Effects of perceptual phonetic training on the perception of Korean codas by native Mandarin listeners

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Previous studies on L2 acquisition

Background: Acquisition of L2 Phonology

Adult L2 learners often experience difficulty acquiring non-native sounds (Flege 1995, Best et al 1996, Levey & Strange 2002 and many others).

- Japanese learners of English: English /ɹ/-/l/ contrast
  (Miyawaki et al 1975, Mackain et al 1981, Yamada & Tohkura 1992, Iverson et al 2003)

- Korean learners of English: English tense/lax vowel distinction
  (Yang 1992, 1996, Flege et al 1997, Koo 2000)

Effects of training on L2 perception

- Adult learners are able to improve their perception of L2 sounds after sufficient training.

- English /r/- /l/ distinction with L1 Japanese participants (Bradlow et al 1999, Iverson et al 2005, Lively et al 1994, Mc-Candliss et al 2002)

- English vowels with L1 Spanish participants (Aliaga-García & Mora 2009, Cenoz & García Lecumberri 1999, Gómez Lacabex et al 2009, Kondaurova & Francis, 2010)

Explicit vs implicit learning in L2 acquisition

- **Explicit learning**
- **Learners are aware that they have learned** something and can verbalize what they have learned.
- Involves memorizing a series memorizing a series of successive facts and thus makes heavy demands on working memory.

- **Implicit learning**
- **Learners remain unaware of the learning** that has taken place and cannot verbalize the learning that has occurred.
- Proceeds without making demands on central attentional resources.

Implicit vs. Explicit learning in L2 acquisition

- **Generally, explicit learning is more effective than implicit learning**.
- Rosa & O'Neill (1999): learners who demonstrated high awareness during learning outperformed those with low awareness.
- Derwing and Munro (2005): Students learning L2 pronunciation benefit from being explicitly taught phonological forms to help them notice the difference between their own productions and those of proficient speakers in the L2 community.
- Venkatagiri & Levis (2007): Explicit instruction can help learners develop 'phonological awareness'.

- **No difference between explicit and implicit learning.**

  (Doughty 1991, Shook 1994)

Motivation for the current study

- L1 Mandarin learners perceptual difficulty with Korean codas.
- To this date, there are no studies of training on the perception of Korean codas by L2 learners.

