An Evaluation of English Pronunciation of Japanese EFL Learners Using Multiple Metrics

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SUMMARY: This is a report on an examination and evaluation of Japanese learners’ English using multiple metrics: phoneme substitution, epenthesis, elision, primary stress, rhythm and overall goodness. In the examination, the difficulty in producing weak/lax vowels was highlighted. The correlation analysis between overall goodness and each of the other metrics indicated that improving both segmental and prosodic features is essential for Japanese learners to achieve good pronunciation. A systematic pronunciation evaluation using multiple metrics is beneficial not only for a deeper and broader understanding of Japanese English but also to the development of pronunciation teaching and learning.

Key words: pronunciation assessment, pronunciation education, English rhythm, phoneme substitutions, improving pronunciation

1. Introduction

There is a trend that native-like pronunciation is neither a realistic nor a suitable goal for leaners of English as a second language (Isaacs 2014). The absence of pronunciation in rating scales of frequently used speaking tests reflects this fact. Even when pronunciation is included in a scale, it is evaluated only in terms of intelligibility or comprehensibility. The idea also seems to have been shared with many researchers on second language pronunciation and foreign accents: While research studying pronunciation in terms of intelligibility or comprehensibility is available (e.g., Derwing and Munro 1995, Hahn 2004, Isaacs 2008), no studies examining learners’ pronunciation from segmental and prosodic features and then rated in terms of perceived goodness or native-likeness were found. Derwing and Munro (1995) showed that many highly intelligible and comprehensible utterances were rated “heavily-accented”. Isaacs (2008) found an evaluation criterion “intelligibility” necessary but not a sufficient condition for advanced non-native English speakers. Taken all together, a pronunciation assessment is needed that describes learner’s pronunciation at different proficiency levels and judges its goodness irrespective of intelligibility or comprehensibility. This paper reports on an examination of English pronunciation which such systematic pronunciation assessments could be based on. English words pronounced by Japanese speakers were examined and evaluated using multiple metrics: phoneme substitution, epenthesis, elision, primary stress, rhythm and overall goodness. Characteristics of Japanese English found in the examination will also be discussed. In addition, the correlation between overall goodness and each of the other metrics was tested to explore which property contributes to good pronunciation.

2. Method

2.1 Utterances

From the utterances obtained in another study (Eguchi and Akahane-Yamada, manuscript in preparation), thirty-nine English words of low and high familiarity produced by ten native Japanese speakers on a word reading-aloud task were used, i.e., 390 utterances in total. Their English ability in terms of grades or scores on English tests varied from EIKEN Grade 3 to TOEIC score 940, and none of them had lived or studied abroad more than 12 months. The words examined were as follows:

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ahead allegory amass aperitif badminton
belfry believe bring calcium caul
Christmas conciliatory curriculum delicious
derelict diode disavow discriminatory doting
emanate flagellate fossil glucosamine grimace
habit handkerchief heterodoxy housework imagine
interviewee kilogram kiosk lady laurel
materialistic mien minus multimillionaire peon

2.2 Examination and Evaluation
The utterances were auditorily examined and evaluated by a phonetically trained Japanese-English bilingual. Each utterance was first transcribed with IPA and then evaluated using six metrics: phoneme substitution, elision, epenthesis, primary stress, rhythm, and overall goodness. Occurrences of phoneme substitution, elision and epenthesis were counted by speaker and by word. Primary stress in utterances was labelled with any of these three: “0”=no stress placement, “1”=stress placement on a wrong syllable”, or “2”=stress placement on a right syllable”. The ratio of the count of “2” to the entire count was the accuracy in primary stress, which was calculated by speaker and by word. Rhythm and overall goodness were rated on a scale of 1 to 5 (1 =not good, 5 =good) and average scores by speaker as well as by word were obtained. One-syllable words were excluded from the metric “primary stress” and “rhythm”.

