



Perceptual Training Enhances the Use of Vowel Quality Cues to Lexical Stress: The Benefits of Intonational Variability

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Introduction

High-Variability Phonetic Training (HVPT)

- Multi-talker perceptual training enhances the perception of difficult second-language (L2) sound contrasts more than does single-talker perceptual training
 - Phonetic categories
(e.g., Logan, Lively, & Pisoni, 1991; Lively, Logan, & Pisoni, 1993; Iverson, Hazan, & Bannister, 2005)
 - Syllable structure
(e.g., Huensch & Tremblay, 2015)
 - Lexical tones
(e.g., Wang, Spence, Jongman, & Sereno, 1999)



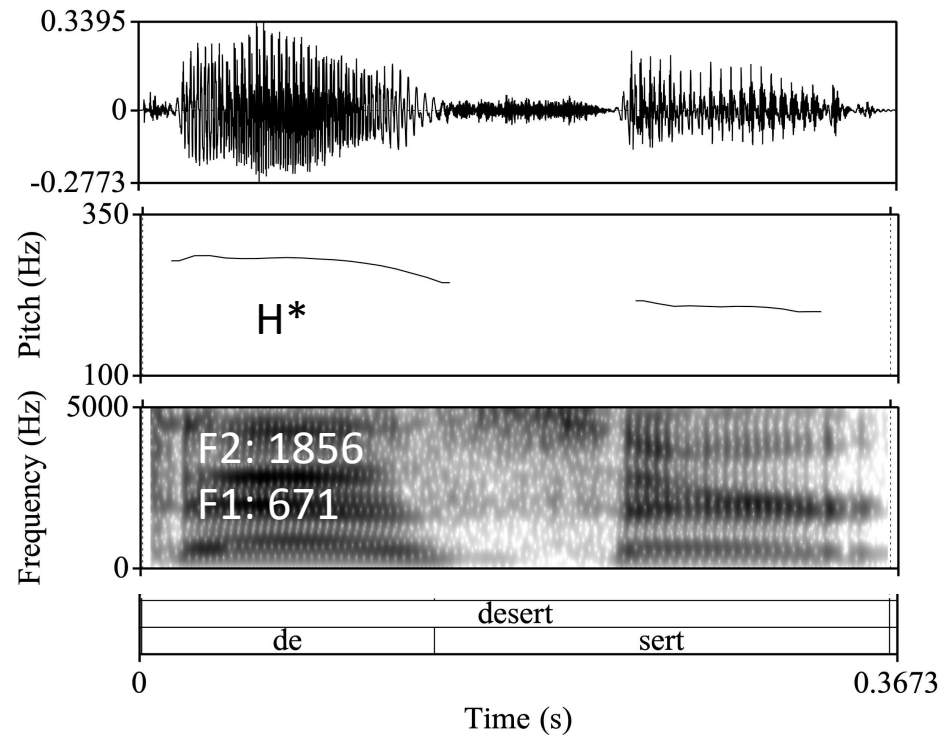
Introduction

- HVPT enables listeners to ***weight*** acoustic cues relative to the talker they hear and develop more ***abstract*** L2 perceptual representations
- Do the benefits of HVPT extend to the weighting of acoustic cues to ***lexical stress*** for listeners whose native language (L1) does not have lexical stress?

