Using Praat and Moodle for Teaching
Segmental and Suprasegmental Pronunciation

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The use of Praat (open-source acoustic analysis software) to provide feedback for learning vowels and diphthongs was described by Brett (2004 - ReCALL 16:103-113). However, his conclusion, and that of Setter and Jenkins (2005 - Language Teaching 38:1-17), was that formant plot interpretation using Praat's interface is too complex for learners. In this paper, classroom data elucidates the use of Praat for measurements such as the duration, pitch, and intensity of sounds. It is shown that a combination of Praat and the Choice activity in Moodle (an open-source Learning Management System) provides a method of pinpointing the weaknesses of each student, thus helping the teacher to make efficient use of class time.

1. Introduction

The use of Praat (open-source acoustic analysis software) to provide feedback in pronunciation classes promotes autonomous learning in a field that has had to rely on native-listener judgements, traditionally, for evaluation. Its use for learning vowels and diphthongs was described by Brett (2004), who concluded that a better interface was needed for the pronunciation learner. Setter and Jenkins (2005) in their state-of-the-art review of pronunciation teaching, point out that being able to successfully interpret formant plots produced by Praat requires "a sophisticated level of understanding" on the part of both teacher and learner (p.10). However, Praat can be used for more than simply plotting formants. It is straightforward for students to measure the duration of speech sounds and to identify which words have higher pitch and intensity (loudness).

In Section 2 of this paper, I will demonstrate how to use Praat for teaching aspects of both segmental and suprasegmental pronunciation such as: (1) vowel length differences before voiced and voiceless stops (e.g., *code* versus *coat*), (2) voice onset time (VOT) of stops (e.g., *goat* versus *coat*), (3) spectrogram differences distinguishing /ɾ/ from /l/ from /ɹ/ (e.g., *heating* versus *healing* versus *hearing*), and (4) intonation and stress. In Section 3 of this paper, I will show teachers how to set up a Choice activity (a method of polling students) within Moodle (an open-source course management system), enabling students to enter their Praat measurements and allowing teachers to pinpoint student problems efficiently.

2. Using Praat to Measure Pronunciation

Praat is open-source software for the acoustic analysis of speech. It can be downloaded freely from <http://www.praat.org> for a range of operating systems, such as Mac, Windows, Linux, Solaris, etc. An in-progress Japanese user manual, including audio and video files, can be found at <http://clrlab1.u-aizu.ac.jp/praat_j.html>.

Although Praat is used by many pronunciation teachers and students, its interface is designed more with the scientist/researcher in mind. Nonetheless, it is extremely useful in pronunciation classes and is currently being used as both a teaching tool and a pronunciation aid in Phonetics and Pronunciation courses at the University of Aizu. After being trained by the teacher on the use of Praat, students are able to record and analyse their own pronunciation. Although pronunciation is often judged and taught solely through the oral/aural medium, this use of Praat opens up analysis to the visual medium as well.

2.1 *Vowel length differences*

It is straightforward for students to measure the duration of speech sounds, at the level of the segment, word, sentence, or above. Students first record speech by selecting "Record mono Sound..." (or stereo) from the "New" menu of the "Praat objects" window (see Fig. 1). After

recording something and saving it to the "Praat objects" window (by clicking on "Save to list" in the SoundRecorder window that pops up), the acoustic signal may be observed by clicking on the "Edit" button (visible when an object exists in the "Praat objects" window).

Figure 1. Praat objects window

Figure 2 shows an example of the Edit window after clicking on the "Edit" button. In this figure, the two words *code* and *coat* can be seen. The vowel part of the word *code* is selected and its duration (in seconds) is indicated by the arrow.
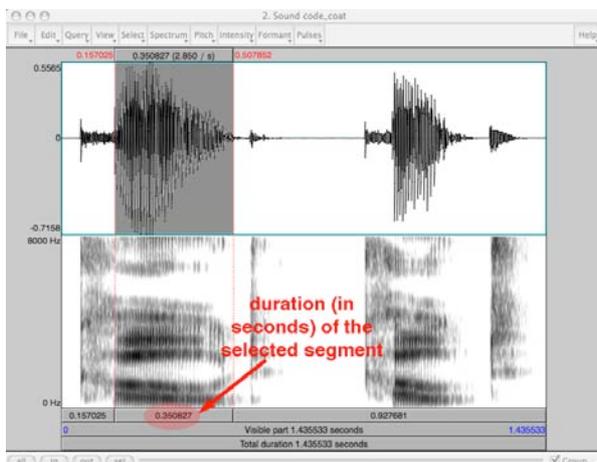

