip muscles that are required to round the lips should help Japanese learners of English make the sounds that are produced by rounded lips and/or a gliding movement of the lips (i.e., /uw/ /o/ /ɔ/ /r/ and /w/). In addition to the difference in the roundedness of lips, vertical lip spreading is something that Japanese learners need to work on since Japanese sound articulation does not include such a movement (Carruthers, 2006). Even though there are /i/ and /e/ in Japanese that sound similar to English /iy/ and /e/ respectively, lips are spread wider in a vertical direction when producing English /iy/ and /e/. This means that when producing English, Japanese learners need to consciously round or spread their lips more than they do in Japanese.

**Tongue:** Palatalized tongue body position

In order to articulate Japanese vowels, the tongue needs to be placed in a certain place but it is rarely moved consciously during the articulation. The distinction is



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made mainly by where the air is pushed toward the right area in the mouth while vibrating the vocal cords. On the other hand, in order to produce the English vowels, it is most important to focus on the control over the tongue movement. Wilson, Horiguchi and Gick (2007) found that AS of tongue blade and tongue dorsum of English speakers was significantly higher than Japanese speakers. This implies that raising the rest position of tongue height can help Japanese speakers to produce English vowels more easily.

Also, tongue curling hardly ever occurs in Japanese while curling up the tongue characterizes many varieties of North American English, which have many r-coloring sounds (Esling & Wong, 1983). In addition, the tongue setting in English is very different from that in Japanese in that while in Japanese the tongue usually rests on the lower jaw relaxed and without touching the upper jaw, in English the tongue is somewhat tensed or raised since "almost throughout English, the tongue is tethered laterally to the roof of the mouth" (Honikman, 1964, p. 278) and the body of the tongue tends to be slightly retracted into the pharynx (Laver, 1980). Therefore, Japanese speakers need to practice and get used to curling and moving the tongue actively. Building the tongue muscle should help Japanese learners of English speaker with making the /r/ sound, which is often said to be one of the most difficult sounds for them.

**Jaw:** Open Jaw and its Gliding Movements

There are some English vowels such as /æ/ and /ɔ/ or any diphthongs that require a wider range of lower jaw movements, articulating each sound more smoothly by connecting and combining the sounds. On the other hand, Japanese has a smaller range of movement with more clearly separated articulation of each sound. Therefore, Japanese learners can practice lowering their lower jaws, which may help

them to build the muscle around the lower jaw that enables them to produce low or back vowels such as /æ/ and /ɔ/ or any diphthongs more easily.

Also, English speakers tend to keep their lower lip round and tight, covering the lower front teeth while lowering the jaw, which gives the sound more resonance (Orion, 1997).

Since Japanese sounds do not require much tension in the lower jaw, Japanese learners can pay attention to how the muscles in lower jaw tense and how the lips cover the teeth when lowering their lower jaws.

### **Muscle Training for Vowel Articulation**

The more the Japanese learners use their articulators in English conversations, it is more likely that they improve their muscle flexibility and coordination. However, they can also do exercises specifically designed to develop muscles of articulatory organs. Exercises adapted from drama techniques to warm up articulatory muscles are introduced by Jull (1992). Other examples of muscle training exercises can be found in the textbooks by Walker (2003) and Takeuchi (2013).

## **2. English Rhythm**

English rhythm has been said to be one of the most problematic aspects of the English sound system for Japanese learners (Moriya, 1988; Yuzawa, 2007; Riney & Anderson-Hsieh, 1993; Smith, 2012). Moria (1988) explains that the rhythm of spoken English is determined by the contrast between strong and weak syllables and this dynamic contrast in terms of volume, pitch and length is the one of the most challenging aspects in English sounds that Japanese learners have been struggling in acquiring.

In addition, even though the contrast of strong and weak syllables is drastic, the

changes in volume, pitch and length are made rather smoothly and gradually. This smooth graduation results in connected sounds and gliding pitch change, which is another aspect that is quite different from Japanese.

These rhythmic characteristics are all new to Japanese learners of English and it must be quite difficult for them to discover such differences on their own (Moriya, 1988) and therefore, these characteristics need to be taught explicitly. The Japanese learners need to 1) be aware of what kind of rules or patterns can be found in the rhythmic phenomena and 2) how they need to change their AS in order to simulate the phenomena so that they can apply them when they speak English (Gilbert, 1994).

