

Assessing the Effects of Mobile Assisted Phonetic Training on L2 Sound Perception

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Abstract: This study evaluated the effectiveness of mobile-assisted phonetic training on the perception of the Korean three-way stop contrast by second language (L2) learners of Korean. It also assessed the relative influences of three types of corrective feedback provided during training on the perceptual learning of the contrast. The results showed that learners benefit from phonetic training using mobile phones to improve their perceptual knowledge of the L2 contrast. Moreover, while all types of feedback had a positive impact on L2 speech perception, correct/incorrect feedback alone led to greater enhancement than correct/incorrect feedback with additional audio-visual information. Taken together, these findings suggest that mobile-assisted phonetic training with simple feedback is most effective in developing learners' perceptual accuracy of L2 contrasts and can result in facilitating L2 sound learning.

Introduction

A vast number of previous studies have shown that L2 learners benefit from auditory phonetic training with immediate feedback to improve their perception of L2 sounds (Bradlow et al, 1997, Aliaga-García & Mora, 2009, Iverson & Evans, 2009, Thomson, 2011, Rato, 2014, Ryu, 2019 and many others). However, most of the phonetic training studies have mainly investigated L2 sounds in laboratory settings and the types of feedback adopted in training are limited, simply providing a right or wrong message to a response or requiring learners to make a selection until they answer correctly.

In addition, despite the abundant studies demonstrating the benefits of corrective feedback on L2 grammar, vocabulary, and writing (see Brown 2016 for a meta-analysis of feedback), to the best of my knowledge, there are only a handful of research on how and to what extent corrective feedback affects L2 speech perception (Lee & Lyster, 2016, Bryfonski & Ma, 2020). For example, Lee and Lyster (2016) investigated the effects of corrective feedback on the perception of English vowels by Korean-speaking learners in a classroom-based setting. They found that a group that received instruction with corrective feedback outperformed a group that received only instruction at the immediate and delayed post-tests as well as on unfamiliar words. This result indicated that corrective feedback plays a significant role in helping L2 learners to acquire their target sounds.

In this regard, the present study aims to evaluate whether mobile-assisted phonetic training is effective in improving learners' perception of L2 sounds while investigating which types of feedback lead to more improvement in perception by assessing L2 learners' identification accuracy of the Korean three-way stop contrast.

Korean has a three-way phonation contrast between aspirated, fortis (tense), and lenis (lax). These are known to be difficult to acquire accurately by L2 learners whose native language has a two-way contrast due to the different use of acoustic cues as well as the acoustic similarities and differences between native language (L1) and L2 sounds (Yasuta, 2004, Schmidt, 2007, Chang, 2010, Holiday, 2015, Ryu, 2017). For instance, Ryu (2017) examined that Mandarin learners of Korean are more successful at perceiving the Korean aspirated stop contrast compared to fortis and lenis regardless of their Korean language proficiency. Moreover, Korean lenis is least likely to be perceived accurately by learners due to their lack of attention to f_0 , which is the most relevant acoustic cue for native Korean speakers in identifying lenis from aspirated and fortis stops.

The focus of this paper is two-fold. The first objective is to examine whether L2 learners can improve their identification ability of the Korean three-way stop contrast via mobile-assisted auditory phonetic training. For this study, an online phonetic training program was developed using *jsPsych* (De Leeuw, 2015) to provide ultimate flexibility for learners to be able to conduct training sessions in a comfortable place and at a convenient time. The second objective is to assess how and to what extent different types of corrective feedback – only correct/incorrect feedback, correct/incorrect and visual feedback, correct/incorrect and audiovisual feedback – provided during training contribute to the development of perceptual accuracy of the Korean contrast.

The following two research questions were used to guide the present investigation: (1) In spite of the perceptual difficulty with the Korean three-way stop contrast, does perception accuracy improve for L2 learners with mobile-assisted phonetic training? (2) How and to what extent do three different types of corrective feedback used during phonetic training differ in terms of their impact on L2 learners' perceptual accuracy of the contrast?