Figure 2. *Code* vowel selected in Praat edit window

In English, vowels that occur before voiced consonants are longer than those before voiceless

consonants and this can be measured easily by students.

2.2 *Voice onset time (VOT)*

VOT is the relative timing of the release of the air for a stop consonant and the onset of phonation (voicing) of a following vowel. Languages differ in how they use VOT to distinguish between voiceless (p, t, k) and voiced (b, d, g) stops. In English, voiceless stops have long VOT values and voiced stops have short (or even negative - i.e., voicing starting before the release of the air) VOT values. However, in Japanese, voiceless stops have medium or short VOT values while voiced stops have negative VOT values. Thus, when some native Japanese speakers pronounce English voiceless stops, they sound like English voiced stops.

Figure 3 shows the measurement of VOT for the /p/ in the word *peas* and the /b/ in the word *bees* for the author's speech. After being given a table of average VOT ranges for English, students can compare them to their own VOT values and practice a more forceful release of air to lengthen their VOT. Teachers and students should be aware, though, that VOT varies from person to person, but that there are tendencies across languages that are important.
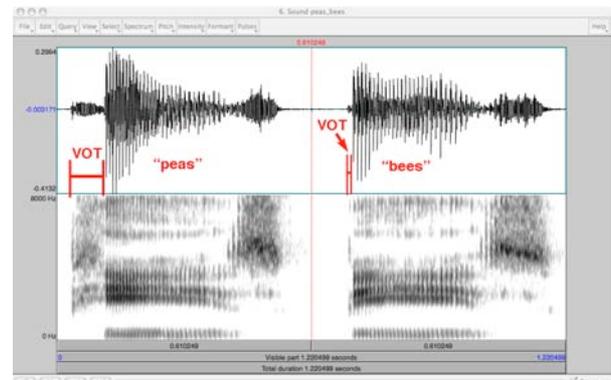

Figure 3. VOT for /p/ versus /b/

2.3 *Spectrogram cues to "Japanese R", L and R*

The North American English liquids ("l" and "r") present difficulty for many Japanese learners, who have neither of these in their native sound inventory, but instead have a "tap" or "flap" consonant identical to that produced in the North American English pronunciation of the word *heating*.

The articulation of these two consonants ("l" and "r") is complex in that it involves more than one part of the tongue at a time. This is readily apparent when the tongue is viewed directly with ultrasound during speech (see Wilson & Gick,

2006), but Praat can also help visualize the differences here and point out to students when they are making errors.

Figure 4 shows the waveform and spectrogram for the words *heating*, *healing*, and *hearing*. The letter "t" in the word *heating* is pronounced as /ɾ/ in North American English, and this corresponds to the pronunciation of "Japanese R" (i.e., the consonant sound in the Japanese syllables: ら, り, る, れ, and ろ). In *heating*, notice the break where the tongue stops the airflow. In *healing*, the airflow continues around the sides of the tongue and in *hearing* it continues over the top of the tongue. The big difference between the /l/ in healing and the /ɹ/ in hearing is the 3rd formant (F3). F3 remains high for /l/, whereas it is low (parallel to F2) for North American /ɹ/.
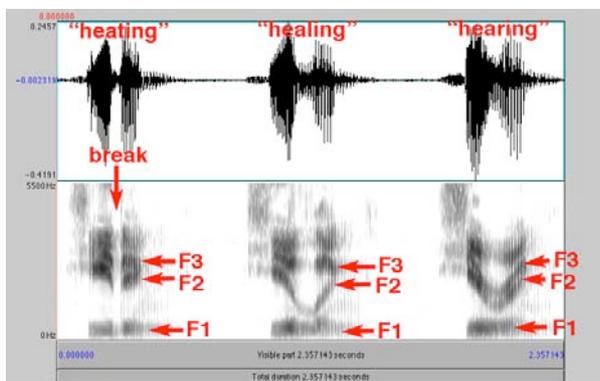