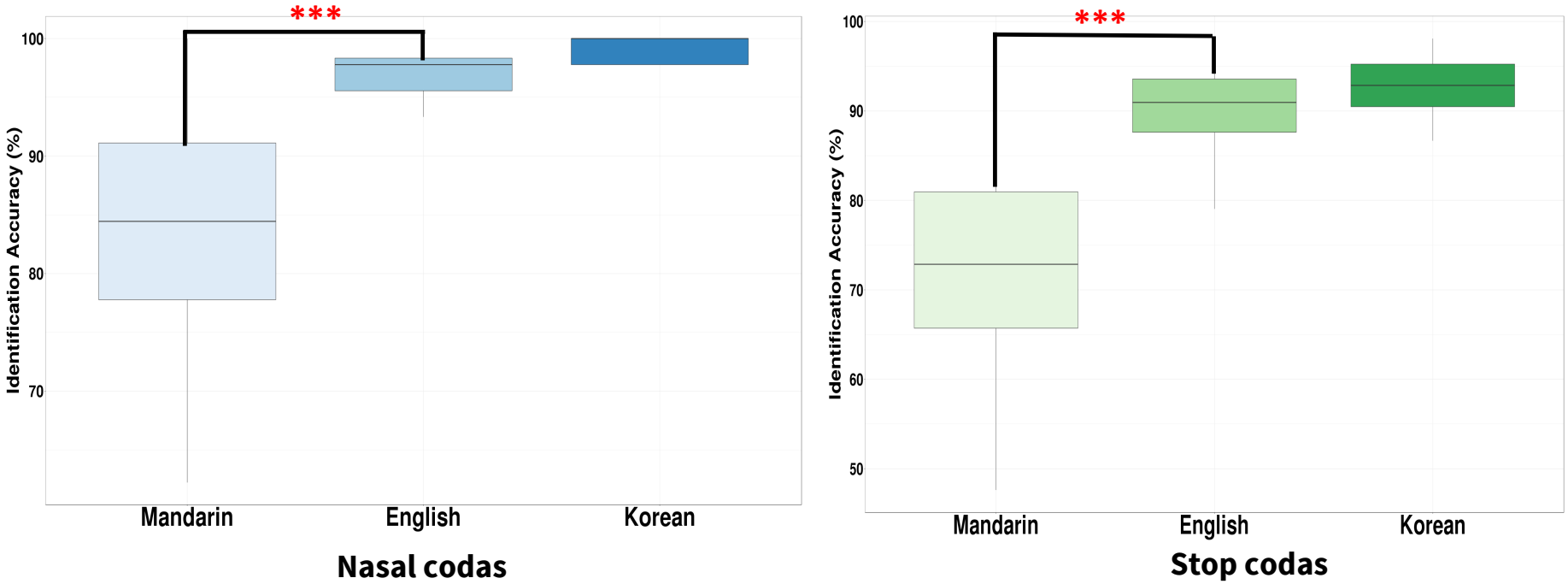

Figure 1. Identification accuracy of Korean nasal/stop codas by L1 group (Ryu 2018)

Goals

- To investigate how Mandarin learners of Korean improve the perception of Korean codas through perceptual training

(1) Effects of perceptual training
(2) Effects of explicit instruction vs. implicit instruction
(3) Effects of generalization test

Mandarin and Korean syllable structure

- Mandarin: Only /n, ŋ/ are allowed in coda position.
- Korean permits 7 consonants in coda position. Final consonants are not released.

Table 1. Mandarin and Korean syllable structure and coda inventories

	Mandarin	Korean
Syllable structure	CVN	CVC
Syllable codas	Nasals /n, ŋ/	Voiceless /p, t, k/ Nasals /n, m, ŋ/ Liquid /l/

Research questions and hypotheses

(1) Effects of perceptual training on L2 perception

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

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

(2) Effects of instruction in L2 perception

Explicit instruction vs. implicit instruction in L2 perception

- **Question 2**: Is explicit instruction more effective than implicit instruction in L2 coda perception?
- **Hypothesis 2**: If there is an effect of explicit training, better identification for Korean codas is expected if L2 learners are instructed to focus on the target sounds during training.

(2) Effects of instruction in L2 perception

Implicit instruction vs. no training in L2 perception

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

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

(3) Generalization effects of training

- **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 of Korea codas acquired through training to novel items.

Method

Participants

- 34 adult native Mandarin speakers enrolled in beginner-level Korean courses at universities (28 females, 6 males; mean: 21.4 years old)
- Randomly assigned to one of three groups: Group 1 (12 subjects), Group 2 (12 subjects), Group 3 (10 subjects)

Group 1	Group 2	Group 3
Explicit training	Implicit training	No training

Design of the study

Phase of study	Type of Task	Speaker variability	Feedback	Experimental tool
Pre-test	Identification	2 speakers (1 female, 1 male)	No feedback	PsychoPy
Online training	Same identification as pretest	4 speakers (2 female, 2 males)	Immediate feedback	Online experiment using Javascript
Post-test	Same identification as pretest	The same speakers as pre-test	No feedback	PyschoPy
Generalization Test	Same format as pretest, but with a new phonetic context	The same speakers as pre-test	No feedback	PsychoPy

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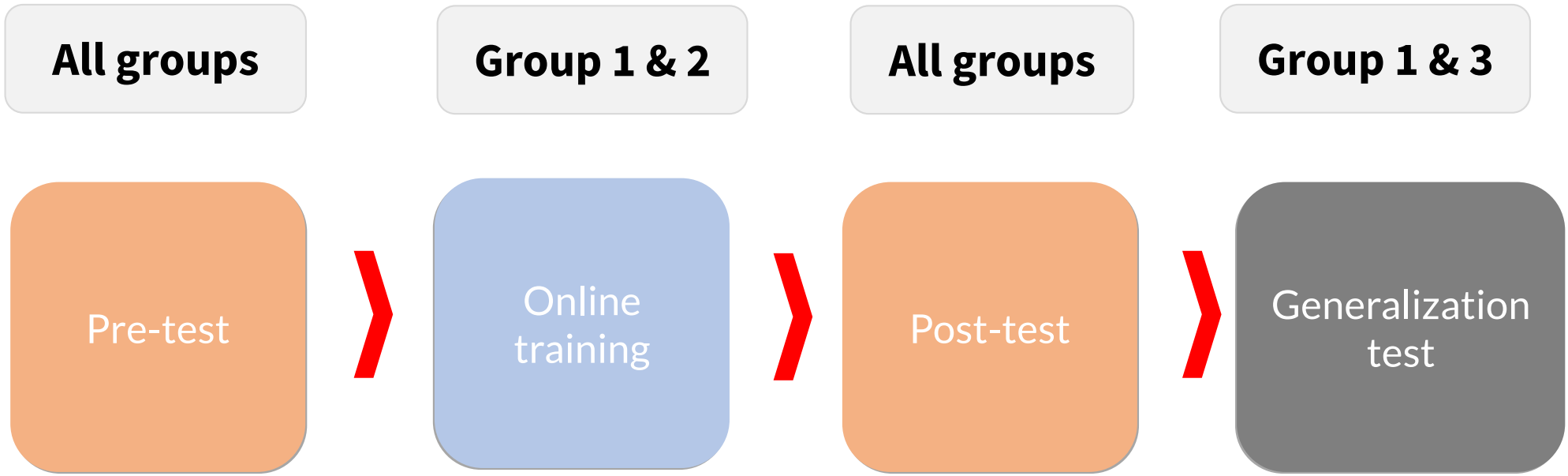
Four phases