Methods

Participants

A total of 44 university-level learners of Korean participated in this study (10 males, 34 females, mean age = 20 years old). They were enrolled in a beginner-level Korean language course at the time of the study and did not have any Korean language experience before the course. They reported no hearing problems and their L1 background was not controlled in this study. Using their mobile phones, participants completed a pre-test, followed by three training sessions, followed lastly by a post-test.

Speech Materials

The stimuli of pre- and post-tests consisted of a total number of 138 tokens (23 minimal triplets x 2 speakers). The Korean three-way stop contrast, aspirated, fortis and lenis (e.g., /ph, p', p/), were embedded in initial position in a CV syllable format (e.g., /pha, p'a, pa/). For training sessions, materials included a combination of 27 minimal triplets of words containing the Korean contrast in the same format, yielding a total of 162 tokens (27 minimal triplets x 2 speakers). 23 minimal triplets were the same as the pre-/post-test and an additional 4 minimal triplets were included in each training session. All tokens were recorded in a sound-attenuated room at 44.1 kHz sample by two native Korean speakers in their 20s (1 female, 1 male).

Procedure

In order to investigate the effects of mobile-assisted auditory training and compare the relative effectiveness of different feedback types offered during training, the participants were allocated to four groups: Three training groups, each provided with a different type of corrective feedback, and a control group which did not receive any mobile-assisted training. Each group included 11 subjects on the basis of their identification scores in the pre-test, with the aim of ensuring a reasonable balance across groups.

All groups completed online identification tasks using their mobile phones for the pre- and post-tests. The training groups took part in three identification training sessions held over a period of approximately 1 week, each session lasting about 20 minutes. During each training session, learners heard a sound and were asked to select the corresponding word on their mobile screen. They received immediate corrective feedback for their response on each trial. To allow for the provision of corrective feedback on perceptual errors, three types of corrective feedback were provided during training as follows.

- (1) Feedback 1 (only correct/incorrect feedback): Learners were provided with only a 'correct' or 'incorrect' message, indicating whether their response was right or wrong.
- (2) Feedback 2 (correct/incorrect and visual feedback): When learners chose a wrong answer, they received an 'incorrect' message as well as the correct answer in written form in order to help them notice their errors and see the answer visually.

- (3) Feedback 3 (correct/incorrect and audiovisual feedback): When learners chose a wrong answer, they received an ‘incorrect’ message accompanied by the correct answer in both spoken and written form to provide more detailed information containing both audio and visual signals simultaneously.

Online phonetic training was run individually on their mobile phones and all sessions were carried out under similar conditions, with students working in quiet surroundings and stimuli presented auditorily via headphones and visually on the mobile screen.

Data analyses

For statistical analysis, a mixed effects logistic regression model with the *lme4* package in R (R Core Team, 2017) was conducted. Response (correct, incorrect) was the dependent variable. Test (pre-, post-test), Contrast (aspirated, lenis, fortis), Feedback (only correct/incorrect feedback, visual feedback, audiovisual feedback), and their interaction were included as fixed effects. Intercepts for subjects and items as well as by-subject random slopes for Test were added as random effects.

Results

The first research question examines whether mobile-assisted phonetic training positively increases learners’ perceptual accuracy of the Korean three-way contrast in stops. Thus, evidence for the effectiveness of phonetic training is drawn primarily from comparing the identification accuracy of the contrast of the three training groups with that of the no-training group. The results of the groups’ performance at pre- and post-test are shown in Figure 1.

