2018 Summer Phonology Forum

Training Mandarin Listeners to Improve Their Production and Perception of Korean Vowels:

The Role of Explicit and Implicit Instruction

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Identification accuracy of Korean vowels by L2 learners

- L2 Mandarin learners have more difficulties with Korean vowels /o, u , ʌ / than L2 English learners

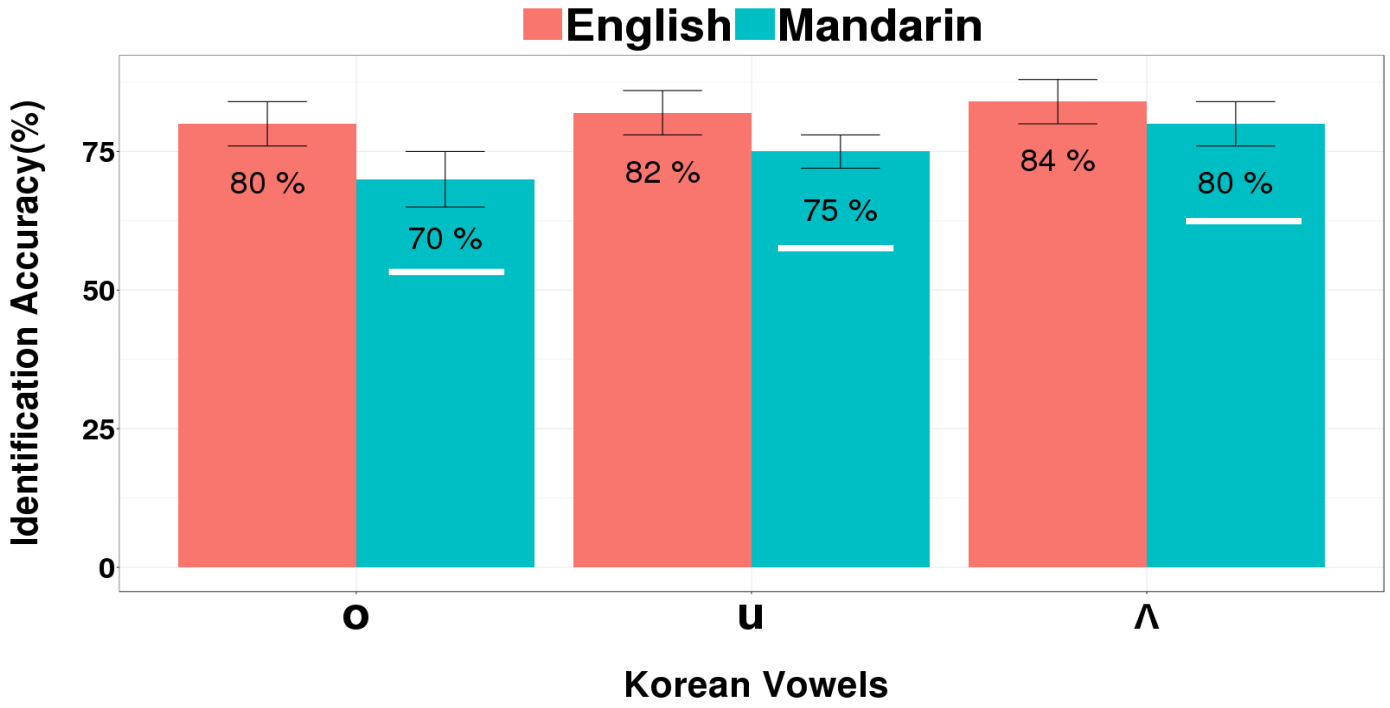


Figure 1. Identification accuracy of Korean vowels /o, u , ʌ / by English and Mandarin listeners (Ryu 2018)

Training effects

- L2 learners' difficulties with non-native sounds can be partly overcome by perceptual training

Perceptual training

Improvement
in **L2 Perception**

Perceptual training

Improvement
in **L2 Production**

No improvement
in **L2 Production**

Goals

- Investigate the benefits of perceptual training on perception and production of Korean vowels by Mandarin L2 learners

(1) Effects of perceptual training on L2 acquisition
(2) Effects of instruction in L2 acquisition
(3) Effects of generalization

Research questions and hypotheses

(1) Effects of perceptual training on L2 acquisition

- **Question 1**: Does perceptual training enhance Mandarin L2 learners' perception and production of Korean vowels?

- **Hypothesis 1**: After a sufficient amount of perceptual training, Mandarin L2 learners' identification and production accuracy of Korean sounds will significantly increase.

(2) Effects of instruction in L2 acquisition

- **Question 2**: Is ***explicit instruction*** more effective than ***implicit instruction*** in L2 acquisition?

- **Hypothesis 2**: If there is an effect of explicit training, better identification is expected if L2 learners are instructed to focus on the target sounds during training.

- **Question 3**: Does ***implicit training*** improve performance compared to ***no training***?

- **Hypothesis 3**: Mandarin L2 learners who are trained on Korean vowels with Implicit instruction show greater accuracy in perception and production of Korean vowels than L2 learners who receive no training at all.

(3) Generalization effects

- **Question 4**: Can the training effect be transferred to sounds in new phonetic contexts?

- **Hypothesis 4**: Mandarin L2 learners' will be able to generalize the knowledge acquired through training to novel items.

