WEB-BASED HIGH VARIABILITY PHONETIC TRAINING ON L2 CODA IDENTIFICATION

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ABSTRACT

This study investigates the effects of web-based high variability phonetic training (HVPT) on the development of L2 coda identification.

45 Mandarin learners of Korean were randomly assigned to receive coda-focused or vowel-focused training (both of which contained identical auditory input), or no training. Performance was assessed using an identification task before and after training, and a generalization test after training.

The results demonstrate that the training groups overall improved their perception of Korean codas compared to the no-training group at post-test, suggesting that L2 learners benefit from online HVPT. Between the two training groups, the coda-focused group performed significantly better than the vowel-focused group. This finding indicates that perception training for L2 sounds can lead to greater improvement when learners are consciously aware of their target sounds than by passive exposure to the target sounds. It was also found that learning effects gained from HVPT can be successfully transferred to new phonetic contexts.

Keywords: High variability phonetic training, identification task, trained vs. untrained L2 codas

1. INTRODUCTION

A vast literature has reported that adult second language (L2) learners have difficulty perceiving and producing non-native sounds. In this regard, there has been a great deal of interest in developing perceptual training methods and examining to what extent adult L2 learners can improve their perception and production of L2 sounds. Specifically, it has been found that L2 learners can benefit from high variability phonetic training (HVPT) in improving their perception and production of L2 speech sounds [1, 3, 4, 9, 11, 17]. The HVPT method proposed by Logan et al. [11] uses multiple voices to provide natural phonetic variability within a phonetic category so that L2 learners are able to detect crucial phonetic cues associated with target sounds as well as cues relevant to their category identification. As a result of HVPT, it was also found that L2 learners who receive training are able to generalize their learning to untrained speech materials [1, 3, 4, 9, 11, 17].

Previous HVPT studies have been mostly laboratory-based, where the learners participate in training in a controlled condition while being monitored by the experimenter. The current study examines whether positive effects can also be observed in web-based training, where the learners can complete the training sessions at a time, location, and pace of their own choice. Developing online HVPT for this study was motivated by meta-analytic review of 25 years of perception training research by Sakai and Moorman [16], who reported that the location of training encourages greater gains when completed at home versus in the laboratory.

In terms of the effectiveness of L2 instruction, Norris and Ortega [13] demonstrated that explicit types of instruction are more effective than implicit types. However, recent studies have found that adult learners can acquire new category contrasts through passive exposure to distributional patterns in the learning input [6, 7, 8]. The current study compares the relative effectiveness of explicit and implicit instruction in L2 perception.

The meta-analysis of L2 pronunciation reported by Lee et al. [10] showed that 97% of the training studies analyzed English as a first or target language. In order to determine how HVPT works among the diversity in language learning, it is imperative to increase the range of languages. Extending previous research, therefore, the current study examines how Mandarin learners of Korean improve their perception accuracy of Korean codas through two types of web-based identification HVPT.

This study addresses the following specific questions:

1. To what extent do Mandarin L2 learners improve their perceptual accuracy in identifying Korean codas as a result of online HVPT?
2. Do different types of HVPT (coda-focused vs. vowel-focused) affect outcomes of L2 coda perception differently, even when the same L2 input is used?

3. Can learning effects gained from HVPT be successfully transferred to novel stimuli?

2. METHOD

2.1. Participants

45 native Mandarin speakers (39 females, 6 males, mean age = 20.7 years old, SD = 2.3 years) who were enrolled in beginner Korean language courses participated in the experiment. They were randomly assigned to one of the three groups: coda-focused training, vowel-focused training and no training (n = 15 per group). The coda-focused group was trained to identify Korean codas, while the vowel-focused group was exposed to the same input as the coda-focused group, but instead participated in a vowel-identification task, in order to direct their attention to vowels. Crucially, this design allowed us to maintain equivalent training input and time between the two training conditions, while differing only the type of training. The no-training group acted as a control group. For their participation, each member of the training groups was paid $65 (CAD), and each member of the no-training group was paid $25 (CAD). None of the participants reported hearing impairments.

2.2. Experimental design

The current study consisted of four phases: (1) a pre-test, (2) online training, (3) a post-test and (4) a generalization test. All tests and training involved the same identification task utilizing the full sets of Korean codas and vowels as suggested by Nishi and Kewley-Port [12], who found that training larger sets of phonemes demonstrated greater gains than training only the most difficult subset of phonemes.

Participants individually participated in pre-, post- and generalization tests built in *PsychoPy* [14]. Participants were given no feedback regarding the accuracy of their responses for the tests. Online training was programmed with *jsPsych*, which is a JavaScript library for running experiments in a web browser [5].

Between the pre- and post- test, the two training groups completed eight online training sessions in a comfortable setting over a 2-week period. Each session was self-paced and typically took between fifteen and twenty minutes to complete. Immediate feedback was provided after each token indicating whether their answer was "correct" or "incorrect". If incorrect, they had to try again until they gave a correct response. Other than the different response choices (coda vs. vowel), all aspects of the experimental design, including input and feedback, were identical between the two training groups. Table 1 summarizes the design of this experiment.