### **Three approaches to learning English rhythm**

Messum (2009) introduced three ways to practice pronunciation:

1. Acoustic matching: Learners try to produce exactly the same sounds of what they hear in English simply based on the acoustic input.
2. Acoustic pattern matching: Learners try to apply the rhythm pattern they identified from what they hear in English as well as the rules they learn from explicit information provided by teachers, textbooks etc.
3. Action matching: Learners try to mimic how English speakers use their articulators in order to produce English sounds

Incorporating all three ways in order to acquire English rhythm, the first thing the Japanese learners can start with is to learn its general concept. They need to be aware of the fact that English and Japanese have very different sound systems. In English, phrasal or sentence stress patterns are created by putting more stress to important words than other relatively not important ones in a phrase or sentence. On the other hand, Japanese phrasal pitch system does not have such a hierarchical order and phrasal pitch is simply the series of word pitch (Ritter & Silver, 1992).

They should also acknowledge that location of word stress is very important in English and if stress is put on the wrong syllable, "it may be quite impossible for anyone listening to understand what [they] are trying to say" (Prator & Robinett, 1985).

In addition, for acoustic pattern matching, they need to learn rules about word stress and sentence stress. They can try to memorize word stress by listening to how each word is pronounced while paying attention to their word stress. For sentence (phrasal) stress pattern, since each sentence or phrase has a certain stress pattern depending on grammatical function or meaning, the Japanese learners can learn simplified general rules and apply them when they talk. However, they should acquire more subtle and contextualized rules by being exposed to and engaged in authentic conversations with English speakers. While the learners get a grasp of rules about word stress or phrasal/sentence stress, they should also learn that such stress is created by contrasting strong and weak syllables and such contrast is made by change in 1) length, 2) volume and 3) pitch.

For an action matching activity, Messum (2009) recommends "the muscular activity that leads to great expiratory drive" (p. 15) to develop "their abdominal musculature to produce stress pulses" (Messum, 2010, p. 24). He points out that abdominal musculature is the key to create stress, and developing such muscle result in enabling learners to produce English rhythm.

Gick, Wilson and Derrick (2013) also point out the benefits of using abdominal muscles for diaphragmatic breathing. They state that diaphragmatic breathing will make larynx and speech articulators flexible for both singing and speaking. Takeuchi (2013) also stresses that diaphragmatic breathing is one of the most important elements Japanese learners need to train themselves to be able to do in order to produce English sounds more accurately and effectively.

### **What can you do to train your AS muscles?**

Messum (2009) suggests that learners can adapt the Accent Method exercises designed to help with coordinating breath, vocal function, articulation, body movement and language (Møller 2013). Takeuchi (2013) and Walker (2003) invented their own activities in order to develop abdominal musculature for diaphragmatic breathing and are introducing them in the textbooks they designed.

Since there is as of yet no empirical evidence that these diaphragmatic breathing exercises helped learners improve their English stress production, there is no way to know which exercises will be useful. However, there should be no harm in doing them since the benefits of diaphragmatic breathing are well known, and helping learners raise their awareness of how their abdominal muscles and diaphragm are closely connected to their articulators in higher structures such as the larynx and jaws may encourage them to have better understanding of their articulators and utilize them further.

It is obvious that strengthening tongue muscle require significant development through conscious and consistent exercises, which indicates that being able to produce English vowels and English rhythm must take some time. Unfortunately this can also imply that any scientific research to investigate the validity of teaching how to use diaphragmatic breathing for better English stress production may not produce any result within a short span of time.

### **Conclusion**

This paper has attempted to show some examples of contrastive analysis of Japanese and English vowels and rhythm from a general AS perspective while exploring different arguments made by researchers in the field. It is hoped that the differences described here in how Japanese speakers and English speakers use

their articulators differently in order to produce vowels and make the rhythm of their native language will help and encourage teachers of English pronunciation to Japanese learners to raise their learners' awareness of the articulators they use and train them to exercise their control over their articulatory organs better. Further empirical studies of not only contrastive analysis of AS but measurement of learners' muscle development in AS in the course of muscle training may be able to give us more insight on whether such muscle training is valid to improve learners' pronunciation and if it is, how effectively learners can develop the muscles of their AS. Meanwhile, the author personally believes in such muscle training based on her own experiences while learning English and hopes that pronunciation teaching classes will incorporate more muscle training which can be further extended to self-directed learning activities outside the class.

## References

- Avery, P. & Ehrlich, S. (1992). *Teaching American English pronunciation*. NY: Oxford University Press.
- Bradford, B. (1993). Teaching English pronunciation to Japanese learners. Retrieved from: <http://cs3.brookes.ac.uk/schools/education/eal/jl-archive/jl-bestof/27.pdf>
- Carruthers, S.W. (2006). Pronunciation Difficulties of Japanese Speakers of English: Predictions Based on a Contrastive Analysis. *TESOL Working Paper Series*, 4(2), 17-23. Retrieved from [http://www.hpu.edu/CHSS/LangLing/TESOL/ProfessionalDevelopment/200680TWPfall06/05Carruthers\\_Phono.pdf](http://www.hpu.edu/CHSS/LangLing/TESOL/ProfessionalDevelopment/200680TWPfall06/05Carruthers_Phono.pdf)
- Celce-Murcia, M., Brinton, D. M., & Goodwin, J. (2000). *Teaching pronunciation: A reference for teachers of English to speakers of other languages*. New York: Cambridge University Press.
- Cook, A. (2000). *American accent training: A guide to speaking and pronouncing*

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*colloquial American English*. (2nd ed.). Hauppauge, NY: Matrix Press.