Effects of Perceptual Training on L2 Vowel Perception

Participants

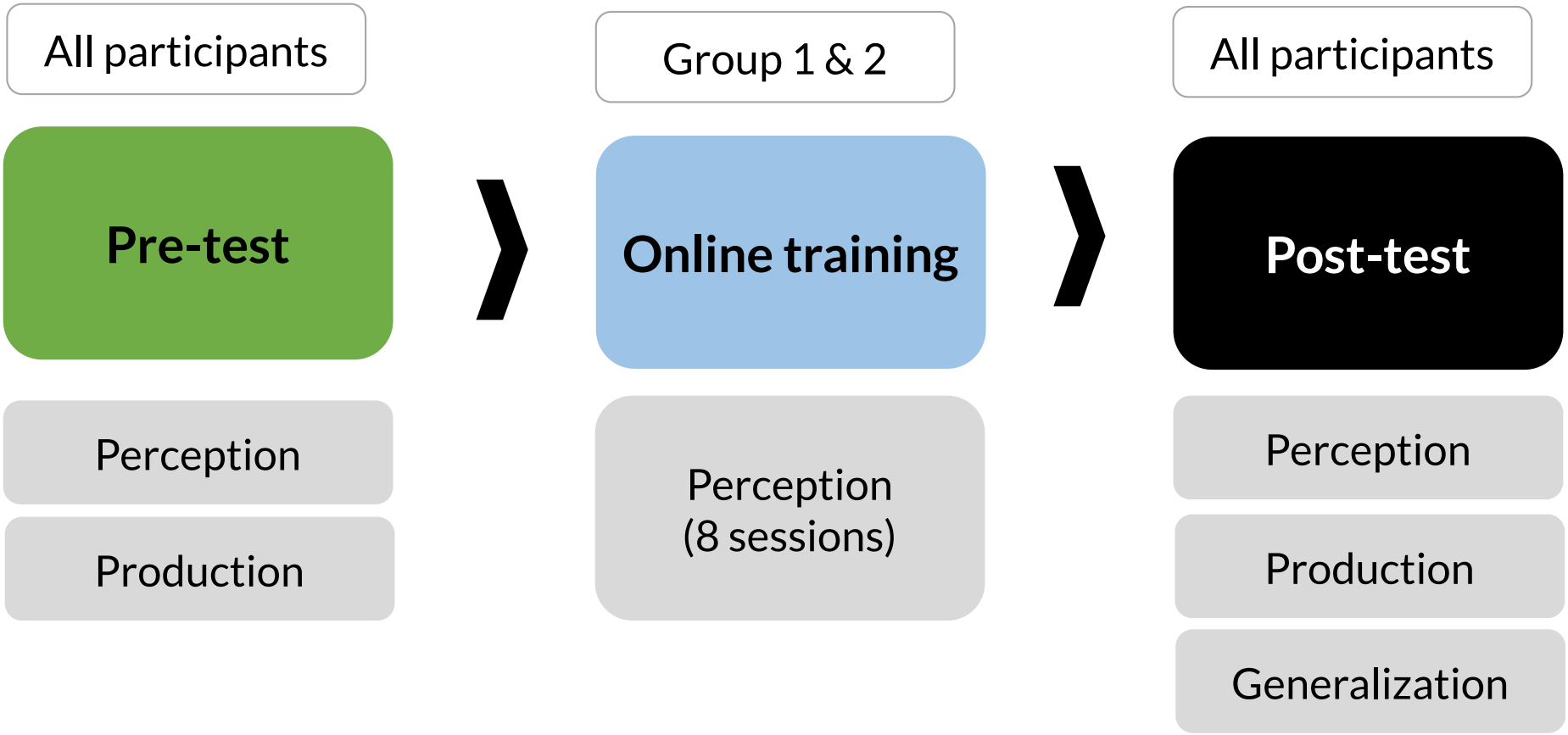
- 30 adult native Mandarin speakers (25 females, 5 males; mean: 20. 5 years old)
- Enrolled in beginner-level Korean courses at universities in Canada
- Randomly assigned to the experimental groups (Group 1 & Group 2) and the control group (Group 3)

Group 1 (11 subjects)	Group 2 (11 subjects)	Group 3 (8 subjects)
Training with explicit instruction	Training with non-explicit instruction	No training

Auditory stimuli

- **98 monosyllabic Korean words (CVC)**
  - Trained phonemes: **7 Korean vowels [a, e, i, o, u, ɨ, ʌ]**
  - Pre-, post-test and online training: 49 words /hVC/
  - Generalization test: 49 words /kVC/
- Recorded by 6 native Korean speakers (3 females, 3 males) in their 20s
- Stimuli were read 5 times in a natural fashion in the phonetics lab