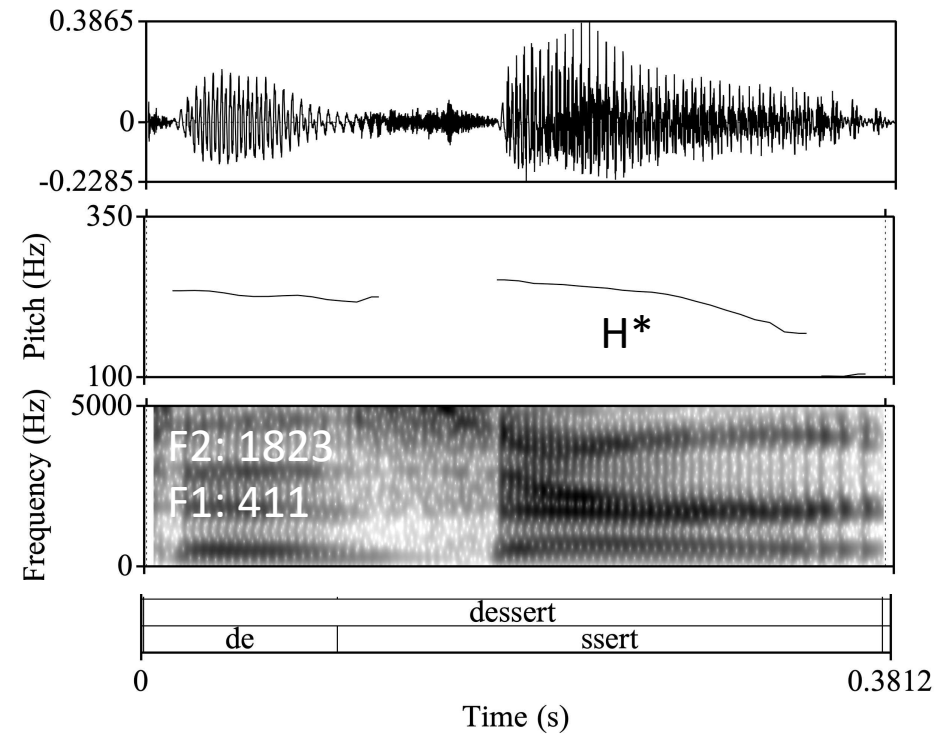


Background: English

DEsert



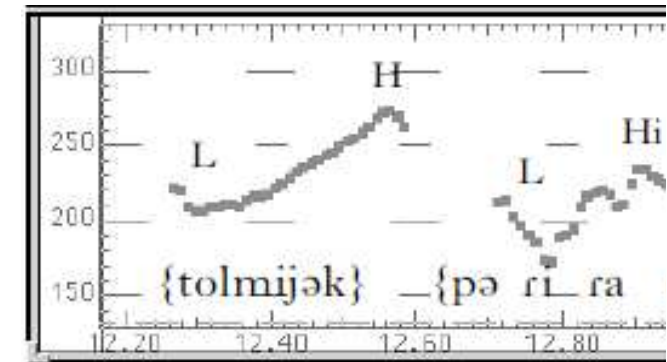
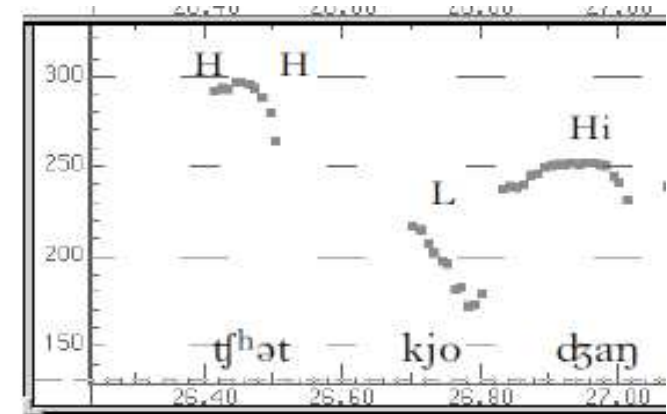
deSSERT

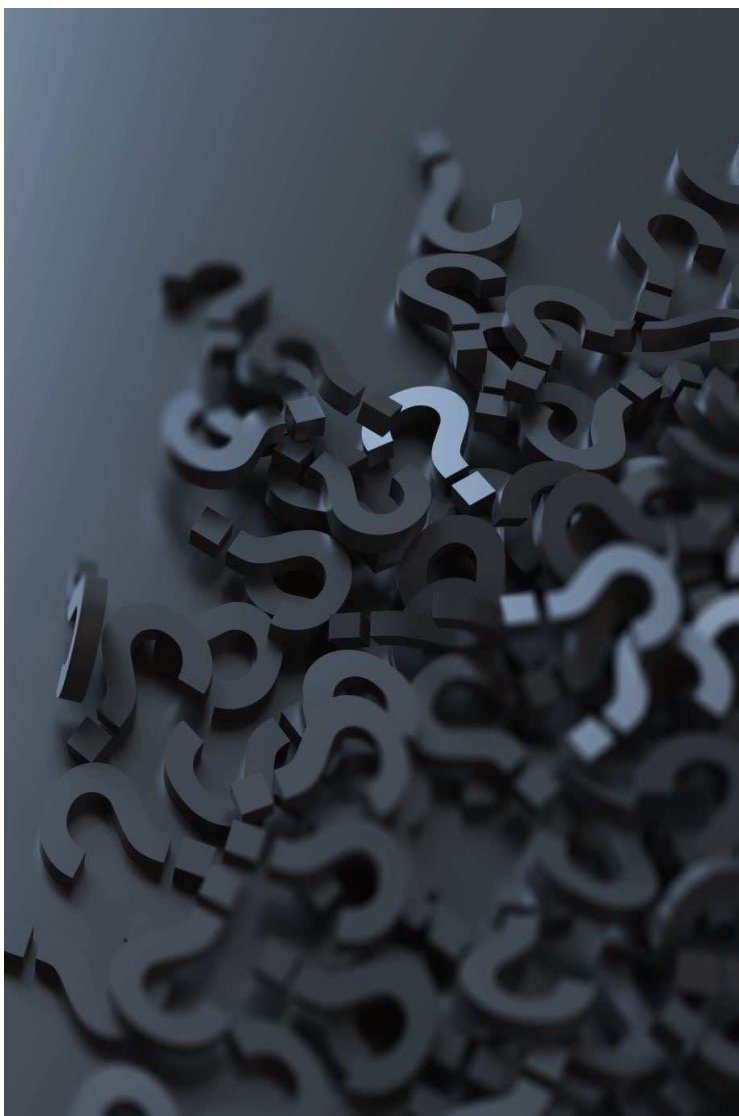


(e.g., Beckman & Edwards, 1994; Gay, 1978; Lehiste, 1970)