All groups
Group 1 & 2
All groups
Group 1 & 3
Pre-test
Online training
Post-test
Generalization test

Auditory stimuli

- 98 monosyllabic Korean words (CVC) naturally produced by 6 native Korean speakers(3 females, 3 males) in their 20s.

  - Trained phonemes: 7 Korean coda consonants [n, m, ŋ, l, p, t, k]
  - Pre-, post-test and online training: 49 words /hVC/
  - Generalization test: 49 words /kVC/

- Stimuli were read 5 times in a natural fashion in the phonetics lab

Web-based perceptual training

- **High variability perceptual training (HVPT): 4 talkers**
- 8 sessions over a period of 2 weeks.
- Completed 8 online sessions in a quiet place.

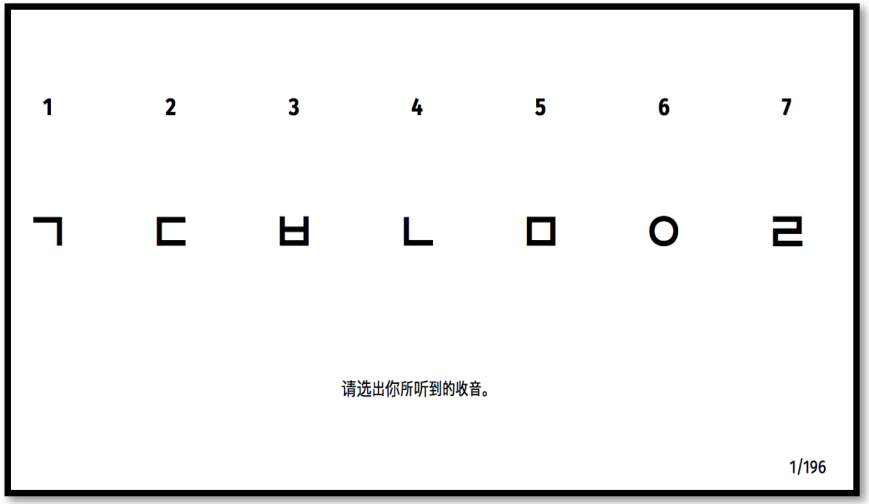
Table 2. Structure of the perceptual training

Group	Target training	No of trials	Speaker variability	Feedback
Group 1	coda consonants	196 trials (49 * 4 talkers)	4 talkers (2 male, 2 female)	Immediate feedback
Group 2	vowels			

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.

Group 1 (Explicit training group)