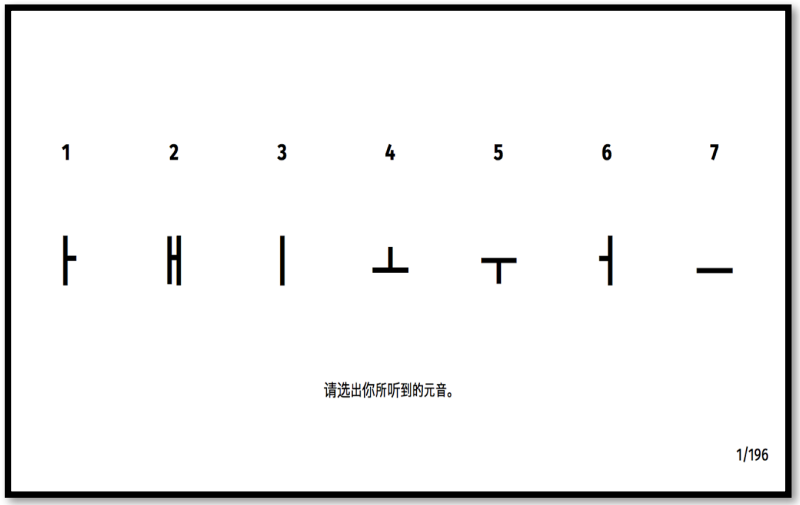
Three phases



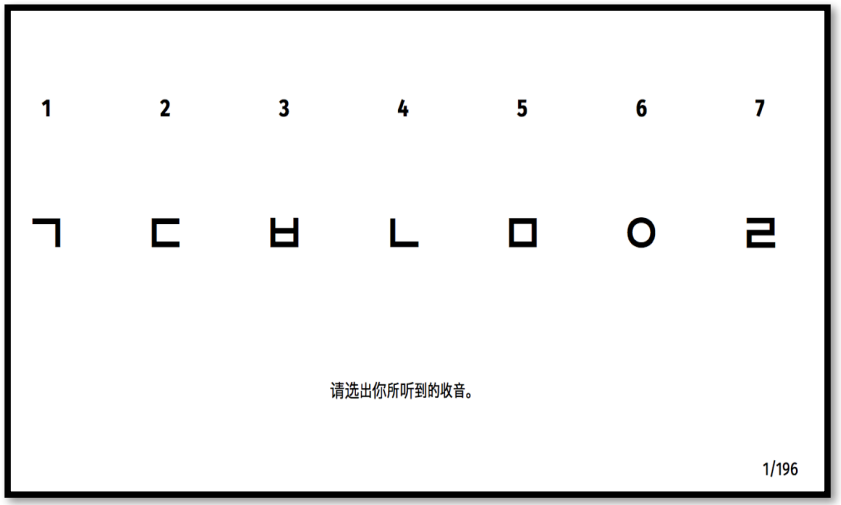
Web-based perceptual training

- All groups were asked to identify a sound they heard and press a corresponding button on the keyboard
- Group 1 and Group 2 were exposed to the same stimuli, but focused on different target segments
- Feedback was provided in the online training

Group 1 (Vowel-focused group)



Group 2 (Non-vowel focused group)



Analysis of vowel perception performance

- A mixed-effects logistic model in R (Baayen 2008; R CoreTeam 2012)
  - The package *lme4* (Bates et al 2011)
  - Dependent variable: Response (correct:1, incorrect:0)
  - Fixed effects: Test (pre-test, post-test, generalization test), group (G1, G2, G3), vowels and their interactions
  - Random effects: Speakers, items

Effects of perceptual training on L2 perception

- Perceptual training had significantly affected learners' identification ability positively.
- Group 1 with explicit instruction: 13% increase
- Group 2 with implicit instruction: 4% increase

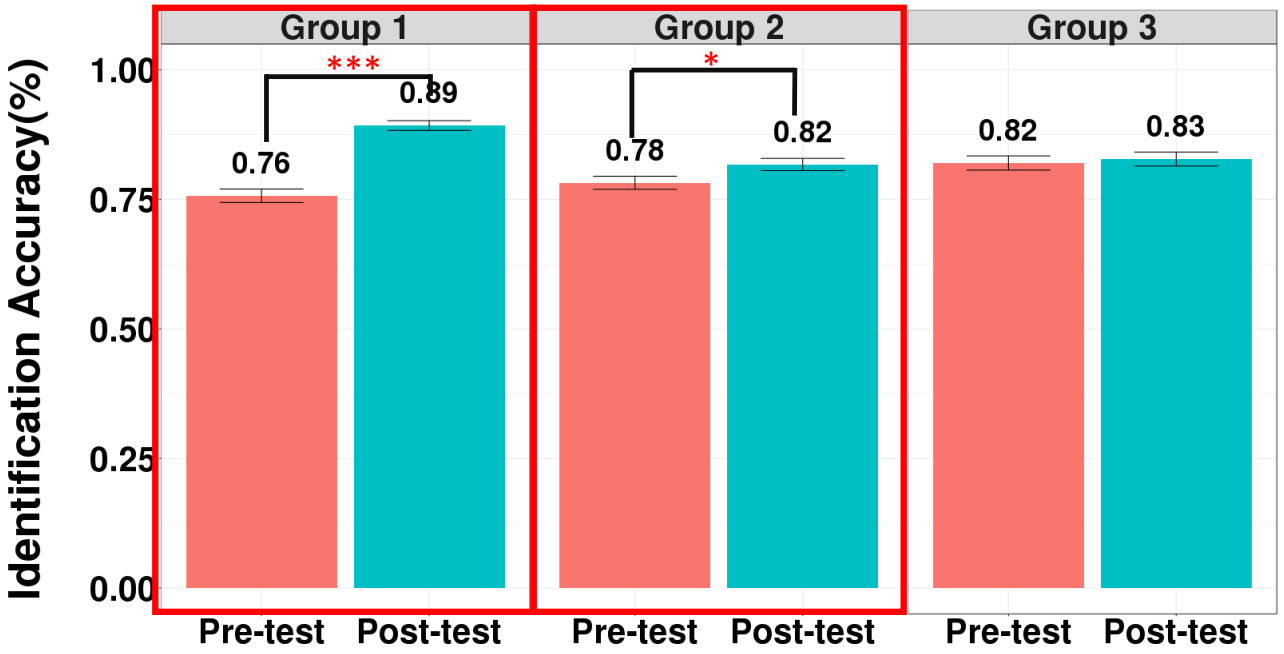


Figure 1. Accuracy of Korean vowel perception at pre- and post-test by group

Effects of instruction on L2 vowel perception

- Only in Group 1 with explicit instruction showed improvement in perception of Korean vowels **/e, o, ʌ/.**