Background: Seoul Korean

- Pitch signals intonational prominence at the level of the Accentual Phrase
(Jun, 1998; examples: pp. 207-208)
 - LH LH tonal pattern when the initial segment is **lenis**
 - HH LH tonal pattern when the initial segment is **fortis** or **aspirated**
 - Consequently, pitch (L vs. H) has become a cue to the lenis-fortis and lenis-aspirated laryngeal contrasts



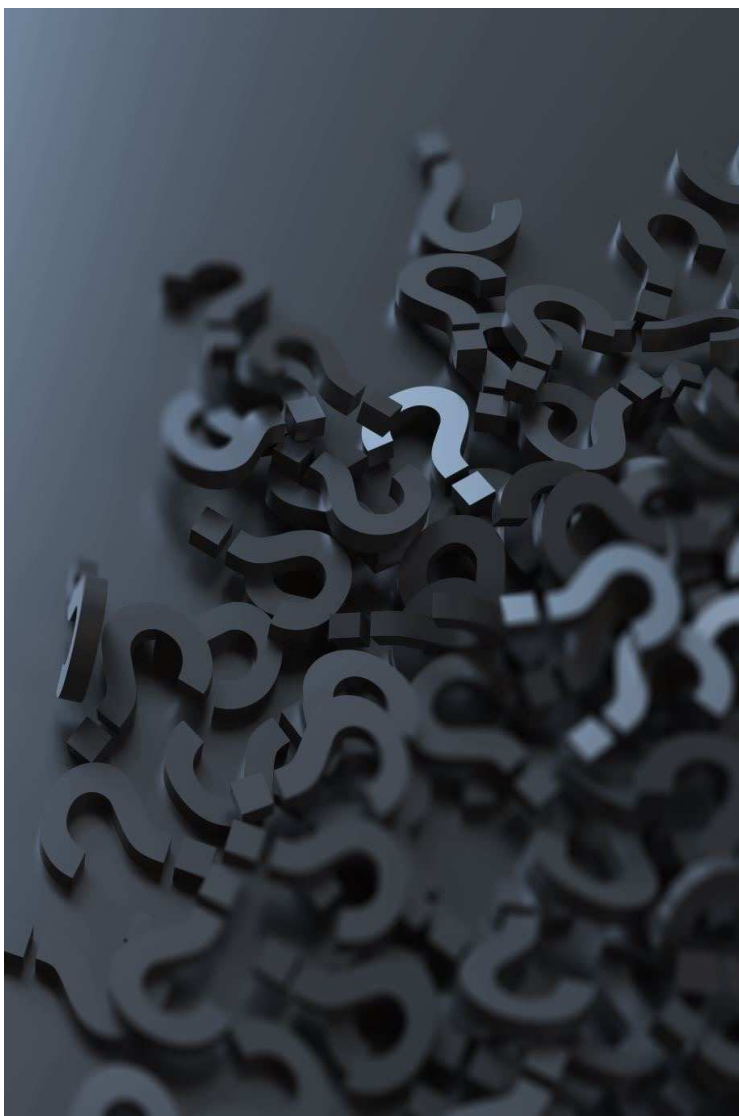


Background:

