



Using an online high-variability phonetic training program to develop L2 learners' perception of English fricatives

Atsushi Iino¹ and Brian Wistner²

Abstract. This study investigated the degree to which Japanese learners of English accurately perceive English fricatives over time and the extent to which fricatives were misidentified. To train and measure perception skills, an online high-variability phonetic training program was used in an English as a Foreign Language (EFL) class in Japan for eight weeks. The results indicated that learners' perception of some of the fricatives improved over time, while others remained difficult to distinguish from other fricatives. Implications for EFL pronunciation instruction are considered.

Keywords: pronunciation, perception, fricatives, high-variability phonetic training.

1. Introduction

For Japanese learners of EFL, pronouncing English fricatives such as [f], [v], [θ], and [ð] can be challenging (Fujinuma & Wilson, 2010; Kawasaki & Tanaka, 2012; Lambacher, Martens, Nelson, & Berman, 2001). Flege's (1995) speech learning model predicts that second language (L2) sounds that are similar to first language (L1) sounds are relatively harder to master, while new sounds that are different from L1 sounds are relatively easier. It has often been observed that L1 Japanese speakers replace the English dental fricative /θ/ with the fricative /s/, and /v/ with /b/, such as in *Sank you bery much* (Thank you very much). Such replacements may indicate that these English sounds are challenging to articulate for some

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EFL learners. One question that arises from this observation is whether learners distinctively perceive the fricative sounds or misidentify them at the perceptual level. If misidentification is involved to a certain degree, learners' perception of English fricatives and the sounds used to replace them may be the cause of confusion in production.

L2 learners are expected to be able to perceive not only standard English sounds but also variations in the same phonemes. This ability is of increasing importance as English is used as a lingua franca throughout the world. High-Variability Phonetic Training (HVPT) enables L2 learners to practice perceiving L2 sounds produced by a variety of talkers in various phonetic environments (Thomson, 2012) and has been shown to improve L2 lexical processing (Melnik & Peperkamp, 2021). HVPT can be provided in an intensive computer-assisted environment so that learners can check their perception of the sounds in a self-directed manner inside and outside the classroom. The purpose of the present study was to examine the effects of computer based HVPT on L2 learners' perception of English fricatives. The research questions were as follows.

- To what extent do Japanese learners of English accurately perceive English fricatives?
- To what extent are the target English fricatives misidentified as other English fricatives?

2. Method

Participants were five university sophomores whose L1 was Japanese. They were enrolled in a mandatory English course in the Faculty of Economics in a university in Tokyo. They used *English Accent Coach* (EAC; Thomson, 2017), which is an online program that provides an HVPT environment to practice perceiving the following English fricatives: [f], [v], [θ], [ð], [ʃ], and [z]. In addition to those, a bilabial [b] was also added as a target sound because Japanese speakers tend to replace [v] with [b].

The participants were assigned to use EAC once a week in class for perception training for eight weeks in a time-series design. Within EAC, the learners were directed to set the linguistic environment to 'initial consonant + all vowels', which means non-word single syllables were used as stimuli. They then began the forced-choice identification task with 100 stimuli in the high-variability condition

where stimulus sounds are provided randomly from differently accented talkers. The participants were assigned to complete a special worksheet created by the researchers in which they recorded misidentified sounds every time they failed to correctly perceive the stimuli.

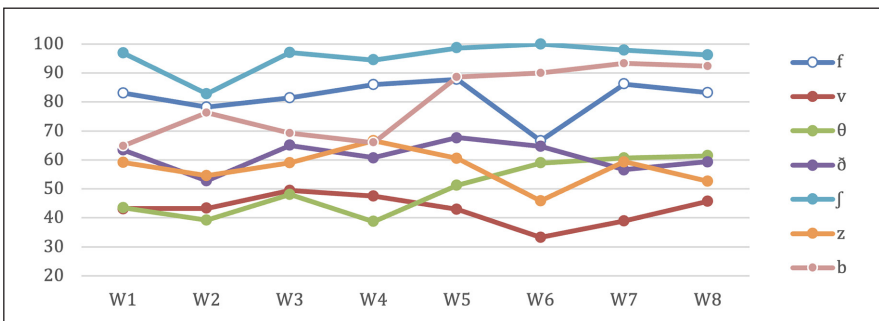
3. Results and discussion

The mean accuracy rates at the end of the eight weeks for each target sound indicated that the lowest ones were 43.0% for [v], followed by 50.2% for [θ], 57.2% for [z], and 61.3% for [ð] (Table 1). The sound of [b] (80.1%), [f] (81.6%), and [ʃ] (95.5%) showed relatively higher overall success rates. Regarding changes over time, [b] began at 64.9% in Week 1 and improved gradually to 92.4% in Week 8 (Figure 1). Progress was also observed for [θ], from 43.5% in Week 1 to 61.4% in Week 8. More HVPT opportunities or other consciousness-raising instructional tasks might be required for the sounds on which progress was not observed, while some might have exhibited a ceiling effect.