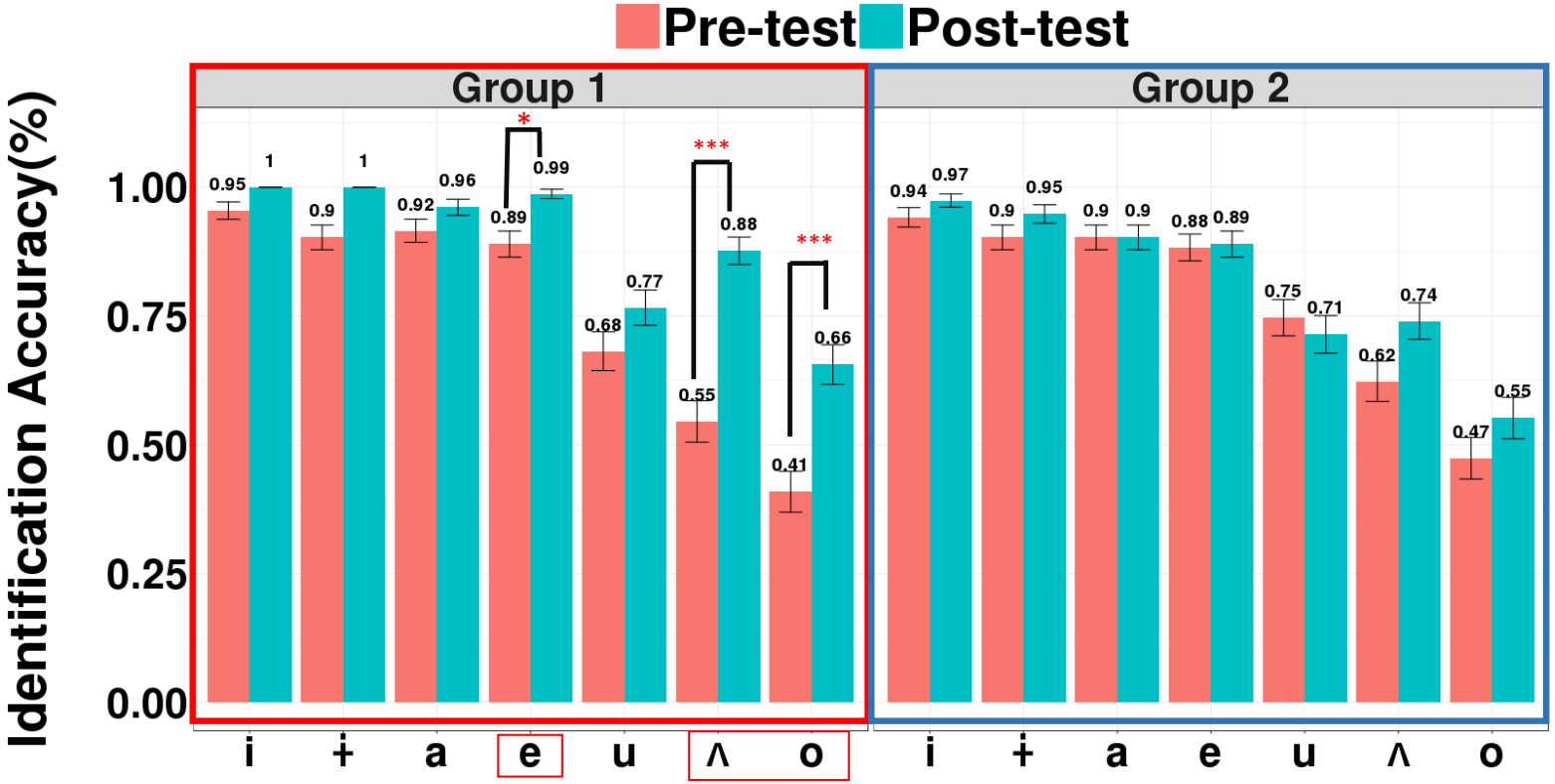


Figure 2. Accuracy in perception of Korean vowels at pre-and post-test by experimental groups

Individual development of L2 vowel perception

- Gradually increase perceptual knowledge of Korean vowels over eight training sessions