Korean L2 learners of English

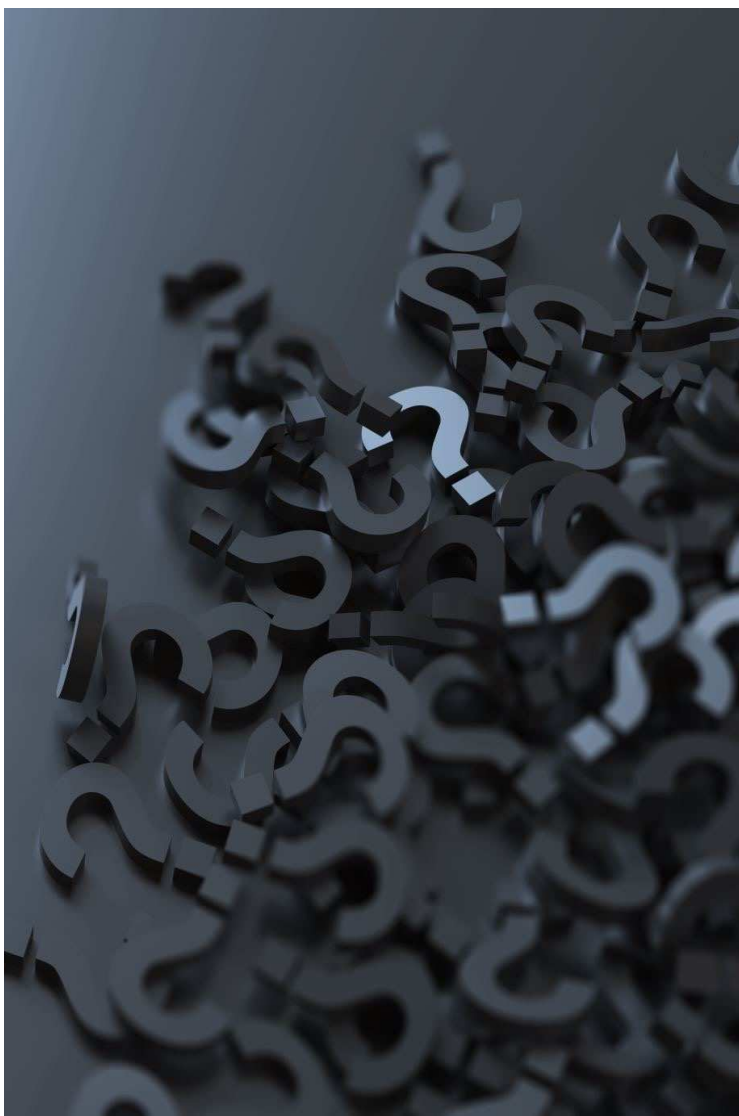
- Perception of suprasegmental cues to English lexical stress
 - Korean L2 learners of English have more difficulty recalling English nonwords differing in lexical stress (e.g., ['mipa] vs. [mi'pa]) than English nonwords differing in a consonant (e.g., ['kupi] vs. ['kuti])

(e.g., Lin, Wang, Idsardi, & Xu, 2014)



Background: Korean L2 learners of English

- Perception of segmental cues to English lexical stress
 - Korean L2 learners of English do not reject nonwords whose incorrect stress placement is signaled by vowel quality cues (e.g., **HOrizon* ['hɑ:ɹaɪzən]) more than incorrectly stressed nonwords without vowel quality changes (e.g., **Enough* ['ɪnʌf]) (e.g., Lin, Wang, Idsardi, & Xu, 2014)



Background: Korean L2 learners of English

- Perception of segmental cues to English lexical stress
 - Korean L2 learners of English show less lexical competition when the target differs segmentally and suprasegmentally from the competitor (e.g., *PArrot* vs. *paRADE*) than when it differs only suprasegmentally from it (e.g., *SURface* vs. *surPRISE*) (e.g., Connell et al., 2018)

A 3D rendering of a red puzzle piece standing out among a sea of white puzzle pieces. The red piece is in the center-right of the frame, slightly raised and tilted. The white pieces are arranged in a grid-like pattern around it, with some pieces missing, creating a sense of a larger puzzle. The lighting is soft, casting gentle shadows and highlighting the glossy texture of the pieces.

Given Seoul Korean
listeners' sensitivity to
pitch as a cue that signals a
segmental contrast, we
might expect them to rely
on pitch cues to English
lexical stress



Research Question

Does HVPT help Korean L2 learners of English rely less on pitch and more on vowel quality when perceiving English lexical stress?

The Present Study

- Compares the efficiency of HVPT and single-talker training (STT) for enhancing Korean listeners' weighting of acoustic cues to English lexical stress
- Distribution of cues in training that mimics spoken English
- Pre-/post-test: Cue-weighting experiment from Tremblay et al. (2021)



Participants

- 54 native speakers of Seoul Korean (mean age: 24, 32 females) at a high-intermediate proficiency in English (LexTALE: 68.1%; Lemhöfer & Broersma, 2012)
 - 27 completed the HVPT
 - 27 completed the STT

Training Materials

- Lexical items
 - 36 English noun-verb minimal pairs that differed in lexical stress
 - 28 with vowel reduction cues (e.g., *REcall* vs. *reCALL*)
 - 8 without vowel reduction cues (e.g., *PERmit* vs. *perMIT*)

(distribution based on Cutler & Carter, 1987)



Training Materials

- Intonational contexts
 - H*L– in *Mary said _____ before* (41.7%)
 - L*H– in *Mary said _____ before?* (16.6%)
 - Deaccented in *MARY said _____ before* (41.7%)

(distribution based on Im, Cole, & Baumann, 2018)



Training Materials

- Audiorecordings
 - HVPT: 4 native speakers of American English (two male and two female)
 - STT: 1 native speaker of American English (female; 4x the number of stimuli produced by each talker in the HVPT)