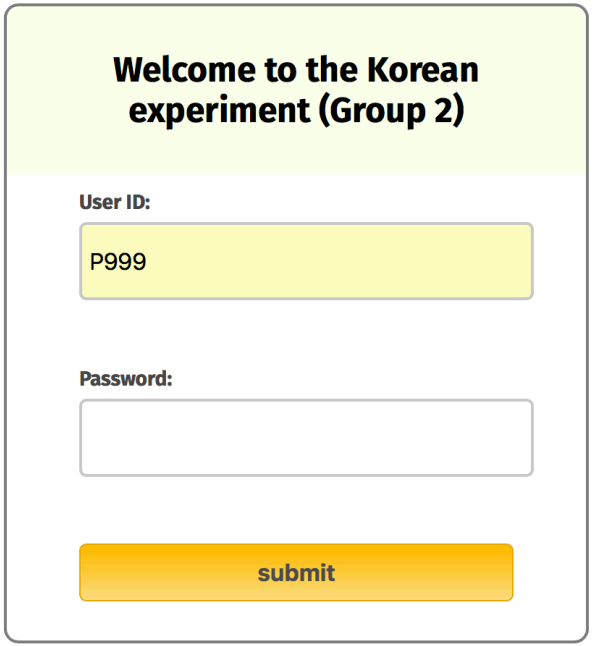
Korean codas

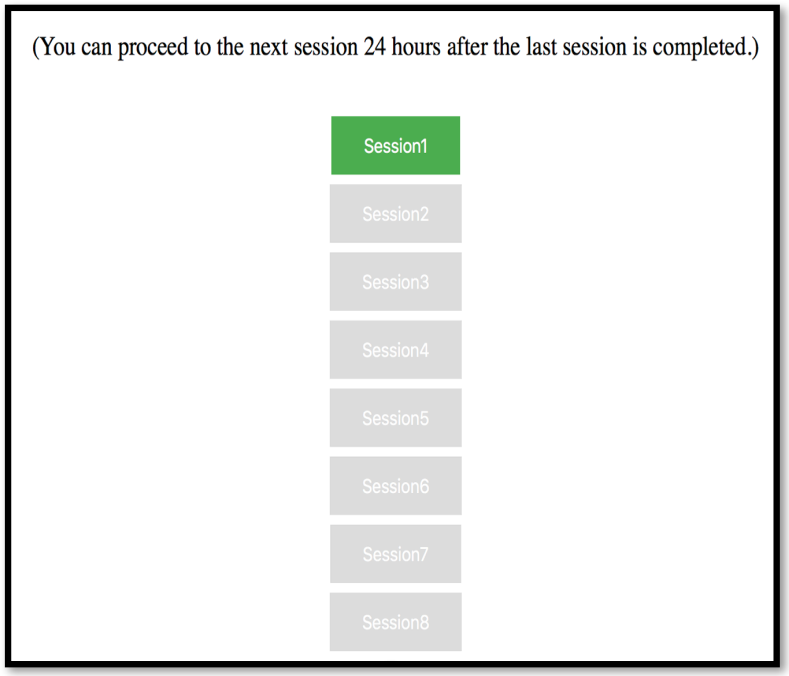
Group 2 (Implicit training group)

Korean vowels

Web-based perceptual training

- ID and PW were provided.
- No more than one training session per day.





Feedback

- Immediate feedback was provided in perceptual eight sessions.

- Asked to write down the number of tokens they answered incorrectly to keep them concentrated on the task.

Analysis of Korean coda 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), codas and their interactions
  - Random effects: Speakers, items

Results

Perception accuracy at pretest

- Pre-test: No significant difference across three groups.