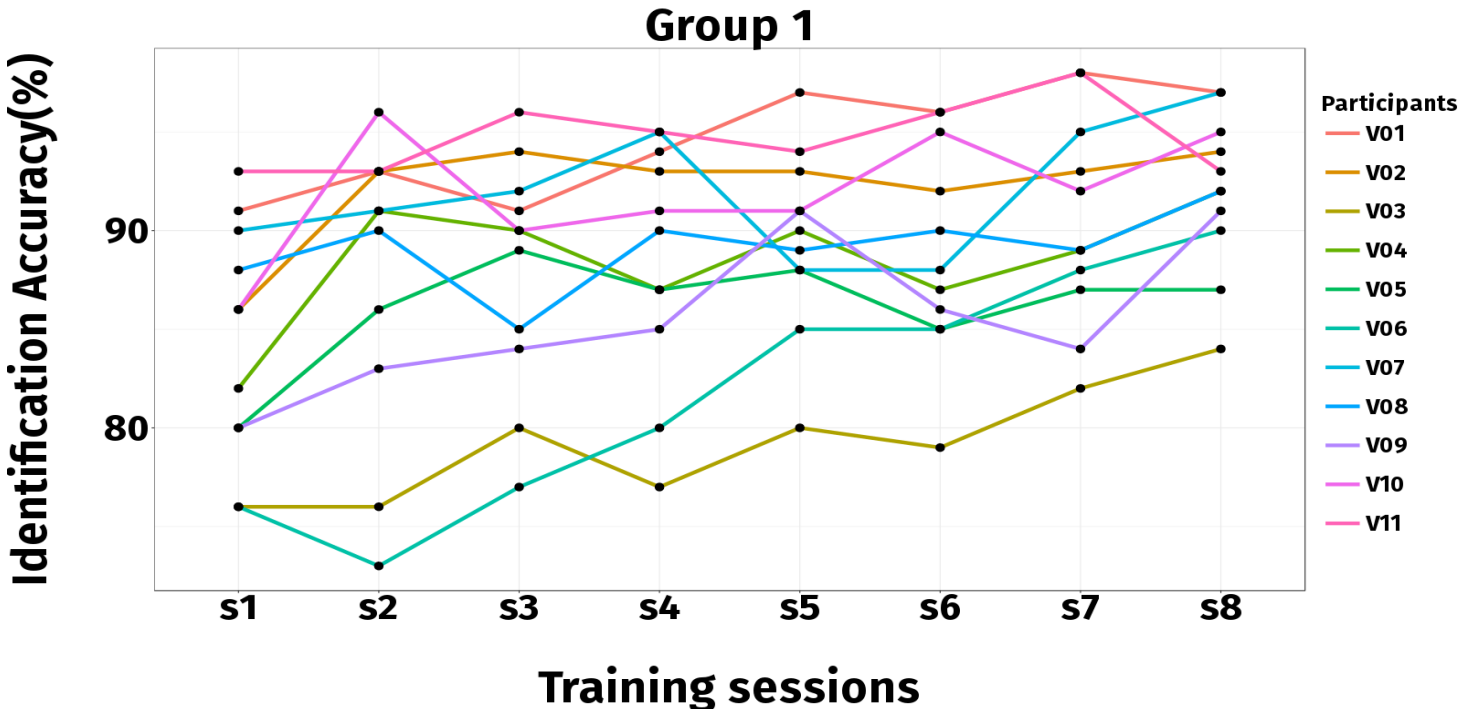


Figure 3. Individual learners' perceptual development of Korean vowels during eight training sessions (Group 1)