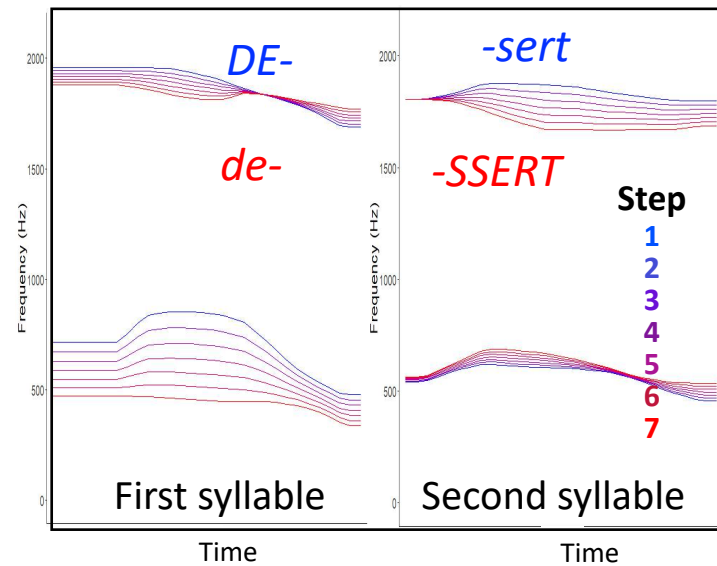
Cue-weighting lexical stress perception task used in Tremblay et al. (2021)



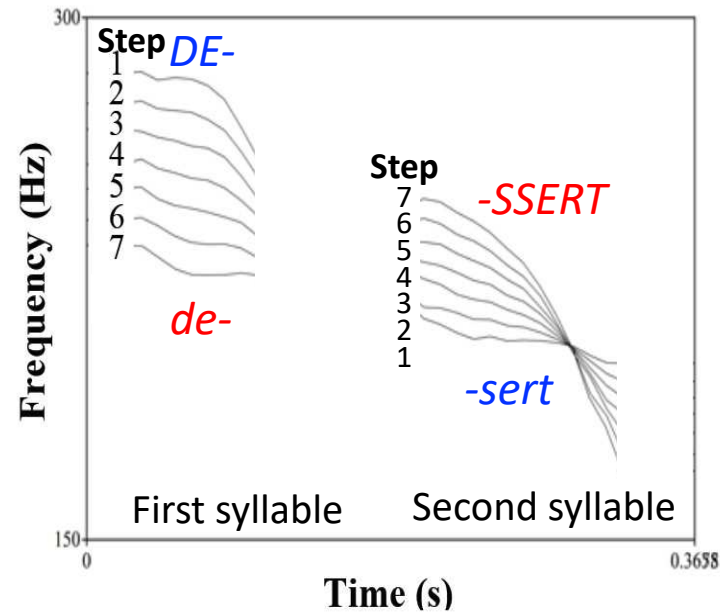
- Auditory stimuli manipulated in 7 equidistant steps from word-initial stress (Step 1) to word-final stress (Step 7)
- Manipulated dimensions
 - **Vowel quality** and **pitch** (duration and intensity neutralized; 49 stimuli x 3 repetitions)
 - **Vowel quality** and **duration** (pitch and intensity neutralized; 49 stimuli x 3 repetitions)
 - **Pitch** and **duration** (vowel quality and intensity neutralized; 49 stimuli x 3 repetitions)

