

# The spread of the High toned /il/ in Seoul Korean: from ‘one’ to other meanings

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**1. Introduction.** Seoul Korean is known to show a LH-LH phrasal tonal pattern in an Accentual Phrase (AP), unless an AP-initial consonant is tensed or aspirated (Jun 1993, 2000). Previous studies have shown that Korean is undergoing a tonogenesis in voiceless stops, where tensed or aspirated consonants are produced with a H tone and lenis stops are produced with a L tone (Silva 2006; Oh 2011; Kang 2014; and among others). Since an AP shows LHLH unless the phrase-initial segment is tensed or aspirated, a vowel-initial AP is expected to show LHLH. However, Jun & Cha (2011) report that an AP-initial /il/ is sometimes produced with a H tone. Their study finds that i) younger speakers aged less than the mid 40s are more likely to produce /il/ with a H tone; ii) out of three meanings of /il/, ‘one (1)’, ‘day’, and ‘work’, /il/ meaning ‘one’ is most frequently produced with a H tone; iii) the High toned /il/ seems to be a unique feature of Seoul Korean.

Since Jun & Cha (2011) is the only previous study on the phenomenon, there is still much to be learned about its development. In particular, considering that many studies on linguistic changes have shown that a linguistic change is the most advanced among adolescents (e.g. Trudgill, 1974; Labov, 2001; and among others), it is hard to fully describe a developing sound change without investigating teenagers. Thus, I examine the High toned /il/ phenomenon by conducting a production experiment with 40 speakers of Seoul Korean and I provide further evidence that the phenomenon is spread to all meanings of /il/.

**2. Methods.** 40 speakers of Seoul Korean participated in a production experiment. 19 participants were aged 20-29, and the other 21 speakers were aged 14-19. All speakers in the 20s group were Korean students studying in the U.S., and the subjects in the teenager group were middle school or high school students living in Seoul (or in the immediate vicinity) in Korea.

	Male	Female	Total	Mean age
Teens	11	10	21	16 (1.14)
20s	10	9	19	25.89 (3.43)
Total	21	19	40	20.7 (5.57)

Table 1: Distribution of the participants by age and gender (standard deviation)

Target words were placed in the second AP in three-AP sentences. There were 60 sentences with target words and 25 filler sentences. Out of 60 sentences, 32 words start with /il/, 24 words start with /i/ followed by six different coda consonants and 4 words have no coda consonant. Among the 32 words starting with /il/, /il/ means ‘one’ in 9 words, ‘day’ in 8 words, ‘work’ in another 8 words, and has other meanings in the last 7 words. The last 7 words start with /il/ but the meaning of /il/ in those words is not related to ‘one’, ‘day’, or ‘work’, for example /il.hin/ ‘seventy’. A carrier sentence was also employed: /tilidorok \_\_\_\_\_ haseyo/ ‘Say \_\_\_\_\_ aloud.’ The subjects were asked to read each sentence twice and a carrier sentence once. The total number of tokens is 7200 (40 participants x 60 target words x 3 times). The obtained f0 values were normalized using z-score transformation. A linear regression model and a mixed-effects model were built to examine the effect of age on the percent of a H tone ( $z > 0$ ) and the interactions of age and meaning.

### 3. Results.

3.1. MEANING. This section explores the effect of the different meaning categories on the target vowels. Figure 1 shows the distribution and the mean z-scores by the meaning categories with beanplots. In line with Jun & Cha’s result (2011) that /il/ ‘one’ is most frequently high-toned, the present study also finds that /il/ ‘one’ has the highest mean z-score (1.163). The mean z-score for /il/ ‘day’ is about zero (-0.049), yet its distribution is negatively skewed. The mean z-score of /il/ ‘work’ (-0.279) is lower than /il/ ‘one’ or ‘day’ and its distribution is also negatively skewed. The mean z-score of /il/ with other meanings (0.23) is higher than ‘work’ or ‘day’, yet it is much lower than /il/ ‘one’. Interestingly, it shows a binomial distribution, which indicates a high level of lexical variation. As expected, the mean z-score of /iC/ is the lowest (-0.512) among all meaning categories.