Generalization effects

- Generalization effects to new words were found in Group 1

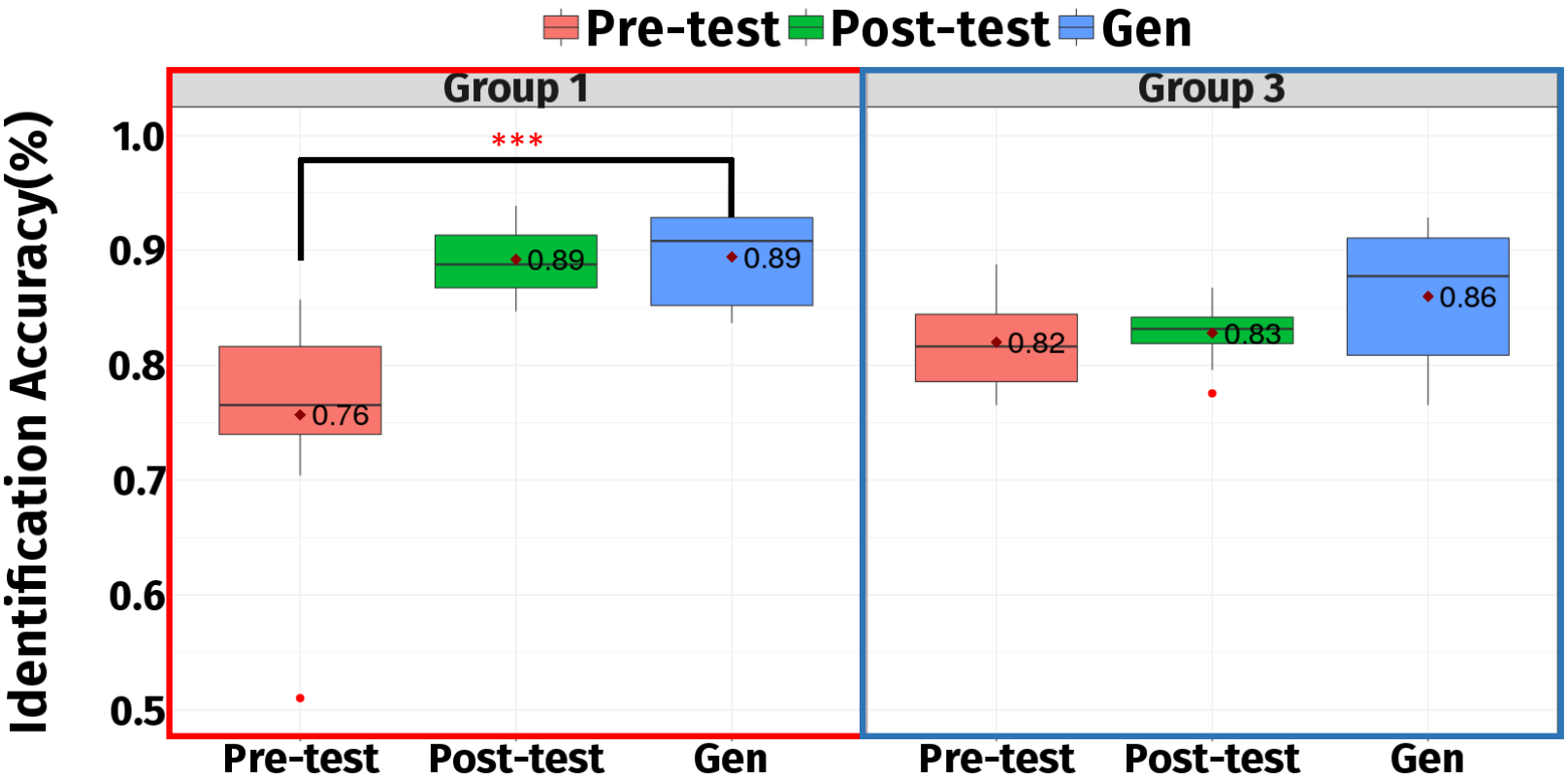


Figure 4. Generalization effects by group

Effects of perceptual training on L2 vowel production

Participants

- The same participants who took part in perception tasks completed the production task

- Included only female participants for acoustic analysis

  - **25** female native Mandarin speakers

  - **3** female native Korean speakers (control group)

Stimuli

- Read words containing target vowels presented in Korean on a computer screen using PsycoPy (Pierce 2007).
- Disyllabic Korean words /hVda/ including 7 Korean vowels (Yang 1996)
- Each set of words appeared five times in isolation

Acoustic analysis

- F1 and F2 values in Praat (Boersma and Weenink 2011)
- 1846 tokens were acoustically analyzed
  - pre-test: 866 tokens
  - post-test: 875 tokens
  - native Korean: 105 tokens

Production accuracy of Korean vowels

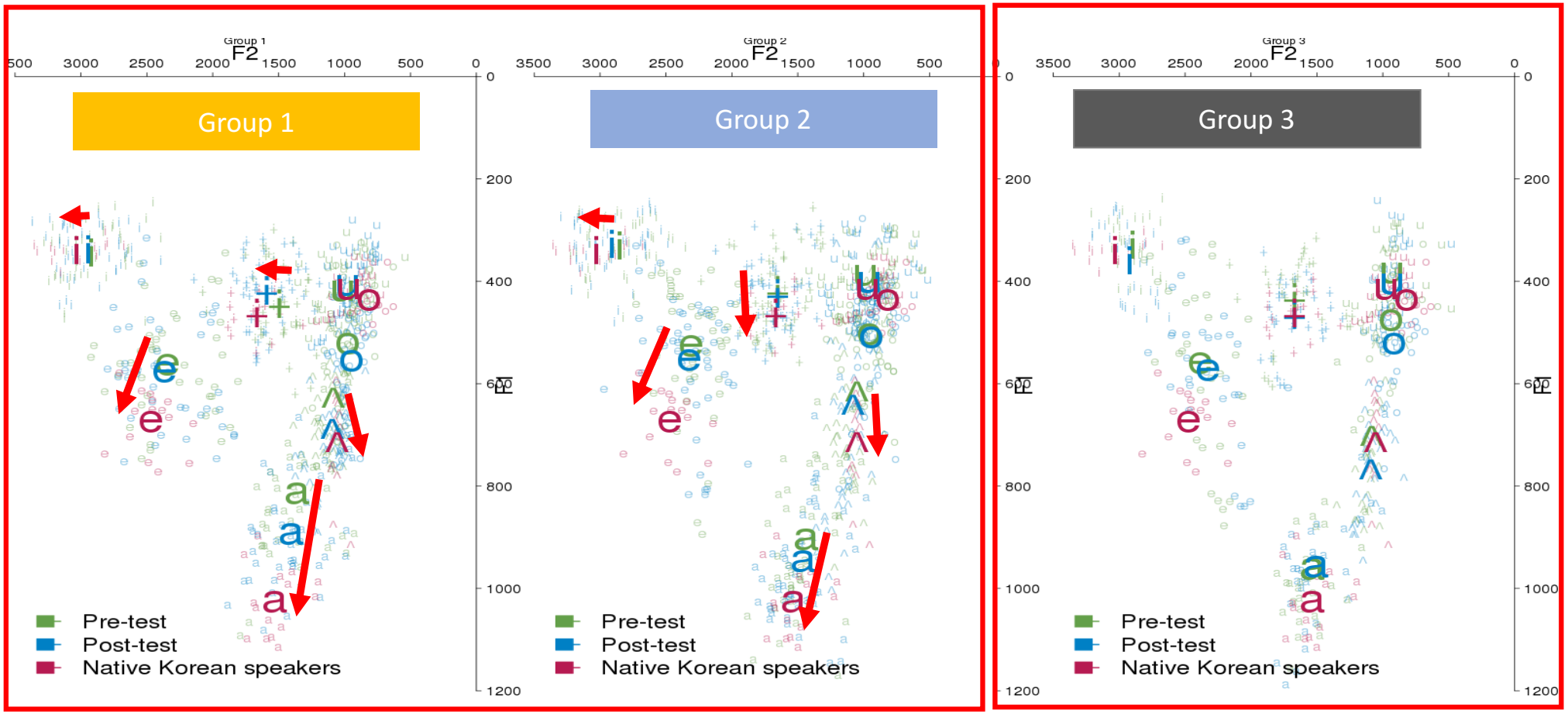


Figure 5. Production accuracy of Korean vowels at pre-and post-test by groups

Statistical analysis

- Linear mixed-effects regression in R (Baayen 2008; R CoreTeam 2012)
    - The package *lme4* (Bates et al 2011)
    - Dependent variable: **Euclidean distance** from the native target
    - Fixed effect: **Test** (pre-test, post-test), **group** (G1, G2,G3), **vowels**
    - Random effect: Speakers, items

- Euclidean distance between non-native productions and target native productions was used to assess L2 production accuracy.