Stimulus Manipulations (Tremblay et al., 2021) *JASA*

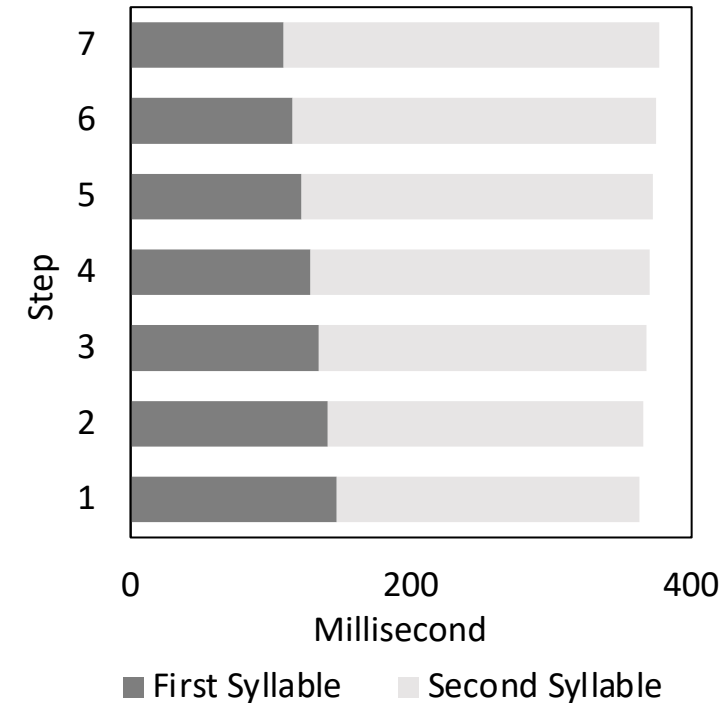
Formants



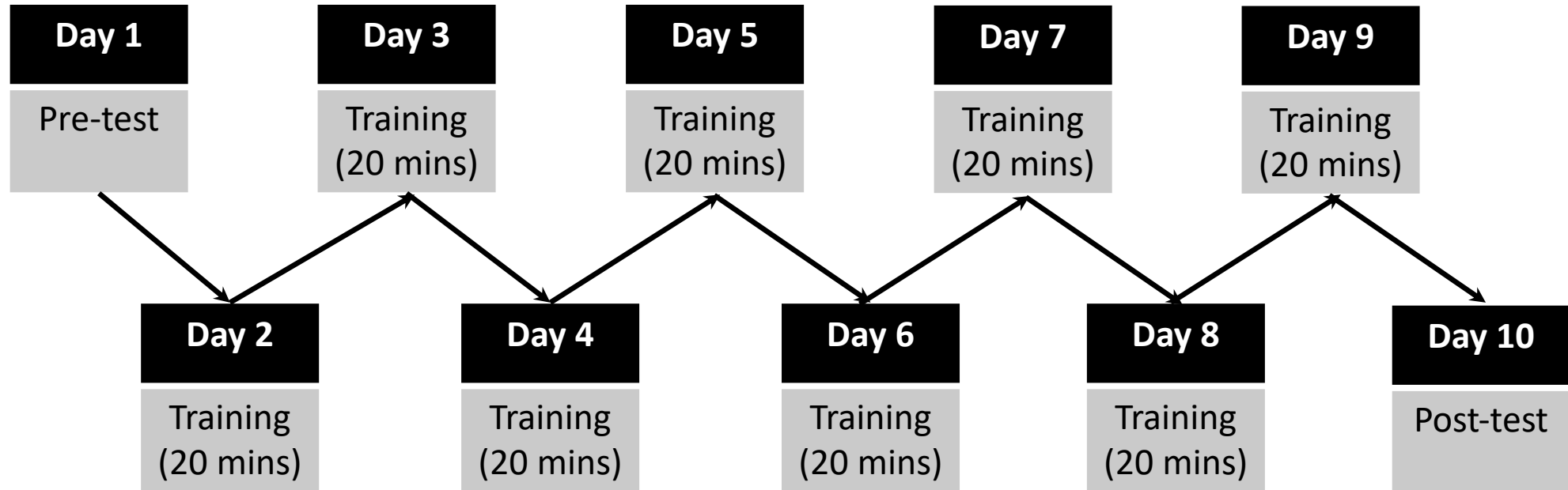
Pitch



Duration



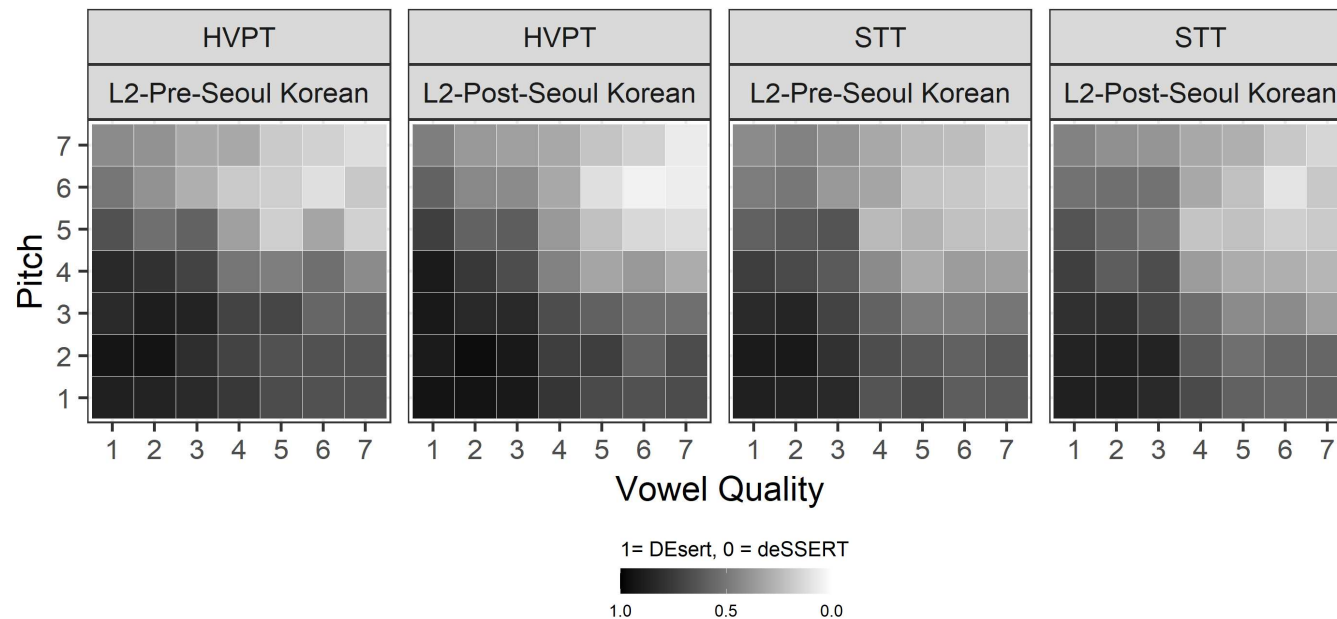
Procedures



Each training session: 36 word pairs x 4 (288 stimuli)
Pre-/post-test conducted in lab; training conducted remotely