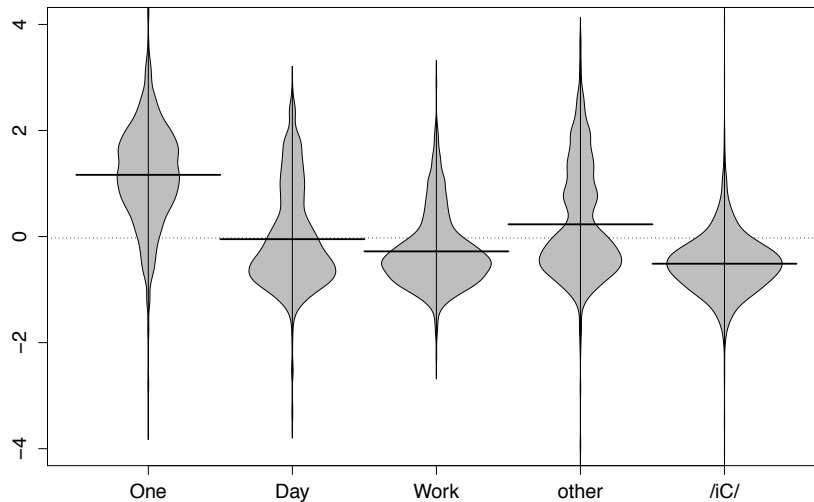


Figure 1. Mean and distribution of z-scores by meaning: a solid bold line for each meaning represents the mean z-score of the category, and the gray areas show the density trace of z-scores.

Table 2 shows the output of the mixed-effects analysis, demonstrating the effect of meaning. Here, the main point is whether /il/-initial words were produced with a significantly higher f0 than /iC/. The result finds that all /il/ categories are estimated to be significantly higher than /iC/. In this model, the estimated mean z-score of /il/ ‘one’ is 1.57 higher than that of /iC/ ( $p < 0.0001$ ). The estimated mean z-score of /il/ ‘day’ is 0.44 higher than that of /iC/, and their difference is statistically significant ( $p = 0.0006$ ). Also, the estimated difference between /il/ ‘work’ and /iC/ is the lowest among all comparisons, 0.26, yet it is still statistically significant ( $p = 0.028$ ). Lastly, the difference between /il/ with other meanings and /iC/ (0.72) is estimated to be significant ( $p < 0.0001$ ).

	Estimate	Std. error	<i>t</i> -Value	Pr (>  <i>t</i>  )
(intercept)	0.1	0.04	2.28	= 0.026
One	1.57	0.09	16.76	< 0.0001
Day	0.44	0.12	3.64	= 0.0006
Work	0.26	0.12	2.25	= 0.028
other	0.72	0.12	5.8	< 0.0001

Table 2: The output of the linear mixed-effects models for the effect of meaning: the intercept shows the *grand mean* of the means of all meaning categories, and the reference category is /iC/.

3.2. AGE. This section explores how participants' age (range: 14 to 30) affects the f0 values of the target vowels. Figure 2 shows the participants' percentages of a H tone ( $z > 0$ ) among all /il/-initial tokens by age.<sup>1</sup> In Figure 2, the percent of a H tone gradually decreases as the age of the participants increases. A linear regression analysis reports that the percent of a H tone decreases by 1.117 per one year (Percent = 79.035 - 1.117\*Age), and this association turns out to be significant (Adj.  $R^2 = 0.14$ ;  $F(1,38) = 7.58$ ;  $p = 0.009$ ). To examine the effect of age on each meaning category, we also built a linear mixed-effects model with age, the meaning categories, and their interactions as fixed-effect variables. Table 3 summarizes the output of the model, and the associations of age and the meaning categories are visually provided in Figure 3.

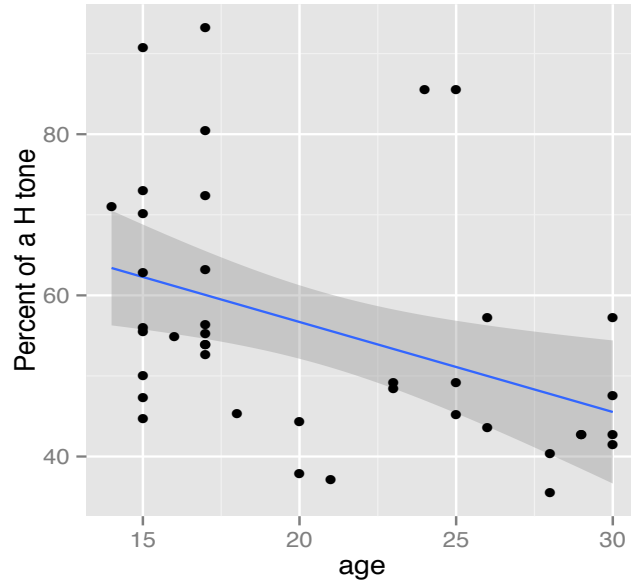


Figure 2. Percent of a H tone among all /il/-initial tokens by age.