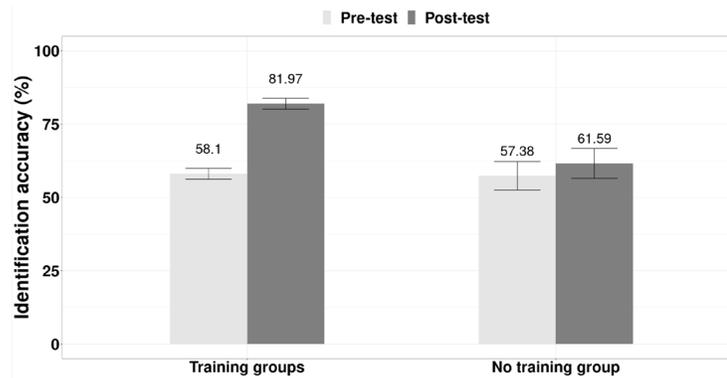


Figure 1. Comparison of identification accuracy of the Korean contrast by the trained groups and the un-trained group at pre- and post-test

As presented in Figure 1, there is a significant difference in the identification accuracy of the Korean three-way stop contrast between the three training groups and the no-training group at post-test (training groups vs. no training group: $z = -3.770, p < 0.005$). The training groups showed higher perceptual accuracy for the Korean contrast compared to the no-training group at post-test. More specifically, the training groups’ perceptual improvement gained 23.87% between pre- and post-test, while the no-training group improved by only 4.21% between the two tests. This finding suggests that L2 learners benefit from mobile-assisted phonetic training to facilitate their L2 sound perception learning.

Next, Figure 2 illustrates the training groups’ identification accuracy of the three distinct phonations of Korean stops (aspirated, lenis and fortis) at both pre- and post-test.

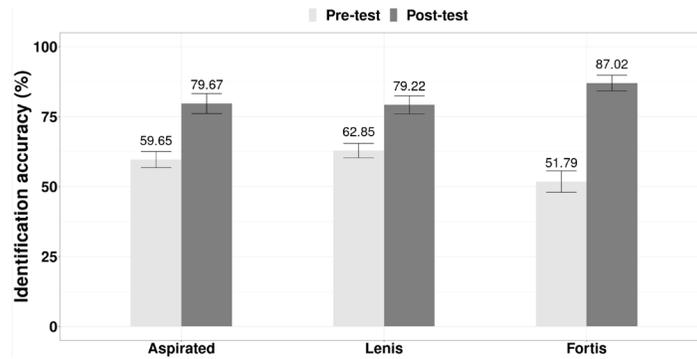


Figure 2. Training groups’ identification accuracy of the three phonation types of Korean stops at pre- and post-test

After phonetic training, as Figure 2 indicates, L2 learners exhibited higher accuracy identifying the three types of Korean stops at post-test (aspirated stops between the two tests: $z = 30.372$, $p < 0.005$, lenis stops between the two tests: $z = 25.510$, $p < 0.005$, fortis stops between the two tests: $z = 112.843$, $p < 0.005$). Specifically, they achieved 79.67 % accuracy for aspirated stops , 79.22 % accuracy for lenis stops, and 87.02 % accuracy for the fortis stops at post-test. One important finding is that fortis stops resulted in the lowest identification accuracy (51.79%) at pre-test; however, the identification accuracy of these most difficult fortis stops significantly improved (87.02%) after phonetic training. This finding also confirms that mobile-assisted phonetic training is effective for L2 learners to improve their perceptual ability of difficult L2 sounds.

The second research question explores how and to what extent different types of corrective feedback offered during phonetic training differ in terms of their impact on L2 learners’ perceptual accuracy of the contrast. In order to gauge the relative effectiveness of feedback types, perceptual improvement between pre- and post-test across the three feedback-trained groups was assessed as presented in Figure 3.

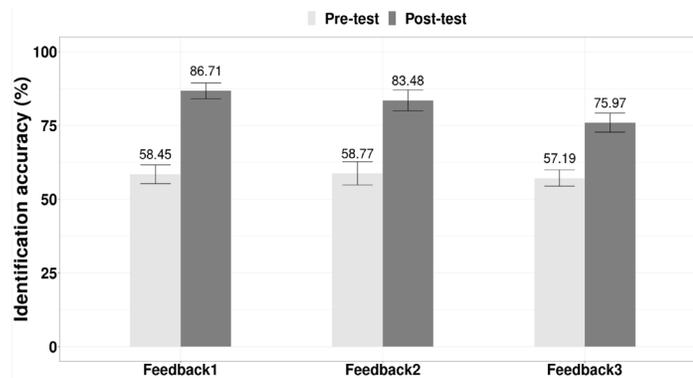


Figure 3. Identification accuracy of the Korean contrast by the three feedback trained groups