Results

- Use of vowel quality increases with training for both HVPT and STT

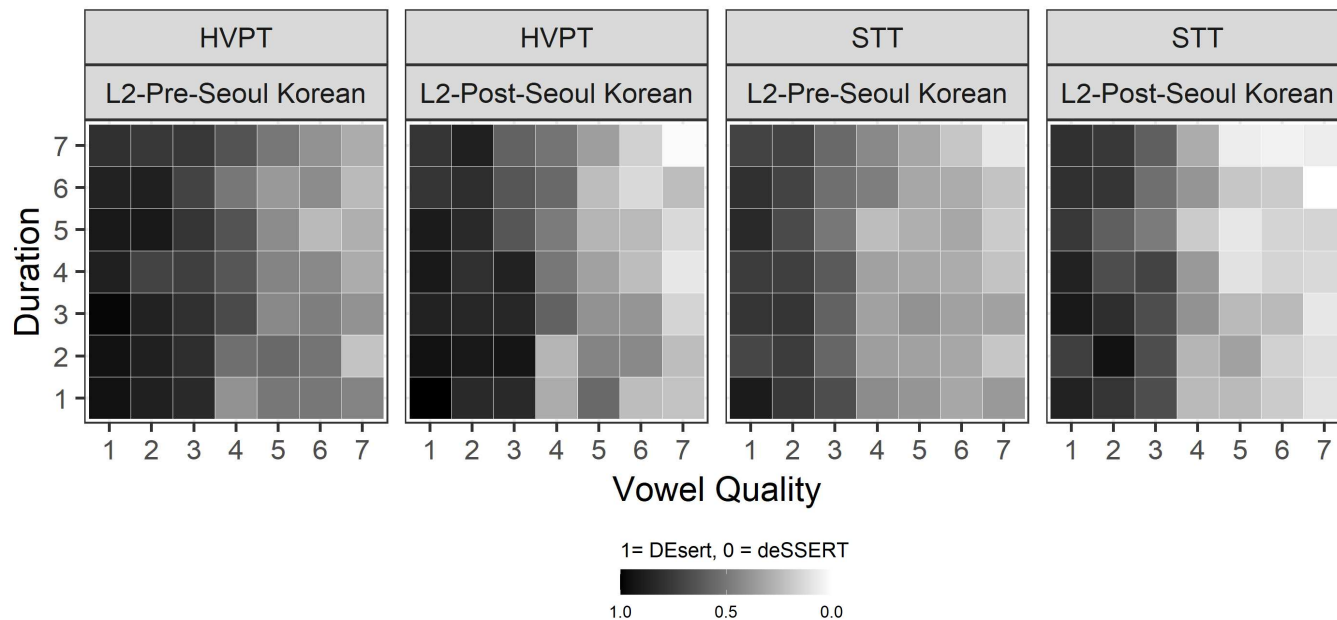


Mixed-effects Logistic Regression with Best Fit for Vowel Quality (VQ) x Pitch Stimuli

	Est.	SE	z	Pr(> z)
(Intercept)	0.25	0.09	2.77	.006
VQ	-0.39	0.03	-13.02	< .001
Pitch	-0.54	0.03	-18.30	< .001
Test (Post-test)	-0.11	0.04	-3.10	.002
Training (STT)	-0.05	0.10	< 1	>.1
VQ × Test (Post-test)	-0.06	0.02	-2.86	.004
Pitch × Test (Post-Test)	-0.03	0.02	-1.34	>.1
VQ × Training (STT)	0.01	0.02	< 1	>.1
Pitch × Training (STT)	0.12	0.02	6.17	< .001

