The perception and production of L2 Mandarin neutral tone by Japanese and Korean learners

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Introduction

- L2 learners have difficulties perceiving and producing L2 English stress.
- The Feature Hypothesis: if the phonetic feature signifying an L2 contrast is also contrastive in the L1, perception and production will be facilitated [1].
- Supported by: Japanese speakers produced the duration of English unstressed vowels better than Korean speakers [2].
- Probably because Japanese contrasts vowel length but not Korean [3].
- Mandarin neutral tone resembles English unstressed syllables, but less studied.
- Properties of neutral tone [4,5]
  - occurs in non-initial positions
  - shorter duration than lexical tones (50~70%)
  - context-dependent pitch patterns (falling after T1/2/4, level/rising after T3)

Preceding tone	Neutral tone	
	Pitch	Duration
T1 [55]	mid falling [41]	50~60%
T2 [35]	high falling [52]	50~60%
T3 [21]	mid level [33/34]	~70%
T4 [53]	low falling [21]	50~60%

Table 1: Pitch patterns and duration of neutral tone.

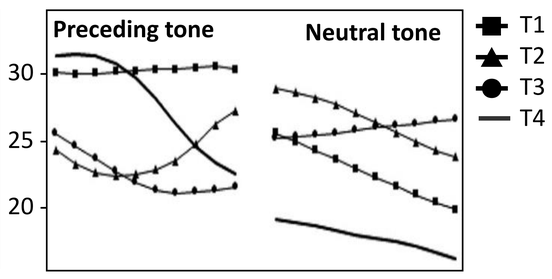

Figure 1: Pitch patterns of neutral tone following different lexical tones [6]

Types		Example	Properties
lexeme		tou2fa0 'hair'	irregular, unpredictable
reduplication		ge1ge0 'brother'	regular predictable
suffix	-de	dui4de0 'right'	
	-le	zou3le0 'gone'	
	-zi	bei1zi0 'cup'	

Table 2: Types of neutral tone words.

- In some cases, neutral tone can differentiate lexical meanings.
- *dong1xi1* 'east and west'
  dong1xi0 'things'

- **The present study:** We compared the perception and production of Mandarin neutral tone by L1-Japanese (NJ) and L1-Korean (NK) L2 learners. Native Mandarin (NM) speakers are also included as the baseline. Duration (phonemic vowel length) [3] and pitch (lexical pitch accent) [7] are contrastive in Japanese but not in Korean [8]. Thus, under the Feature Hypothesis, NJ speakers are predicted to outperform NK speakers.

Methods

- Participants
  17 NJ speakers (≥ HSK 5); 16 NK speakers (≥ HSK 5); 20 NM speakers for perception experiment; 10 speakers each for production
- Perception experiment
  - Task 1: AX discrimination task
    - Aim: testing whether L2 learners can differentiate neutral tone from lexical tones perceptually.
    - Stimuli: 15 disyllabic minimal pairs + fillers
  - Task 2: Meaning matching task
    - Aim: testing whether L2 learners are sensitive to the meaning differences distinguished by neutral tone.
    - Stimuli: another 5 disyllabic minimal pairs.
    - Procedure: participants heard two audio stimuli and saw a context sentence on the computer. They were required to match the correct audio stimuli to the appropriate context.
- Production experiment: Reading aloud
  - Aim: analyzing the pitch and duration of neutral tone acoustically.
  - Stimuli: 56 disyllabic neutral tone words (4 preceding tones × 14 words)
  - Procedure: Remote data collection (ZOOM + smartphone recording) [9]; Target word were embedded in *wo3du2__san1ci4* 'I read __ three times' with two repetition.
  - Measurements:
    - F0 values at 10 equal distant time points of the neutral tone syllables
    - duration of neutral tone and its preceding tone
    - duration ratio = duration of neutral tone/duration of its preceding tone.

Results

- **Perception of neutral tone**
  - AX discrimination task
    - No significant difference between NJ, NK, and NM groups ($F(2,50) = 1.314$, $p = .278$)
  - Meaning matching task
    - No significant difference between the NJ and NK groups ($p = .524$)
    - Both NJ and NK groups are significantly lower than the NM group ($ps < .001$)
- **Pitch patterns of neutral tone**

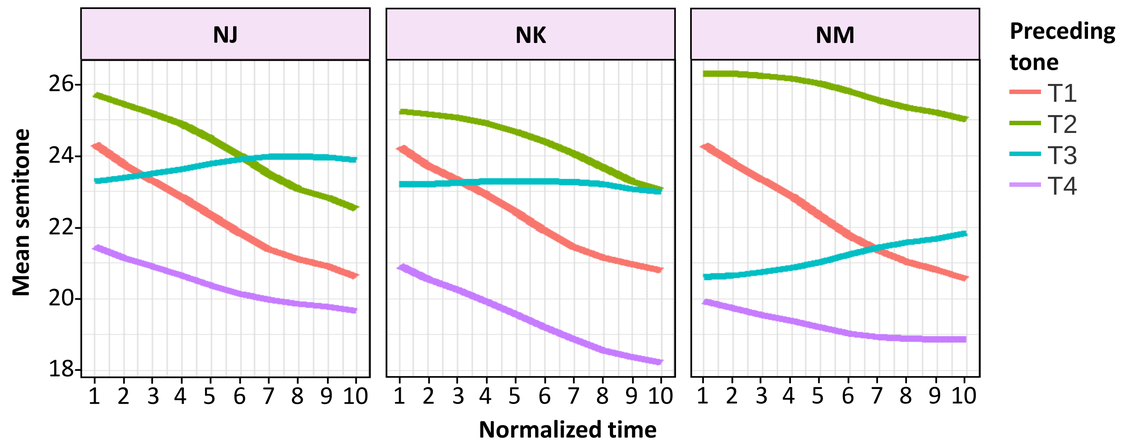

Figure 4: Pitch patterns of neutral tone produced by the three groups.