Figure 4. Formant differences in /ɾ/, /l/, and /ɹ/

2.4 *Intonation and stress*

Praat can also be used to teach aspects of suprasegmental pronunciation such as intonation and word stress. English stress can be indicated by one or more of the following: high pitch, high intensity (loudness), longer vowel duration, and full vowel quality (no reduction to schwa). Pitch and intensity displays are turned on from the *Pitch* and *Intensity* menus of the Edit window. These are straightforward to interpret and are shown in Fig. 5.
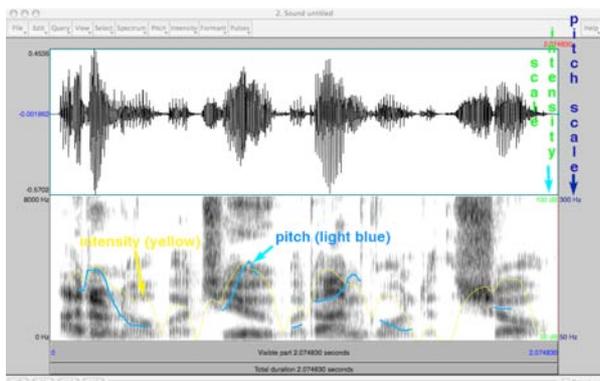

Figure 5. Pitch and intensity in the edit window

In Section 2, I have shown how to use Praat to make a variety of phonetic measurements. Once students are comfortable making those measurements, teachers can use Moodle to enable students to input their data for teachers to check.

3. Using Moodle's *Choice* Activities with Praat

The *Choice* activity in Moodle is a method of quickly polling students to see which of a number of choices each student selects. In my pronunciation classes, I have set up *Choice* such that each possible selection is a different range of values on a phonetic continuum. Using Praat, students first measure those values for their own speech, and then they select the appropriate range in the *Choice* activity. An example of a Choice activity can be seen in Fig. 6. Students measure their VOT for /p/ in the word *peas* and then select the range that it falls in.
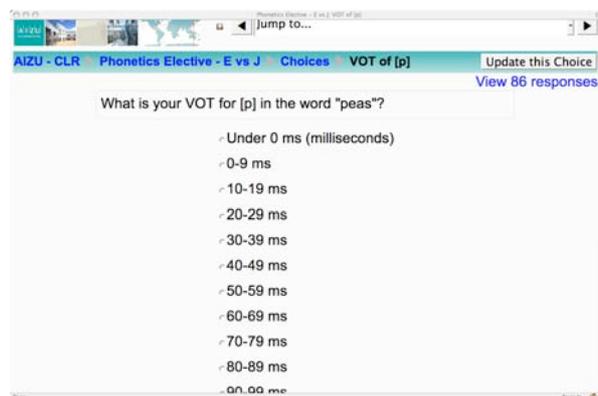

Figure 6. Choice activity: VOT of English /p/

The *Choice* results are instantly displayed to the teacher, and optionally to the students, as a table showing the students who have selected each choice (see Fig. 7). Thus, the teacher can determine quickly which students fall outside the normal range for a given phonetic measurement, and then efficiently give individual feedback. This saves valuable class time by helping teachers quickly choose which students need individual attention on which sounds.