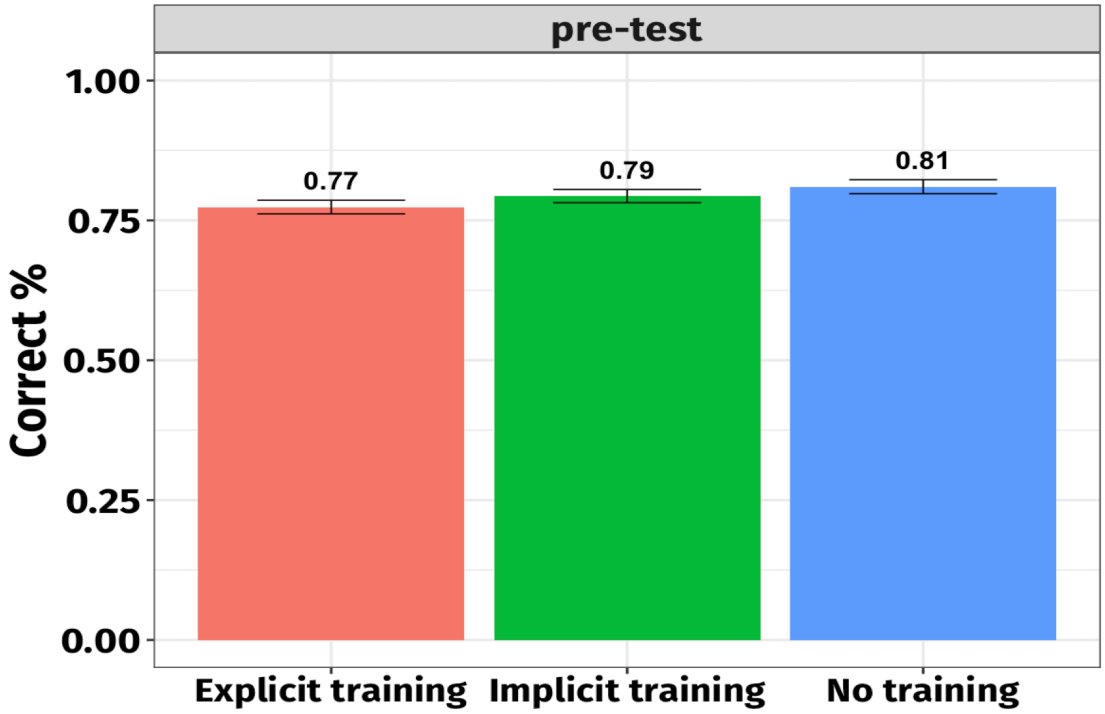


Figure 2. Perception accuracy of Korean codas by group at pre-test

Effects of perceptual training on L2 coda perception

- Strongly significant improvement is found after explicit training (10 % increase)
- Significant improvement is also found after implicit training (4% increase)

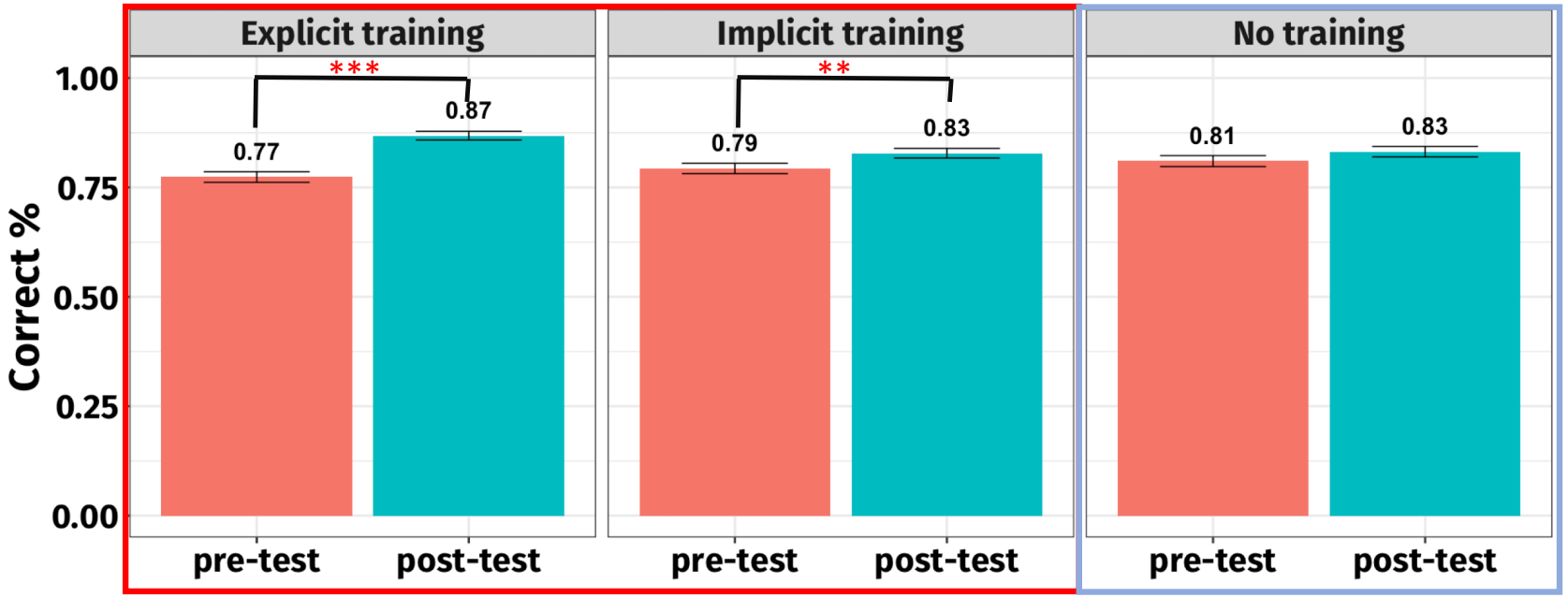


Figure 3. Perception accuracy of Korean codas at pre-and post-test by group

Perception accuracy of individual Korean codas

- The hierarchy of accurate perception at pre- test: **[l > m > p > n> t > ŋ > k]**
- Perception accuracy of the most difficult Korean codas **/k, ŋ, t/** improved after training