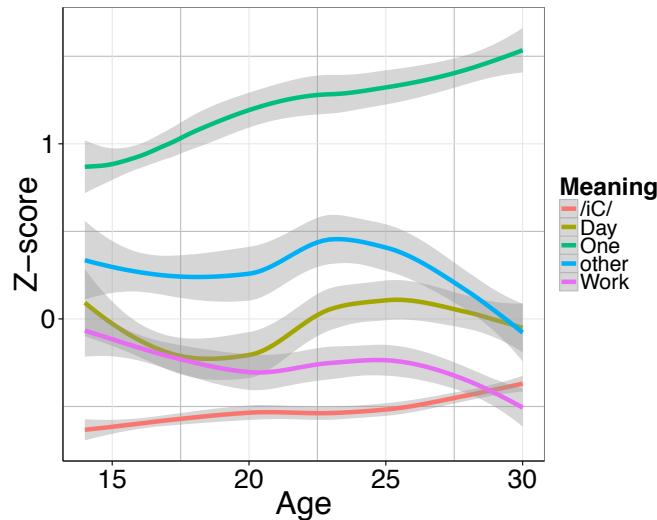


Figure 3. The z-scores of each meaning category by age. (gray areas: 95% confidence interval)

<sup>1</sup> Note that a H tone is defined as having a positive z-score in this paper, as a positive z-score indicates a single f0 value is higher than the mean f0 value of a speaker.

The mixed-effects model estimates that the difference in z-score between /il/ ‘one’ and /iC/ significantly increases by 0.027 per year ( $p < 0.0001$ ). That is, older speakers produced /il/ ‘one’ with a higher z-score than younger speakers did. On the other hand, the model finds that the estimated differences between the other /il/-initial categories and /iC/ decrease per year, which indicates younger speakers in general produced those categories with a higher f0 than older speakers. The difference in /il/ ‘day’ and /iC/ (-0.007/yr) does not reach statistical significance ( $p = 0.135$ ), yet the other comparisons are found to be significant ( $p < 0.0001$  for the three comparisons). Also, while both /il/ ‘work’ and /il/ with other meanings are estimated to decrease with similar rates (0.033 and 0.031 per year), the coefficients of their main effects differ considerably (1.417 for /il/ with other meanings and 0.975 for /il/ ‘work’), indicating the estimated z-score is also higher for /il/ with other meanings than for /il/ ‘work’.

	Estimate	Std. error	t-Value	Pr (> t )
(intercept)	-0.018	0.058	-0.308	= 0.758
One	1.06	0.13	8.145	< 0.0001
Day	0.601	0.159	3.787	= 0.0002
Work	0.975	0.16	6.074	< 0.0001
other	1.417	0.166	8.529	< 0.0001
Age	0.006	0.002	3.421	= 0.001
One*Age	0.027	0.005	6.002	< 0.0001
Day*Age	-0.007	0.005	-1.493	= 0.135
Work*Age	-0.033	0.005	-6.206	< 0.0001
other*Age	-0.031	0.005	-6.093	< 0.0001

Table 3: The output of the linear mixed-effects model for the effect of the interaction of age and meaning: the reference group of meaning is /iC/.

**4. Conclusion.** Based on the result that /il/ ‘one’ was produced with the highest f0 by all participants, we confirm that the phenomenon has started from /il/ ‘one’. Furthermore, considering that the estimated coefficients of /il/ ‘day’, ‘work’, and /il/ with other meanings increase for teenagers, we propose that the phenomenon is spreading to all meanings of /il/ among younger speakers, which may result in a potential tonal contrast between /il/ and /iC/ in Seoul Korean. If this change continues to spread, it may be expected to see a higher percentage of the High toned /il/ among children. A future study would be worthwhile investigating how children produce this phenomenon.

## References

- Jun, Sun-Ah. 1993. *The Phonetics and Phonology of Korean Prosody*. Columbia, OH: The Ohio State University dissertation.
- Jun, Sun-Ah. 2000. K-ToBI (Korean ToBI) labeling conversions: Version 3. *Speech Sciences* 7. 143-169.
- Jun, Sun-Ah & Jihyeon Cha. 2011. High-toned [il] in Seoul Korean. Proceedings of the 17<sup>th</sup> ICPHS, Hong Kong, China.
- Kang, Yoonjung. 2014. Voice Onset Time merger and development of tonal contrast in Seoul Korean stops: A corpus study. *Journal of Phonetics* 45. 76-90.
- Labov, William. 2001. *Principles of linguistic change: Social factors*. In the series, *Language in Society* 29. MA: Blackwell Publishing.
- Oh, Eunjin. 2011. Effects of speaker gender on voice onset time in Korean stops. *Journal of Phonetics* 39. 59-67.
- Silva, David. J. 2006. Acoustic evidence for the emergence of tonal contrast in contemporary Korean. *Phonology* 23. 287-308.
- Trudgill, Peter. 1974. *The social differentiation of English in Norwich*. Cambridge: Cambridge University Press.