Language-Specific Cue Weighting Effects in the Identification of the Korean Voiceless Stops by English-Speaking L2 Learners of Korean

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ABSTRACT

The current study investigates to what extend the acoustic properties of the native language (L1) influence the identification of a new phonemic contrast in a second language (L2). Considering that English only has two voiceless stops (e.g., [p] and [p^h]), this study examines what acoustic cues English-speaking L2 learners of Korean use in categorizing the three-way voiceless stops in Korean (e.g., [p], [p'], and [p^h]). 30 English-speaking L2 learners of Korean completed a lexical identification task, in which VOT and F0 were orthogonally manipulated. The results revealed that learners primarily use VOT, but they switch to use also F0 as their proficiency in Korean increases.

Keywords: identification, F0, VOT, Korean stops, second language acquisition.

1. Introduction

All the languages in the world show phonetic contracts that differ from each other in language-specific ways, that is, using a specific set of acoustic cues (e.g., [1]). Perceptually, not all cues are weighted similarly by native speakers (e.g., [2]), such that there is a particular cue reliance/weighting during the identification of these sounds ([3]). For example, while English primarily uses VOT to distinguish between voiced and voiceless stops in word-initial position ([4]), in Korean, F0 is as important as VOT for distinguishing the three voiceless stops (i.e., aspirated-/p^h/, lenis-/p/, and fortis-/p'/) (e.g., [5]). Learning an L2, thus, implies learning new sound contrasts, not present in learners' L1. This opens the question of what happens with this language-specific cue weighting: Are learners able to acquire this specific perceptual property of their L2, do they continue using the cue weighting of their L1 (when possible), or do they employ different mechanisms than native speakers to identify the different sound contrasts in their L2?

Given the cue weighting differences between English and Korean production and perception of stops, the current study aims to explore how English-speaking L2 learners of Korean, at different levels of proficiency, use the cues to distinguish between the three Korean stops (F0 and VOT) and how they pattern with respect to native speakers of Korean (from [5]). Previous studies seem to indicate that L2 learners of Korean primarily rely on VOT in acquiring the Korean stop contrast ([6]). However, it is not clear whether there is a switch towards more native-like use of the cues as these learners' proficiency in Korean increases, a gap that this study aims to address.

2. Methods

2.1. Subjects

30 English-speaking L2 learners of Korean completed a lexical identification task using Paradigm [7]. Participants were asked to complete a background questionnaire containing information regarding their proficiency (established using self-ratings) and experience with Korean, as reported in Table 1.

Table 1: Background Information

	AOA	Years of instruction	Length of immersion (months)	L2 Proficiency (self-ratings 1-10)
Mean	21.4	1.73	3.25	3.67
SD	6.75	2.1	5.83	2.03

2.2. Stimuli and Design

The stimuli were 120 real words ('풀' [p^{h}ul] (glue/grass), '불' [pul] (fire), '뿔' [p'ul] (horn)) orthogonally varying both VOT and F0. A 5-step VOT continuum ranging from 10 to 98ms in 22ms steps (10, 32, 54, 76 and 98ms), by compressing and expanding the VOT portion of a base token produced by a male native speaker of Seoul Korean. Then, at each of the five VOT steps, the onset F0 was lowered to 85Hz and heightened to 160Hz in 15Hz steps, yielding a 6-step F0 continuum (85, 100, 115, 130, 145 and 160Hz). The endpoints of the continua fall into one of the three stop categories in Korean ([8]).

Participants' task was to select which word they thought they had heard from the three options presented in the screen.

2.3. Analysis

Listeners' categorical responses were analysed using a multinomial logistic regression model, using *nnet* package ([9]) in *R* ([10]). In this model, the dependent variable was the three discrete categories chosen by the listeners and independent variables were the different levels of VOT and F0, treated as continuous variables, proficiency, treated as a continuous variable (with proficiency ranging from 1 'low-beginner' to 10 'near-native'), and their interactions. This model predicts the odds of being categorized as each of the three categories as a function of VOT and F0, while considering the effects of proficiency in this categorization.