- Ellis, R. (1994). *The study of second language acquisition*. (3rd ed.). New York: Oxford University Press.
- Esling, J. H. (1982). Pronunciation considerations in ESL: Voice quality settings. *Working Papers of the Linguistics Circle of the University of Victoria*. 2(1). Retrieved from <http://journals.uvic.ca/index.php/WPLC/article/view/5480/2088>
- Esling, J. H. & Wong, R. F. (1983). Voice quality settings and the teaching of pronunciation. *TESOL Quarterly*, 17(1), 89-95.
- Gick, B. Wilson, I, Koch, K. & Cook, C. (2004). Language-specific articulatory settings: *Evidence from inter-utterance rest position*. *Phonetica*, 61(4), 220-233. doi:10.1159/000084159
- Gilbert, J. B. (1994). Intonation: A navigation guide for the listener (and gadgets to help teach it). In J. Morley (Ed.), *Pronunciation pedagogy and theory: New views, new directions* (pp. 36-48). Alexandria, VA: TESOL.
- Grate, H. G. (1974). *English pronunciation exercises for Japanese students*. Englewood Cliffs, NJ: Prentice Hall Regents.
- Honikman, B. (1964). Articulatory settings. In D. Abercrombie et al. (Eds.), *In honor of Daniel Jones*, (73-84). London: Longman.
- Jull, D. (1992). Teaching pronunciation: An inventory of techniques. In Avery, P. & Ehrlich, S. (Eds.), *Teaching American English pronunciation* (6th ed.), 207-214. NY: Oxford University Press.
- Kohmoto, S. (1969). *New English phonology: A Contrastive study of English and Japanese pronunciation*. Tokyo: Nan'undo
- Kawase, I., & Sugihara, M. (1978). *Nihongo: The pronunciation of Japanese*. Tokyo: Bonjin-sha.
- Kreidler, C. W. (1989). *The pronunciation of English: A course book in phonology*.

Cambridge, MA: Blackwell.

- Laver, J. (1980). *The phonetic description of voice quality*. Cambridge: Cambridge University Press.
- Messum, P.R. (2009). Grounding stress in expiratory activity. *Speak Out!*, 41, 12-16.
- Messum, P.R. (2010). Understanding and teaching the English articulatory setting. *Speak Out!*, 43, 20-24. Whitstable: IATEFL.
- Moriya, Y. (1988). English speech rhythm and its teaching to non-native speakers. [S.l.]: Distributed by ERIC Clearinghouse. (ED No. 303 033)
- Møller, K. (2013). The Accent Method. Retrieved from: <http://www.voicesource.co.uk/article/180>
- Ohata, K. (2004). Phonological differences between Japanese and English: Several potentially problematic areas of pronunciation for Japanese ESL/EFL learner. *The Asian EFL Journal*, 6 (4) 1-19.
- Orion, F. (1997). *Pronouncing American English: Sounds, stress, and intonation*. (2nd ed.). New York: Heinle & Heinle.
- Prator, C. H., Jr., & Robinett, B. W. (1985). *Manual of American English pronunciation*. (4th ed.). New York: Harcourt Brace Jovanovich.
- Riney, T. & Anderson-Hsieh, J. (1993). Japanese pronunciation of English. *JALT Journal*, 15(1), 21-36.
- Smith, B. (2012). Pronunciation patterns of Japanese learners and their implications for teaching. *Polyglossia*, 23, 199-206. doi: <http://hdl.handle.net/10367/3958>
- Takeuchi, M. (2012). *Manual of English pronunciation for Japanese*. Tokyo: Ask Shuppan.
- Thornbury, S. (1993). Having a good jaw: Voice-setting phonology. *ELT Journal*, 47(2), 126-131.
- Todaka, Y. (1995). A preliminary study of voice quality differences between



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Japanese and American English: Some pedagogical suggestions. *JALT journal*,  
17(2), 261-268.

Walker, S. (2002). *Jingles English pronunciation: Articulatory muscle training for  
international level (Level 87)*. Tokyo: DAI-X sha.

Yuzawa, N. (2007). Teaching English pronunciation. *The Economic Journal of  
TCUE*, 50, 95-107.