3. Result
3.1 Phoneme Substitution, Elision, Epenthesis
Frequent instances are as follows:
· Substitution of /a/ or /eɪ/ for weak vowel /ə/ (e.g. grimace, amass)
· Substitution of /i/ for /ɪ/ (e.g. imagine, believe)
· Substitution of /ɔs/ for /əs/ (e.g. disavow)
· Substitution of /i/ (alveolar flap) for /i/ (e.g. aperitif, curriculum)
· Epenthesis of /w/ (e.g. b_ring, bel_fry)
· Elision of /s/ (e.g. conciliatory, discriminatory)
There was a strong negative correlation between overall goodness and the substitutions ($r=-0.92$, $p<0.001$, Fig. 1) and the epenthesis ($r=-0.70$, $p<0.05$) Fig. 2) counted by subject. No correlation was found between overall goodness and the elision by subject ($r=0.04$, $p=0.9$, Fig. 3) or any of the substitution ($r=-0.68$, $p<0.005$, Fig. 4), the epenthesis ($r=-0.29$, $p=0.7$, Fig. 5), or the elision ($-0.45$, $p<0.05$, Fig. 6) by word.
3.2 Primary Stress

Primary stress was perceived in all the bi- and polysyllabic words. The average accuracy by speaker varied from 50.0% to 86.1% and the average accuracy by word varied from 0% to 100%. A strong correlation was evident between overall goodness and the average accuracy by speaker ($r=0.86$, $p<0.001$, Fig. 7) as well as the average accuracy by word ($r=0.75$, $p<0.001$, Fig. 8).

![Figure 4](image4.png) Correlation between substitution by word and overall goodness.

![Figure 5](image5.png) Correlation between epenthesis by word and overall goodness.

![Figure 6](image6.png) Correlation between elision by word and overall goodness.

![Figure 7](image7.png) Correlation between primary stress by speaker and overall goodness.

![Figure 8](image8.png) Correlation between primary stress by word and overall goodness.
3.3 Rhythm

The average rhythm by speaker varied from 1.4 to 4.5 and the average by word varied from 1.4 to 4.1. A very strong correlation was found between overall goodness and the average rhythm by speaker \( r = 0.98, p < 0.001 \), Fig. 9) as well as the average by word \( r = 0.92, p < 0.001 \), Fig. 10).

4. Discussion

Apart from a well-known substitution of /ɾ/ for /ɹ/ by Japanese speakers, the substitution of /a/ for /ə/ as well as /i/ for /ɪ/ were highlighted in the examination. Among substitutions of /i/, one instance was intriguing: Nine out of ten speakers substitute /i/ for /ɪ/ on the third syllable of the word “imagine” which made the preceding consonant /dʒ/ sound like /dʑ/. As these speakers pronounced the third syllable unstressed and some of them occasionally succeeded in producing /ɪ/ in other unstressed environment, the substitution of /i/ for /ɪ/ must occur frequently after /dʒ/ among Japanese speakers. A strong negative correlation between the number of substitutions and overall goodness suggests reducing substitution will contribute to good pronunciation. Successful production of weak/lax vowels, therefore, will be a great gain for many Japanese speakers. Since weak vowels are also a decisive component of English rhythm, we could expect a positive effect on their English rhythm as well.

The correlation analysis indicated a strong association between overall goodness and phoneme substitution, primary stress and rhythm. The strongest correlation was found between rhythm and overall goodness. The limited number of instances does not allow us to discuss the correlation between elision / epenthesis and overall goodness in this report. It should also be mentioned that all the elisions except for one were /ɔ/ in discriminatory and conciliatory, which are likely to be reduced to /ə/ in natural speech.

We also found that the number of syllables played a significant role in pronunciation: The average overall goodness decreased as the number of syllables increased (Fig. 11). Nevertheless, to discuss effect of the number of syllables, words for the evaluation needs to be more carefully chosen in order to exclude other factors which may be associated with it, such as word familiarity or the number of unfamiliar sound units contained in a word.

This report showed that both reducing segmental errors and improving prosodic features are essential for Japanese speakers to achieve good English pronunciation. Having more than one rater provide assessment is necessary to test precision and reliability of the finding. A larger scale assessment with a controlled word set for a closer examination of correlations among the metrics is also being considered.

Accumulating this type of systematic pronunciation assessment is beneficial not only for a deeper and broader understanding of Japanese English but also to the development of pronunciation education. Com-
puter-based pronunciation assessment and feedback, for example, will be more precise and instructive by integrating knowledge gained from such data.

References

Eguchi, S. and R. Akahane-Yamada “Effect of phonological factors on the perception of English syllables and stress by native Japanese speakers.” manuscript in submission


(Received Dec. 28, 2017, Accepted May. 27, 2018)