Figure 3 illustrates that there was no significant difference in perceptual accuracy across the three groups at pre-test. However, the training groups which were provided with different feedback types during phonetic training, achieved significantly higher identification accuracies at post-test than at pre-test (Feedback 1 group between the two tests: $z = 51.8759$, $p < 0.005$, Feedback 2 group between the two tests: $z = 32.9507$, $p < 0.005$, Feedback 3 group between the two tests: $z = 16.5785$, $p < 0.005$). This result indicates that all forms of feedback had a positive impact on learners’ perceptual ability of L2 contrasts.

More interestingly, of the three types of feedback, the ‘correct’ or ‘incorrect’ only feedback led to the most substantial improvement (28.26%), followed by the correct/incorrect plus correct response in written form feedback which achieved 24.71% improvement, followed lastly by the correct/incorrect plus correct response in audio and visual form feedback which gained 18.78% increase for the contrast.

Post-hoc tests showed that there was no statistically significant difference between Feedback 1 and Feedback 2 groups or Feedback 2 and Feedback 3 groups with respect to the degree of the perceptual improvement. However, significant difference was found between Feedback 1 and Feedback 3 groups. Feedback 1 group outperformed Feedback 3 group in the identification accuracy of the contrast at post-test (Feedback 1 vs. Feedback 3 group: $z = 4.4186, p < 0.05$). In other words, simple feedback, namely providing only a 'correct' or 'incorrect' message, contributed to more accurate L2 perceptual learning than complex feedback which provided additional audiovisual information.

The present findings suggest that corrective feedback can play a role through mobile-assisted training to improve learners' L2 phonological knowledge and that simple feedback is most effective for learners in enhancing their perceptual learning of L2 sounds. This result leads to interesting questions and warrants further discussion regarding why less is more in terms of giving feedback in phonetic training.

Conclusions and Discussion

This study examined the effects of mobile-assisted phonetic training with different types of corrective feedback on the perception of the Korean three-way stop contrast. The primary aim of this study was to investigate whether mobile-assisted phonetic training is beneficial for L2 learners to improve their perceptual learning of L2 contrasts. Results revealed that trained groups performed better in the identification task at post-test compared to the untrained group. Moreover, the identification accuracy of the fortis stops, which presented the most difficulty for learners at pre-test, significantly improved after phonetic training. This study also aimed to assess the effectiveness of three types of corrective feedback and identify which types of feedback promote better perceptual learning of L2 sounds. The results demonstrated that all feedback types employed during training sessions resulted in significant improvement in the perception of the Korean contrast, suggesting that learners' perceptual skills can indeed be improved with all three types of mobile-generated feedback.

Most importantly, of the three different feedback-trained groups, only Feedback group 1 that received the simple 'correct/incorrect' feedback significantly outperformed Feedback group 3 that received additional audiovisual feedback. This result might be surprising if you expect that multimodal feedback would be more advantageous than simple feedback in enhancing the perception of L2 sounds, because multimodal feedback can both aurally reinforce the target sound and enhance learners' awareness of the sound visually; however, the audiovisual feedback proved to be the least effective in improving L2 perception in comparison with the other feedback types in phonetic training. The findings thus allow me to conclude that less detailed feedback like 'correct/incorrect feedback' can be informative enough for learners to notice their errors and consolidate their L2 phonological knowledge, while multimodal feedback may cause an overload in cognitive processing and/or hinder improvement of L2 contrasts.

To summarize, a significant finding that emerged from this study is that mobile-assisted training plays a pivotal role in helping learners improve their perceptual accuracy of L2 sounds. Moreover, the most noteworthy finding of this study is that learners become most accurate at identifying L2 sounds when provided only with correct/incorrect feedback during phonetic training. Further investigation is needed to explore how long the effects last and determine whether the effects vary depending on L1 background, L2 learning experience and whether this can be extended/generalized to other L2 segments.

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