- Both NJ and NK speakers distinguished the pitch patterns (falling vs. non-falling) of neutral tone after different lexical tones like NM speakers did.
- Still some observable difference: both NJ and NK groups had less dispersed distribution of neutral tone after four lexical tones.

- **Duration patterns of neutral tone**

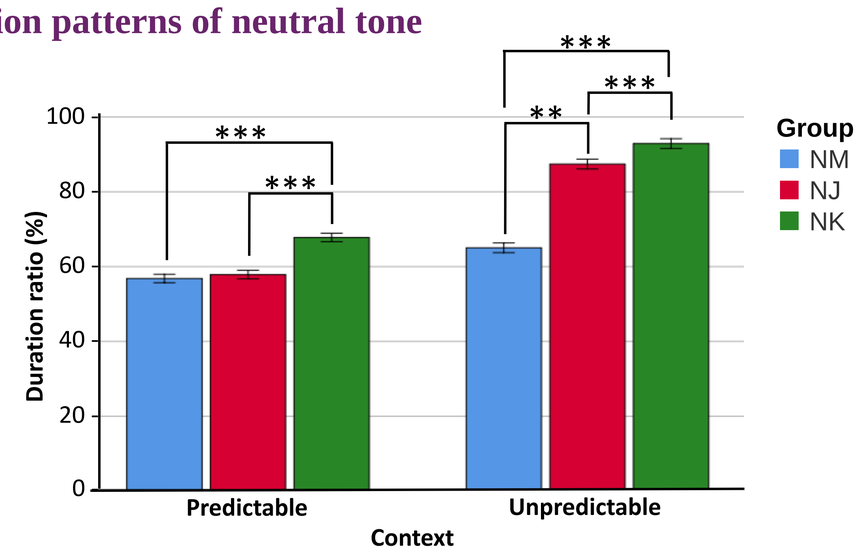

Figure 5: Duration ratios of neutral tone produced by the three groups.

- Predictable context (reduplication and suffix types): NM = NJ < NK
- Unpredictable context (lexeme type): NM < NJ < NK
- Therefore, NJ speakers had better performance than NK speakers.

Discussion

- NJ and NK speakers did not differ significantly in the AX discrimination task, probably due to the simple task nature.
- Both NJ and NK speakers had difficulties distinguishing neutral tone words in context.
- Inconsistent with out prediction, both NJ and NK speakers could produce the context-conditioned pitch patterns of neutral tone. However, cross-linguistic differences may be obscured by high proficiency.
- NJ speakers produced more native-like duration ratios of neutral tone than NK speakers did. The results supported the Feature Hypothesis.
- NK speakers nevertheless produced neutral tone with shorter duration. Is it because durational difference is relatively easier to acquire [10]? Influence from learning English unstressed syllables? Or both.
- Future studies need to include L2 learners with various L1 backgrounds and proficiency levels.

[1] McAllister, R., Flege, J. E., & Piske, T. (2002). The influence of L1 on the acquisition of Swedish quantity by native speaker of Spanish, English and Estonian. *Journal of Phonetics*, *30*(2), 229–258. [2] Lee, B., Guion, S. G., & Harada, T. (2006). Acoustic analysis of the production of unstressed english vowels by early and late Korean and Japanese bilinguals. *Studies in Second Language Acquisition*, *28*(3), 487–513. [3] Hirata, Y. (2004). Effects of speaking rate on the vowel length distinction in Japanese. Journal of Phonetics, 32(4), 565–589. [4] Lin, M., & Yan, J. (1980). Beijinghua qingsheng de shengxue xingzhi[Acoustic properties of neutral tone in Beijing Mandarin]. *Fangyan*, *3*, 166–178. [5] Lee, W.-S., & Zee, E. (2008). Prosodic characteristics of the neutral tone in Beijing Mandarin. *Journal of Chinese Linguistics*, *36*(1), 1–29. [6] Tang, P. (2014). Riben gaoji hanyu xuexizhe hanyu qingsheng yunlv xide pianwu fenxi[A study of prosodic errors of Chinese neutral tone by advanced Japanese students]. Huawen Jiaoxue Yu Yanjiu, 4, 39–47. [7] Kawahara, S. (2015). The phonology of Japanese accent. In M. Shibatani & T. Kageyama (Eds.), *Handbook of Japanese phonetics and phonology* (pp. 445–492). De Gruyter. [8] Jeon, H.-S. (2015). Prosody. In L. Brown & J. Yeon (Eds.), *The handbook of Korean linguistics* (pp. 41–58). John Wiley & Sons, Inc. [9] Ge, C., Xiong, Y., & Mok, P. (2021). How reliable are phonetic data collected remotely? Comparison of recording devices and environments on acoustic measurements. *Proceedings of INTERSPEECH 2021*, 3984–3988. [8] Bohn, O.-S. (1995). Cross Language Speech Perception in Adults First Language Transfer Doesn''t Tell It All. *Speech Perception and Linguistic Experience: Issues in Crosslanguage Research*.