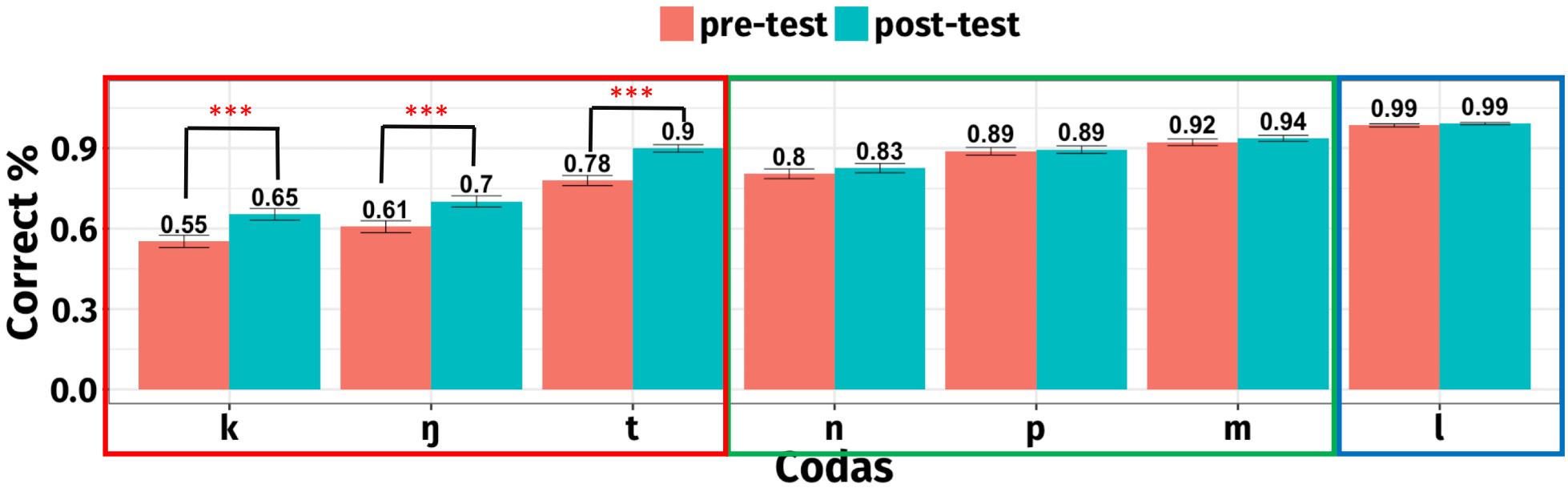


Figure 4. Perception accuracy of each Korean coda at pre- and post-test

Perception accuracy of individual Korean codas by group

- /k, ŋ, t/ are significantly improved after explicit training.
- /n, t/ are significantly improved after implicit training.