- A shorter euclidean distance indicates more native-like production.

Effects of perceptual training on L2 production

- Perceptual training was successful in improving the production of Korean vowels.
- Post-test performance for articulation of Korean vowels was significantly greater in Group 1

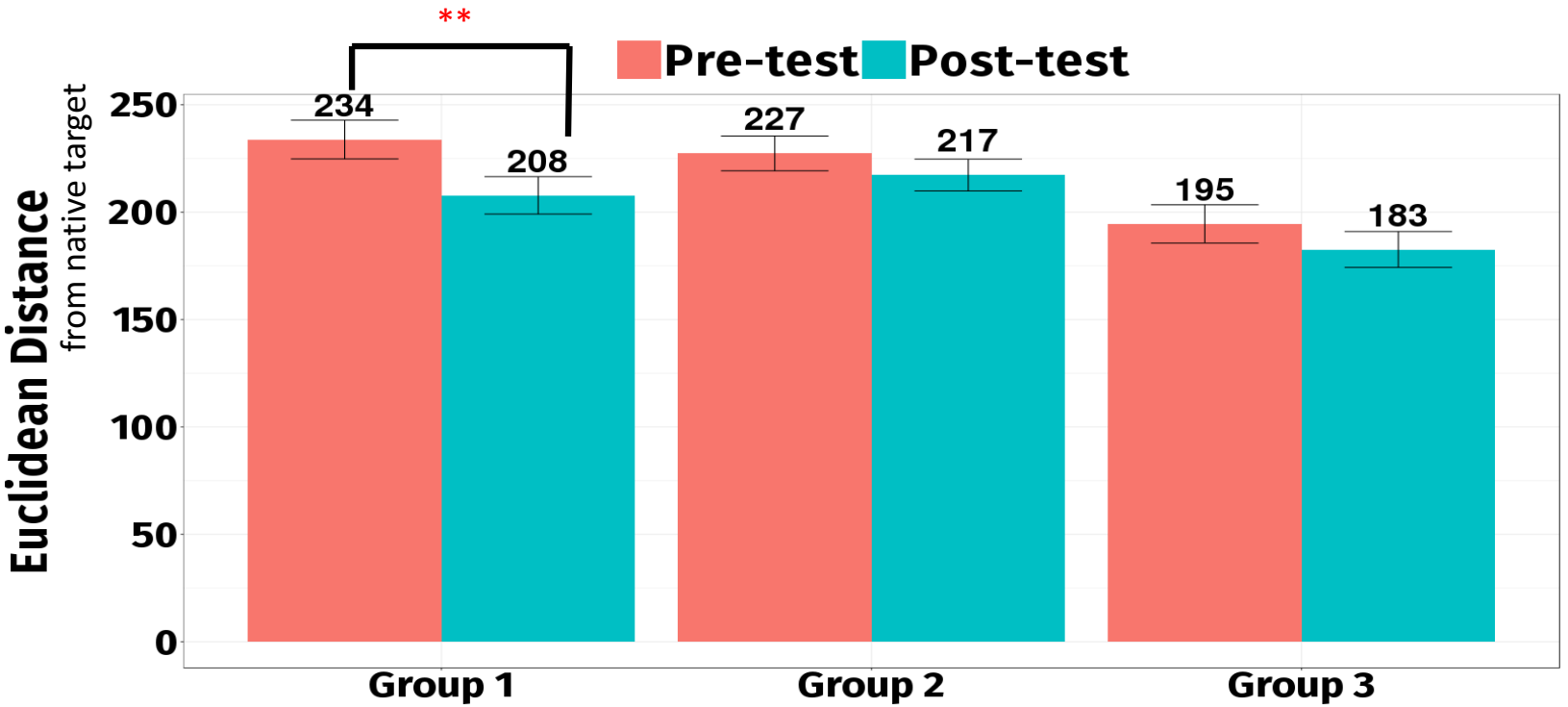


Figure 6. Effects of training on production accuracy for Korean vowels by group

Effect of instruction on L2 vowel production

- In Group 1 with explicit instruction, production accuracy of /a , u, ɨ/ increased