Results

- Use of vowel quality increases with training for both HVPT and STT

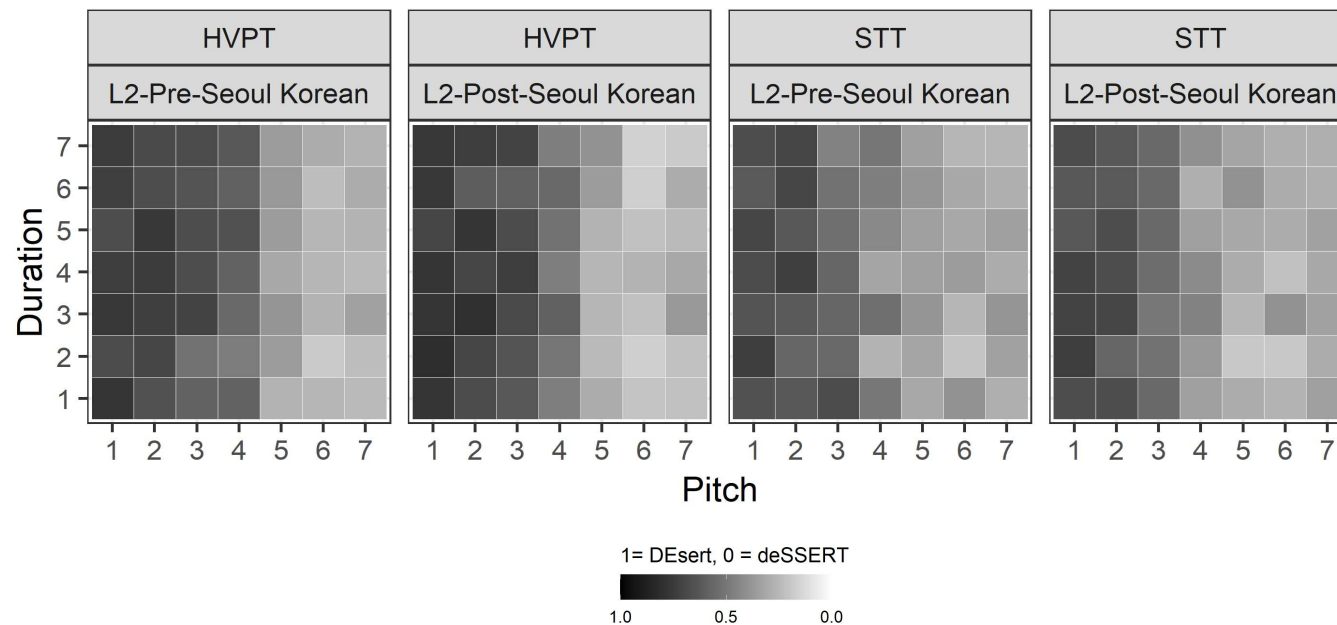


Mixed-effects Logistic Regression with Best Fit for Vowel Quality (VQ) x Duration Stimuli

	Est.	SE	z	Pr(> z)
(Intercept)	0.47	0.14	3.29	.001
VQ	-0.42	0.02	-18.09	< .001
Duration	-0.05	0.02	-2.33	.020
Test (Post-test)	-0.33	0.04	-9.32	< .001
Training (STT)	-0.19	0.20	< 1	>.1
VQ × Test (Post-test)	-0.08	0.02	-4.45	< .001
Duration × Test (Post-test)	-0.02	0.02	-1.26	>.1
VQ × Training (STT)	0.00	0.02	< 1	>.1
Duration × Training (STT)	0.00	0.02	< 1	>.1

Results

- Use of pitch *increases* with training for both HVPT and STT

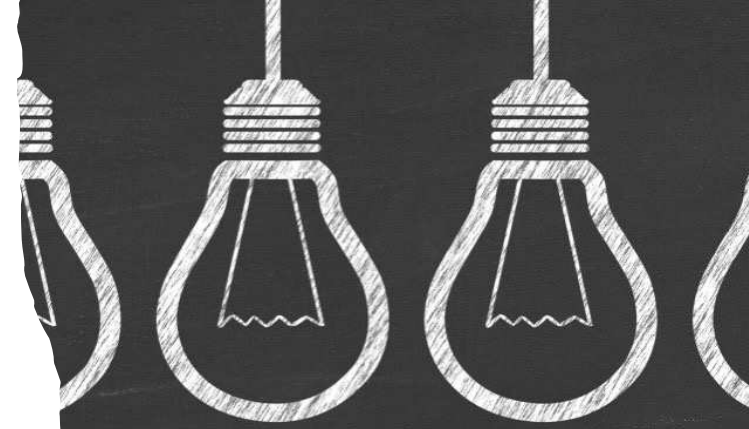


Mixed-effects Logistic Regression with Best Fit for Pitch x Duration Stimuli

	Est.	SE	z	Pr(> z)
(Intercept)	-0.02	0.09	-0.18	>.1
Pitch	-0.44	0.02	-19.95	< .001
Duration	0.04	0.02	2.00	.045
Test (Post-test)	-0.14	0.03	-4.09	< .001
Training (STT)	-0.03	0.12	< 1	>.1
Pitch × Test (Post-test)	-0.06	0.02	-3.25	.001
Duration × Test (Post-test)	-0.02	0.02	-1.26	>.1
Pitch × Training (STT)	0.13	0.02	7.43	< .001
Duration × Training (STT)	-0.02	0.02	-1.31	>.1

Discussion and Conclusion

- HVPT and STT yielded comparable effects on the use of vowel quality cues to English lexical stress
 - Intonational variability in both training types may have encouraged the development of robust representations
- The greater occurrence of H* than of L* in training may have led listeners to rely more on this cue after training
 - Future training should make pitch cues to lexical stress unpredictable





Discussion and Conclusion

First study to show beneficial effects of perceptual training on listeners' weighting of acoustic cues to lexical stress

Thank You!
Děkuji!