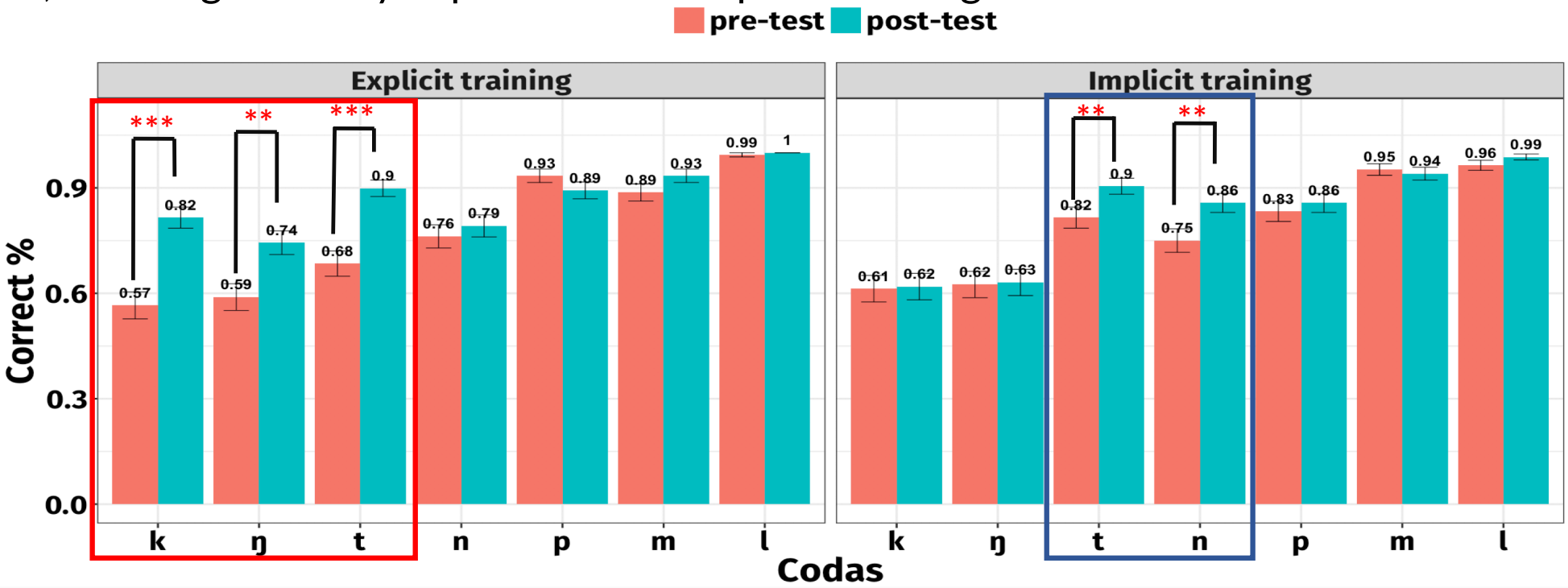


Figure 5. Perception accuracy of individual Korean codas by group

Individual development of L2 coda perception during training

- Overall, there was a significant increase in perceptual knowledge of Korean codas between Session 1 and Session 3 followed by a more gradual increase across the rest of the sessions.