Table 1. Progress in perception of target sounds over eight weeks (%)

	W1	W2	W3	W4	W5	W6	W7	W8	M
f	83.1	78.2	81.5	86.0	87.8	66.7	86.1	83.2	81.6
v	43.2	43.3	49.5	47.5	42.9	33.3	38.9	45.7	43.0
θ	43.5	39.2	48.1	38.7	51.2	58.9	60.7	61.4	50.2
ð	63.5	52.8	65.0	60.8	67.7	64.7	56.6	59.4	61.3
ʃ	96.9	82.8	97.1	94.5	98.6	100	97.9	96.3	95.5
z	59.1	54.6	59.0	66.6	60.5	45.9	59.4	52.6	57.2
b	64.9	76.3	69.2	66.0	88.6	90.0	93.3	92.4	80.1
M	64.9	61.0	67.1	65.7	71.0	65.6	70.4	64.9	67.0

Figure 1. Changes in perception over eight weeks (%)



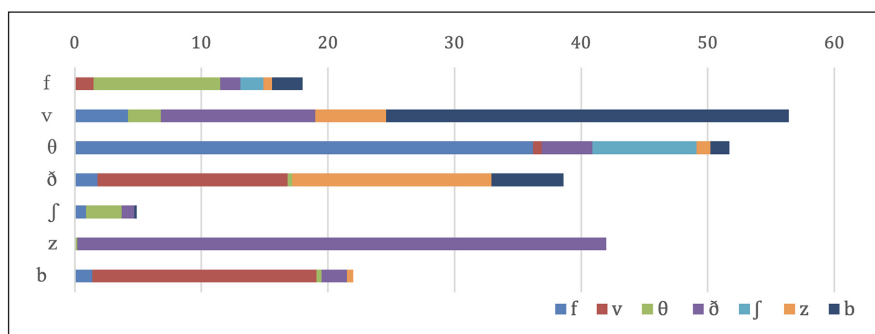
Regarding the misidentification rates (Table 2, Figure 2), the most misidentified sound was [v] (56.3%), which was mistaken mainly as [b] (31.8%). This relationship was also reflected in the results for [b] (22%) to [v] (17.7%). The sound [v] was also mistaken as [ð] (12.2%), which was mentioned in Fujinuma and Wilson (2010).

The sound [θ] (51.6%) was mostly confused with [f] (36.2%) and sometimes with [ʃ] (8.2%). The sound [ð] (38.5%) was most confused with [z] (15.7%) or [v] (15%). This relationship was also observed for [z] (42%) and [ð] (35.4%), which was the most confusing sound. Finally, the sound [f] (17.9%) was mistaken most for [θ] (10%), which was consistent with Lambacher et al. (2001).

Table 2. Error and misidentification rates for each sound over eight weeks

Target sounds	No. of items (M)	Error rate (%)	Misidentification rate (%)						
			f	v	θ	ð	ʃ	z	b
f	13.1	17.9	0	1.5	10	1.6	1.8	0.7	2.4
v	13.2	56.3	4.2	0	2.6	12.2	0	5.6	31.8
θ	11.5	51.6	36.2	0.7	0	4	8.2	1.1	1.5
ð	14.5	38.5	1.8	15	0.4	0	0	15.7	5.7
ʃ	13.8	4.9	0.9	0	2.8	1	0	0	0.2
z	16.1	42.0	0	0	0.2	41.8	0	0	0
b	17.7	22.0	1.4	17.7	0.4	2	0	0	0

Figure 2. Details of misidentified sounds



These results indicate that the reciprocal relationship between [f] and [θ] might have contributed to the improvement in perception of the dental fricative [θ]: the most misidentified sound for [f] (17.9%) was [θ] (10%), and the sound [θ] was most misidentified as [f] (36.2%) (Table 2). A paired relationship was observed for [v] and [ð], which means while the target sound [ð] was mistaken for [v] (15%),

the target [v] tended to be perceived as [ð] (12.2%). Even though progress over time was not observed, reciprocity was also found. The case between [b] and [v] was also similar. The target sound [v] was often misidentified as [b] (31.8%) and [b] was mistaken as [v] (17.7%). Although the recognition of [v] was the lowest for the entire period, the perception rate of [b] improved the most. Additionally, [ð] tended to be perceived as [z] (15.7%), and the target [z] tended to be misidentified as [ð] (41.8%). From these data, the high functional load pairs elicited from HVPT might be the key features for developing learners' consciousness of the acoustic differences during instruction, which could also facilitate production of the sounds.

4. Conclusion

The results of the current study indicated that weekly practice using HVPT could facilitate L2 learners' perception of some English fricatives, and the misidentification rates helped to identify confusing pairs or sets of English fricatives: [θ] and [f], [v] and [b], and [ð] and [z] / [v]. Considering the limited time available for the in class training, further progress might have been observed if the learners had used EAC outside of class. Further research could examine such a combination as well as having learners repeatedly record and reflect on their perception and production accuracy as they utilize HVPT.

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