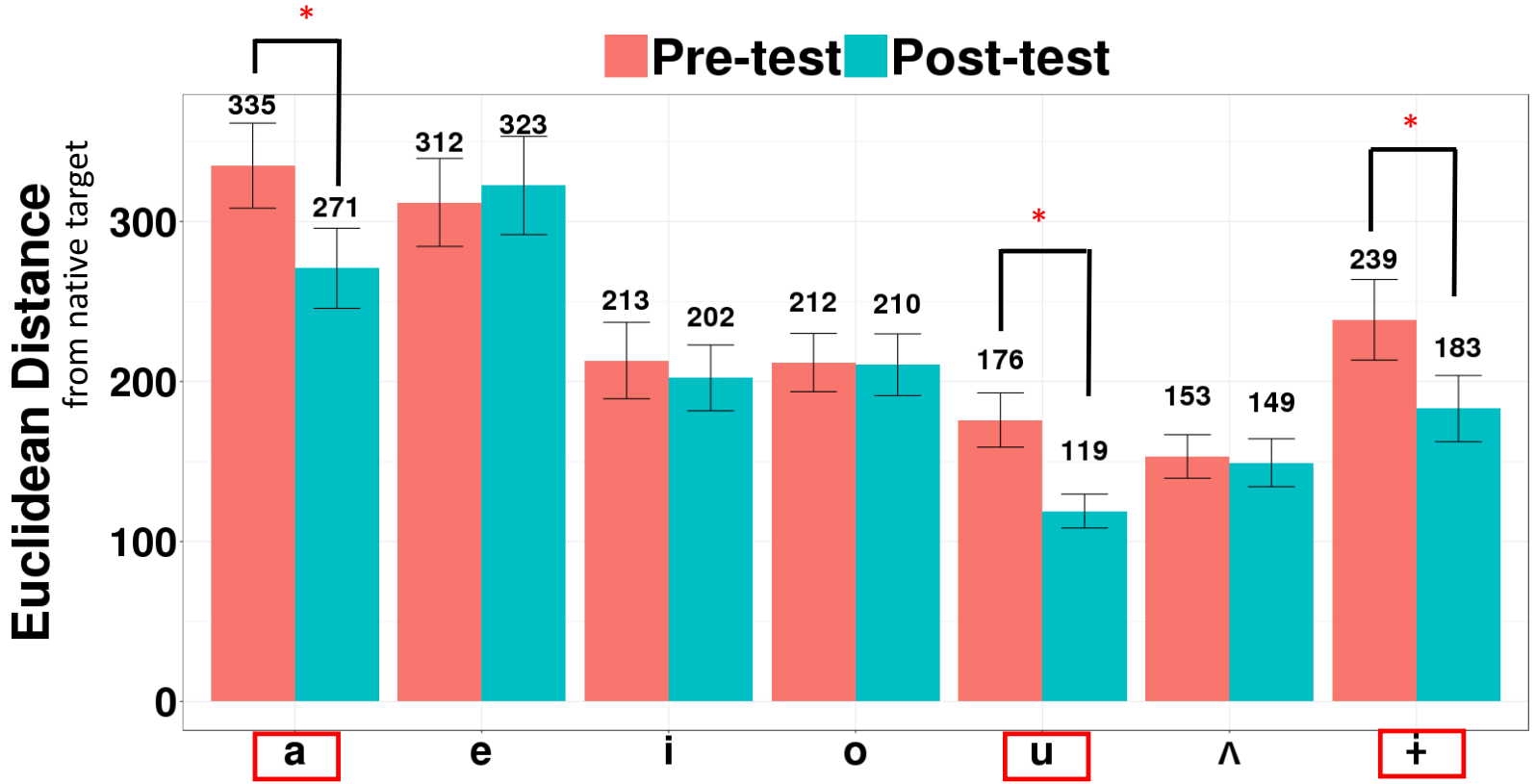


Figure 7. Production accuracy of Korean vowels after explicit training (Group 1)

Conclusions

- Perceptual training is effective in improving L2 perception and production
- Asymmetry in production and perception abilities for Korean vowels

Effects of training in L2 vowel perception	Effects of training in L2 vowel production
/e, ʌ, o/ accurately perceived	/a, u, ɨ/ accurately produced

- Explicit instruction is more beneficial than implicit instruction

Effects of instruction in L2 vowel perception	Effects of instruction in L2 vowel production
Explicit training: 13% improvement Implicit training: 4% improvement	Explicit training: Significant improvement Implicit training: No significant improvement

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Selected References

- Aliaga-García, C., & Mora, J. C. (2009). Assessing the effects of phonetic training on L2 sound perception and production. *Recent research in second language phonetics/phonology: Perception and production*, *231*.
- Best, C. T. (1994). The emergence of native-language phonological influences in infants: A perceptual assimilation model. The development of speech perception: The transition from speech sounds to spoken words 167(224), 233–277.
- Bradlow, A. R., Pisoni, D. B., Akahane-Yamada, R., & Tohkura, Y. I. (1997). Training Japanese listeners to identify English /r/ and /l/: IV. Some effects of perceptual learning on speech production. *The Journal of the Acoustical Society of America*, *101*(4), 2299-2310.
- Escudero, P. (2005). *Linguistic perception and second language acquisition: Explaining the attainment of optimal phonological categorization*. Netherlands Graduate School of Linguistics.
- Flege, J. E. (1995). Second language speech learning: Theory, findings, and problems. *Speech perception and linguistic experience: Issues in cross-language research* 233–277.
- Garcia Perez, G. M. (2003). *Training Spanish speakers in the perception and production of English vowels* (Doctoral dissertation), Simon Fraser University.
- Inceoglu, S. (2016). Effects of perceptual training on second language vowel perception and production. *Applied Psycholinguistics*, *37*(5), 1175-1199.
- Iverson, P., & Evans, B. G. (2007). Learning English vowels with different first-language vowel systems: Perception of formant targets, formant movement, and duration. *The Journal of the Acoustical Society of America*, *122*(5), 2842-2854.
- Klecka, W. R. (1980). Discriminant analysis, quantitative applications in the social sciences, Vol. 19. Newbury Park, CA: Sage.
- Nishi, K., Strange, W., Akahane-Yamada, R., Kubo, R., & Trent-Brown, S. A. (2008). Acoustic and perceptual similarity of Japanese and American English vowels a. *The journal of the Acoustical Society of America*, *124*(1), 576-588.
- Sakai, M., & Moorman, C. (2017). Can perception training improve the production of second language phonemes? A meta-analytic review of 25 years of perception training research. *Applied Psycholinguistics*, 1-38.
- Strange, W., Bohn, O. S., Nishi, K., & Trent, S. A. (2005). Contextual variation in the acoustic and perceptual similarity of North German and American English vowels. *Journal of the Acoustical Society of America*, 118, 1751–1762.