Table 1: Design of the study.

Phase	Group	Feedback	Platform & location
Pre-test	All groups	No	PsychoPy in the lab
Training	CODA, VOWEL	Yes	jsPsych online
Post-test	All groups	No	PsychoPy in the lab
Generaliz-ation	CODA, NONE	No	PsychoPy in the lab

Note. CODA = Coda-focused group, VOWEL = vowel-focused group, NONE = No-training group.

2.3 Stimuli

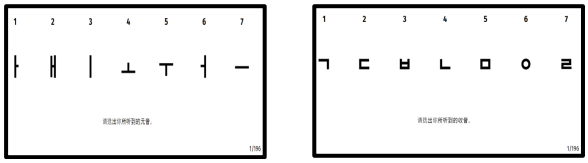
Pre-test, post-test and training stimuli contained 49 monosyllabic CVC words in which the initial consonant was /h/, the vowel was one of the seven Korean vowels /a e i o u ɨ ʌ/, and the final consonant was one of the seven codas /t k p n m ŋ l/. In the generalization task, the stimuli consisted of Korean CVC words in which the initial consonant was /k/.

The stimuli for the online training were recorded by four native Korean speakers (2 females, 2 males) for a total of 196 tokens (49 stimuli * 4 speakers) to create a high-variability training condition. The stimuli for the pre-, post- and generalization tests were recorded by two native Korean speakers (1 female, 1 male, 98 tokens = 49 stimuli * 2 speakers). These speakers were different from the training stimuli speakers to ensure that the perception improvement gained in the training would not be specific to the tokens or speakers that the learners were exposed to in the training, but rather the improvement, if any, would be more general.

2.4. Procedure

The participants were instructed to listen to words through headphones and were asked to identify the stimulus that matched one of seven visual targets presented in Hangul, the Korean alphabet, on a computer screen by pressing the corresponding number from 1 to 7 on the keyboard. For example, participants in the coda-focused group heard [han] and were asked to identify what the coda was (target response: <n>), while the vowel-focused group was asked to identify the vowel (target response: <a>) during online training. Participants had to press one of the seven options before the next stimulus was presented.

Figure 1: Identification task in pre-test, post-test, online training and generalization test.



Korean vowels Korean codas

2.4. Statistical analysis

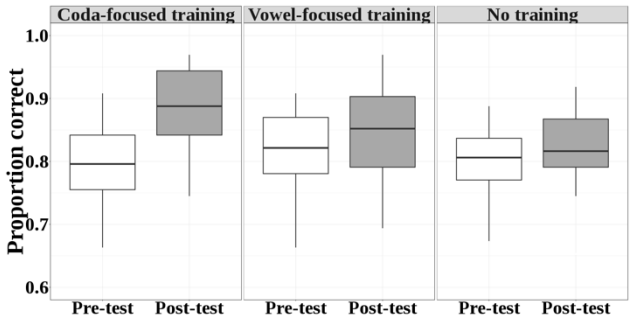
The perception performance of Korean codas was assessed using a mixed-effects logistic regression model with the *lme4* package [2] in R [15]. The dependent variable was whether the response was correct or incorrect. As fixed effects, we included GROUP (coda-focused, vowel-focused, or no training) and TEST (pre-, post-, or generalization test) and their interaction. TEST was dummy-coded and GROUP was Helmert-coded to (i) compare the explicit and implicit training groups and (ii) compare training groups against the no-training group. As random effects, we had intercepts for subjects and items, as well as a by-subject random slope for TEST and by-item random slopes for TEST and GROUP.

3. RESULTS AND DISCUSSION

3.1 Effects of online HVPT on L2 codas

Figure 2 shows the pre- and post-test results before and after the web-based training for each group.

Figure 2: Boxplots of identification accuracy for Korean codas at pre-test (white boxes) and post-test (grey boxes) after eight training sessions by group.



As seen in Figure 2, at pre-test, the three groups did not differ significantly in the identification scores of Korean codas (two training groups vs. no-training group: $\beta = -0.225$, $z = -1.024$, $p = 0.305$, coda-focused group vs. vowel- focused group: $\beta = 0.003$, $z = 0.014$, $p = 0.989$), indicating that participants had similar proficiency in perceiving the target sounds before they received training.

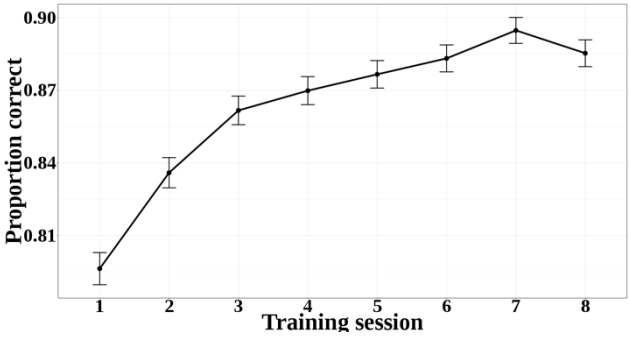
There were significant interactions between TEST and GROUP. The two training groups as a whole improved significantly compared to the no-training group ($\beta = 0.368$, $z = 2.410$, $p = 0.015$), which suggests that training groups yielded significant improvement as a result of online HVPT. This positive effect of web-based HVPT is consistent with previous studies of laboratory-based HVPT [1, 3, 4, 9, 11, 17].