3. Results

The model summarized in Table 2 revealed a simple effect of VOT (for both the fortis and lenis conditions) as well as an interaction, in both cases, between F0 and proficiency. These results indicate the English-speaking L2 learners of Korean primarily used the VOT cues to distinguish between the three voiceless stops in Korean but that, as their proficiency in Korean increases, they could make use of F0 cues.

Table 2: Multinomial Logistic Regression Model Results

		Estimate (SE)	*z*	*p*
Fortis	Intercept	1.87 (0.2)	9.30	< .001
	VOT	-0.71 (0.03)	-26.33	< .001
	F0	-0.07 (0.04)	-1.52	0.13
	Proficiency	0.24 (0.05)	5.23	0.00
	F0 x Proficiency	-0.05 (0.01)	-4.88	0.00
Lenis	Intercept	2.12 (0.19)	10.99	< .001
	VOT	-0.83 (0.03)	-31.42	< .001
	F0	0.02 (0.04)	0.44	0.66
	Proficiency	0.40 (0.04)	8.91	< .001
	F0 x Proficiency	-0.10 (0.01)	-8.89	< .001

Note: df = 1080; $\alpha = .05$

4. Discussion

The current study examined how English-speaking L2 learners of Korean use F0 and VOT cues to distinguish the Korean stops, while determining whether there is a switch towards more native-like use of the cues as learners' proficiency in Korean increases.

The results of this study seem to be compatible with a scenario in which these learners start using the cues present in their L1 and, with increasing proficiency, they can switch towards using the cues in a more native-like way. English uses VOT primarily to distinguish between the voicing contrast in word-initial stops ([4]), which then they transfer in their discrimination of the Korean voiceless stops. However, with increasing proficiency, they can start using both F0 and VOT cues, the same way in which native speakers of Korean discriminate among these three sounds (e.g., [5]).

Taken together, this study demonstrates how learners of L2 Korean develop their use of VOT and F0 cues in categorizing Korean stops. However, further studies need to examine at which point (in terms of proficiency) learners start to use F0, by testing a larger population of learners, as well as with other language backgrounds.

References

[1] Lisker, L. (1978). Rapid vs. rabid: A catalogue of acoustic features that may cue the distinction. *Haskins Laboratories Status Report on Speech Research, 54*, 127-132.

[2] Nearey, T. M. (1989). Static, dynamic, and relational properties in vowel perception. *The Journal of the Acoustical Society of America*, *85*(5), 2088-2113.

[3] Scobbie, J. M. (1989). Interactions between the acquisition of phonetics and phonology. In *Papers from the 34th Annual Regional Meeting of the Chicago Linguistic Society.* (pp. 343-358). Chicago Linguistics Society.

[4] Lisker, L., & Abramson, A. S. (1964). A cross-language study of voicing in initial stops: Acoustical measurements. *Word*, *20*(3), 384-422.

[5] Lee, H., Politzer-Ahles, S., & Jongman, A. (2013). Speakers of tonal and non-tonal Korean dialects use different cue weightings in the perception of the three-way laryngeal stop contrast. *Journal of phonetics, 41*(2), 117-132.

[6] Chang, S. E., Burge, M., & Choi, Y. (2011). A cross-linguistic study of Korean laryngeal stops by the native speakers of Chinese, English, Korean, and Spanish. In *Proceedings of the 17th International Congress of Phonetic Sciences* (pp. 432-435).

[7] Tagliaferri, B. (2005). Paradigm. Perception Research Systems, Inc. Retrieved from www.perceptionresearchsystems.com

[8] Kang, K. H., & Guion, S. G. (2006). Phonological systems in bilinguals: Age of learning effects on the stop consonant systems of Korean-English bilinguals. *The Journal of the Acoustical Society of America, 119*(3), 1672-1683.

[9] Venables, W. N., & Ripley, B. D. (2013). Modern applied statistics with S-PLUS. Springer Science & Business Media.

[10] R Development Core Team (2008). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org.