Figure 7 shows the results of the VOT Choice for /p/ in the word "peas". The leftmost column of students is those who have not answered the question yet. The other columns are for ranges of VOT values, from 0-9 ms, on the left (with 9 students), to 120-129 ms on the extreme right (with 1 student). The red vertical line on the left has been added to show the average VOT for *Japanese* /p/, spoken by a native Japanese speaker. The red vertical line on the right has been added to show the average VOT for *English* /p/,

spoken by a native English speaker. The VOT values contained in the two columns marked with red dots are so low that the word "peas" would typically be mistaken for "bees" by a native English listener. The 14 students in these two columns would be targeted first for extra help.
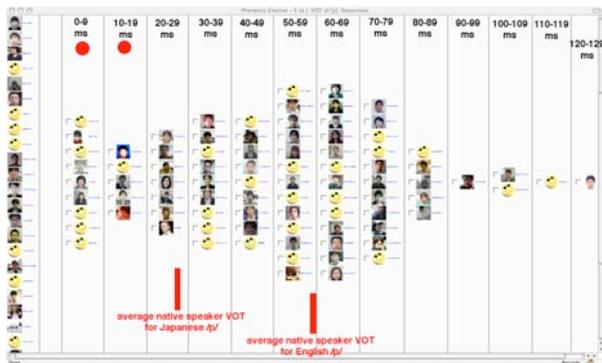

Figure 7. Choice results for VOT of English /p/

After asking the students to record the sentence *I use a computer every day*, I had them measure the duration of the vowel (i.e., schwa) in the first syllable of the word computer. For a native speaker of English, the schwa is extremely short - on the order of 5-20 ms. If one really drags out the pronunciation and says "come" + "pewter", the duration of the vowel (no longer schwa) may reach 60-80 ms. A common mistake for Japanese learners of English is to pronounce schwa as a full vowel. By having students measure the duration of their schwa and entering it into a Moodle *Choice*, teachers can quickly determine who needs extra attention in this area. Figure 8 shows such results. Note that the majority of students have a schwa of duration 81-100 ms, far too long. It is possible that some students included the "m" of *computer* in their measurement of schwa. This would be something to go over with the class as a whole.
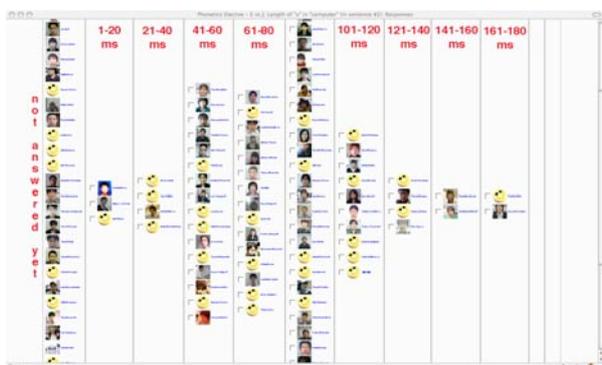

Figure 8. Choice results for schwa duration

Finally, Figure 9 shows the *Choice* results of the pitch difference between the "om" and the "u"

syllables of the word *computer*. All students falling on the left of the red line had a higher pitch on the first syllable than the second syllable.
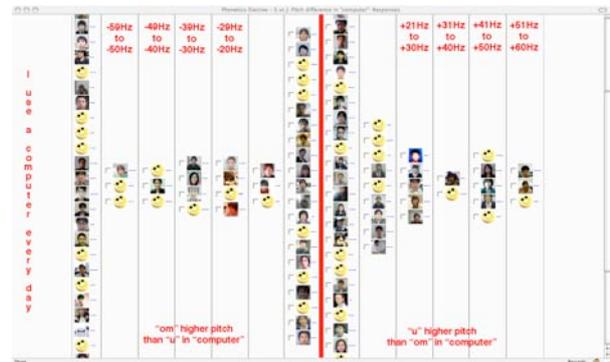

Figure 9. Choice results for pitch difference

4. Conclusion and Future Steps

In this paper, I have demonstrated a method of setting up a *Choice* function within Moodle that has students enter measurements they have made of their pronunciation using Praat.

By using Praat to analyse their own pronunciation, learners are becoming more autonomous in a field that has had to rely on native listener judgements, traditionally, for evaluation. For a pronunciation teacher who is teaching large classes, the combination of Praat and Moodle provides a way of very quickly pinpointing which students need assistance in which areas.

In the near future, a website for teachers using Praat in pronunciation classes will be developed. The website will be located at <http://clrlab1.u-aizu.ac.jp/praat.html>.

References

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