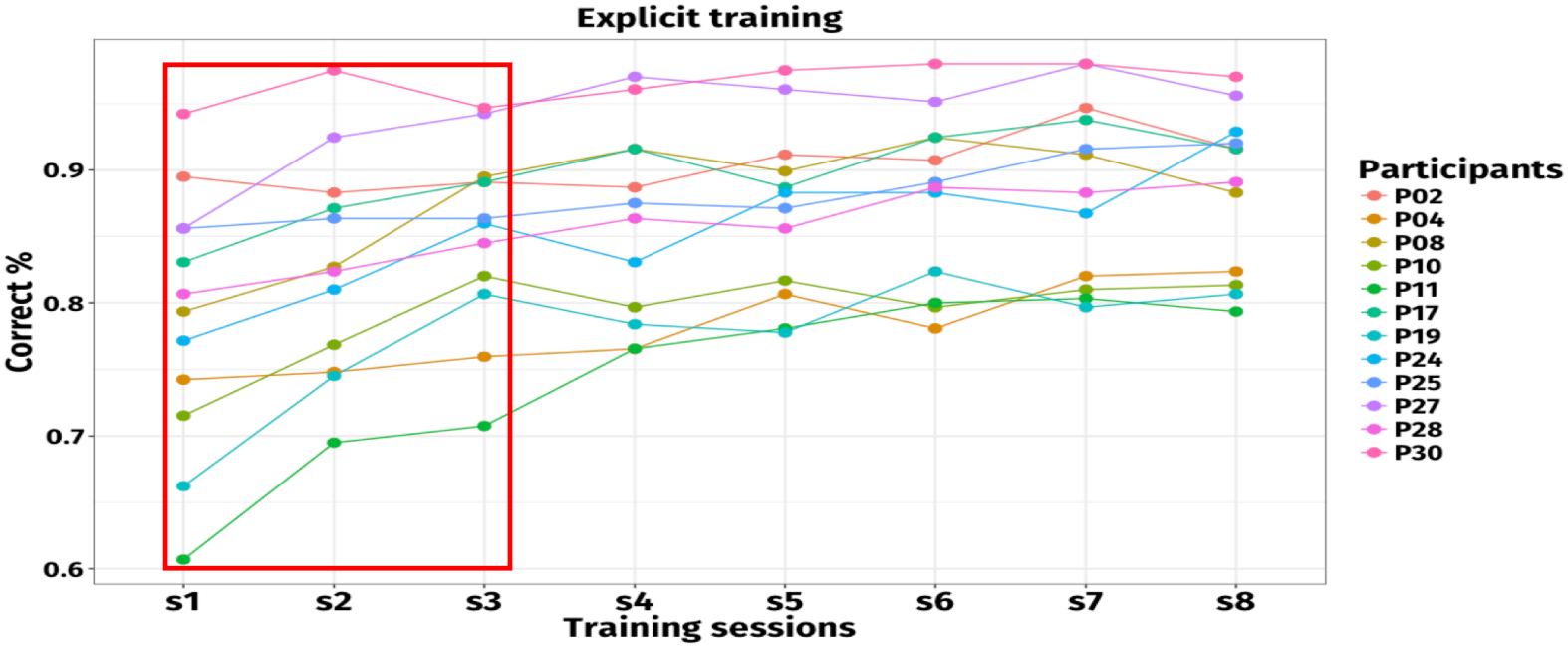


Figure 6. Individual learners' perception accuracy during the training sessions

Generalization effects of training

- Generalization effects to new words were found in explicit training

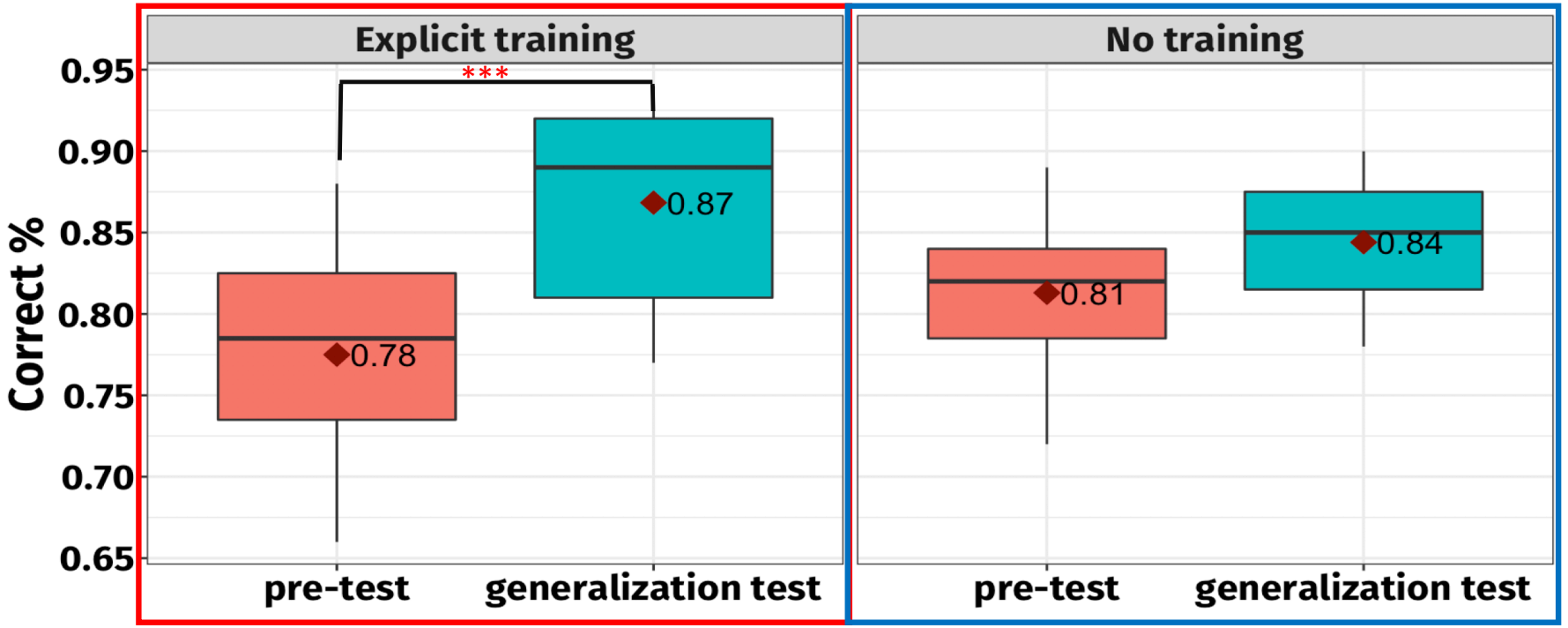


Figure 7. Effects of generalization test by group

In summary

Effects	Hypothesis	Results	Confirmed
Effects of perceptual training on L2 coda perception	Improvement of Korean coda perception after perceptual training	**Improvement from pre- to post-test** Explicit training ✓ Implicit training ✓ No training ✗	Confirmed
Effects of explicit vs. implicit training on L2 coda perception		**Group * test interaction**	
	Explicit training > Implicit training	Explicit training > Implicit training	Confirmed
	Implicit training > No training	No difference between implicit training and no training	Not confirmed
Effects of generalization tests	There will be generalization effects of training	Explicit training – Generalization effects No training – No effects	Confirmed

Conclusion

Conclusion and future plans

- Perceptual training is effective in improving the perception of Korean codas.
- Both explicit and implicit training are effective but explicit training is more beneficial for improving the most difficult Korean codas /k, ŋ, t/.
- Future plans:
  - Investigating effects of perceptual training on production of Korean codas in order to examine the relationship between perception and production in L2 acquisition.
  - Investigating the long-term effects of perceptual training.

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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.