In addition, there was a significant difference in identification improvement between the two training groups ($\beta = 0.651$, $z = 3.651$, $p = 0.001$), showing that the coda-focused training was more effective than the vowel-focused training in improving perception of Korean codas. This finding indicates that different types of training on L2 sounds lead to different degrees of improvement. More specifically, the coda-trained group significantly improved their Korean coda perception from the pre-test to the post-test (by approximately 10%), whereas the vowel-trained group, which was only passively exposed to Korean codas, had less improvement of coda perception (approximately 3%). These results provide promising evidence that perception training of L2 sounds is more effective through deliberate listening with feedback than through passive exposure.

3.2 Development of L2 coda perception during online HVPT

Figure 3 presents a visual illustration of the coda-focused group's degree of improvement in Korean coda perception accuracy from session 1 to session 8 of online HVPT.

Figure 3: Coda-focused group's development of Korean coda identification accuracy during eight training sessions.

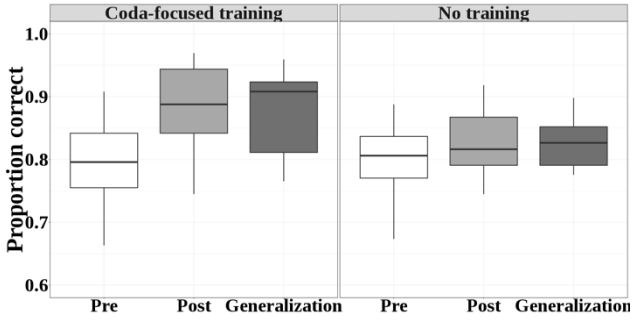


Overall, there was a significant increase in perception accuracy of Korean codas between session 1 and session 3, followed by a stable upward trend across the remaining sessions. This might be due to the fact that immediate feedback was helpful for L2 learners in noticing their errors and shifting attention to relevant acoustic cues to improve the ability of identification of their target sounds during HVPT.

3.3 Generalization effects of HVPT

Figure 4 illustrates the degree to which L2 learners who received explicit coda training can generalize their newly acquired knowledge to new items. In other words, it shows whether learning from the /hVC/ context during HVPT can be successfully transferred to the /kVC/ context in the generalization test.

Figure 4: Boxplots of identification accuracy for Korean codas at pre-test (white boxes), post-test (grey boxes) and generalization test (dark grey boxes) by group.



As shown in Figure 4, there was no significant difference in perception accuracy between the coda-focused training and no-training group at pre-test (β = -0.19206, z = -0.948, p = 0.343). However, for the generalization test, a statistically significant difference in perception improvement between the coda-trained and no-training group was found (β = 0.994, z = 4.596, $p < 0.001$). This finding reveals that the coda-trained group made significant improvements in the identification of new phonetic contexts from pre-test to generalization test, while the no-training group showed no change. In particular, the coda-trained group showed improved identification accuracy from pre-test (79.5%) to post-test (88.6%), and this increase in performance was maintained for the test of generalization (88%), while the no-training group did not show a significant increase from pre- to generalization test (β = -0.02035, z = -0.080, p = 0.936). That is, exposing learners to high-variability L2 input allows them to attend to relevant cues for category identification, and this acquired knowledge can be transferred to the perception of novel stimuli.

4. CONCLUSIONS AND FUTURE RESEARCH

In this study, we examined the effect of online HVPT and compared the type of training on the perception of Korean codas by Mandarin learners of Korean. In HVPT, both the coda- and vowel-focused groups were trained during eight online sessions in a comfortable setting to identify target sounds produced by multiple talkers. We found that performance significantly differed between the experimental groups and the no-training group indicating that online HVPT training can result in significant development in the perception of L2 codas. It was also found that the improved perception gained in online HVPT identification training can generalize to new phonetic contexts.

Most importantly, between the two types of language training, the coda-focused training was substantially more advantageous than the vowel-focused training, even though participants were exposed to the same phonetic input during training. Thus, this study suggests that the two training conditions affect perception of non-native sounds differently. Identification of L2 sounds can be better improved with exposure and directed attention to the target input sounds than with passive exposure to the target sounds.

In future studies, different language proficiency levels will be included to explore whether HVPT can play a significant role in L2 acquisition not only for beginner learners but also for advanced learners. In addition, we will look at production of Korean codas before and after HVPT to examine the relationship between perception and production in L2 acquisition.

5. REFERENCES

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