Korean L2 speakers' phonological representation of the English /l/-/r/ contrast

Our study investigates how L2 speakers represent phonemic contrasts not present in the L1. Specifically, we test how the arguable absence of an /l/-/r/ contrast in L1 Korean affects the encoding of these phonemes in L2 English. It is well-documented that L2 learners face challenges in accurately perceiving and producing contrastive L2 phonemes that are absent in the L1; L2 speakers' perception of contrasts is influenced greatly by the experience they have with their L1 phonology ([1]). A well-known example is the English /l/-/r/ contrast and the difficulties it poses for Korean and Japanese speakers. Furthermore, even highly proficient bilinguals who appear to have no foreign accent are not quite native-like in distinguishing L2-specific sounds ([6]). More recently, in work with L1 Japanese/L2 English speakers, Ota et al. [5] showed that visual recognition of non-native words and, by implication, their lexical representations, are influenced by L1 phonology (the absence of an /l-r/ distinction in Japanese) even when auditory perception is not involved. **Our study** looks at Korean, which has a more complex system of liquid phonemes and thus allows us to gain new insights into speakers' phonological representations. By observing adult Korean speakers' categorization of the English /l/-/r/ contrast in onset position, we aim to further our understanding of how L1 phonological categories influence L2 lexical representations.

Korean liquids: Some linguists argue that the basic form of the Korean liquid is /l/, not /r/ ([4]), but others claim that the phonological representation of the Korean liquid is neutral with respect to the phonetic differences between [l] and [r] ([3]). Crucially, Korean liquids are realized differently in different syllable positions ([2]): Syllable-initial liquids in Korean–though rare–are realized as a flap. A liquid in coda position is realized as an alveolar lateral /l/; intervocalically, it is realized as an alveolar flap /ɾ/. Thus, [2] proposed that Korean speakers (unlike Japanese speakers) have a phonetic model available to them for the English /l-r/ contrast as long as the segments are *not in word initial position.* Thus, they predict that Korean speakers would have difficulty perceiving the /l-r/ contrast word-initially.

Experiment: To test this, we adapted Ota et al.'s visual *semantic-relatedness decision task* and stimuli, with the aim of investigating how L1 Korean speakers learning English encode potentially homophonous English pairs involving /l/-/r/. We used 20 /l/-/r/ "near-homophone" pairs (e.g., LOCK-HARD and ROCK-KEY, Table 1) and 20 spelling-controls (SOCK-HARD and SOCK-KEY). Target words were paired with semantic associates of their competing phoneme-counterparts. E.g., LOCK was paired with HARD because HARD is a semantic associate of LOCK's competing phoneme-counterpart ROCK. If seeing LOCK (in the LOCK-HARD pair) activates ROCK, a person might incorrectly think the two words are related in meaning or take longer to decide they are not. We also included 120 filler pairs.

Table 1. Sample experimental pairs and their corresponding spelling controls

/l/-experimental	spelling-control	/r/-experimental	spelling-control
LOCK-HARD (HARD is a semantic associate of ROCK)	SOCK-HARD	ROCK-KEY (KEY is a semantic associate of LOCK)	SOCK-KEY

Participants: 16 L1 Korean/L2 English late bilinguals and 16 L1 English controls participated.

Materials: Participants took part in (i) an online semantic-relatedness decision task, (ii) an offline phoneme identification task, and (iii) an offline lexical knowledge test. In the semantic-relatedness decision task, participants were asked to decide whether pairs of words were related in meaning. The phoneme identification task was necessary to ensure that the Korean participants were able to differentiate /l/ and /r/ perceptually. Following Ota et al., we used a two-alternative forced choice matching task involving auditory and visual nonsense syllables (e.g., /la/ vs. /ra/). We also tested participants' lexical knowledge of the words used in the stimuli through the lexical knowledge test. Only those items that participants answered correctly in this screening task were included in the analysis.

Results: For the semantic-relatedness decision task, we compared the accuracy rates and Reaction Times (RTs) in the experimental condition and the spelling-control condition. ***Accuracy***: We

first report how often participants correctly responded "NO" to the items. All experimental pairs and their spelling-control pairs were semantically *unrelated,* requiring "NO" responses. We ran Repeated Measures ANOVAs to test the effects of *Phoneme* (*/l/* vs. */r/*) and *Condition* (*Experimental* vs. *Control*) within each participant group. There was an overall effect of *Condition* in both the L1 Korean group (F1(1,15)=8.74, *p*<.01, F2(1,19)=3.41, *p*=.081) and the L1 English control group (F1(1,15)=8.17, *p*=.012, n.s. by item). We then looked separately at /l/- and /r/-items. Planned paired-samples t-tests showed that Korean speakers made more false positive errors (incorrect "YES") in the experimental condition when compared to the spelling-control condition, for both /l/ and /r/ items. With L1 English controls, planned comparisons revealed no significant differences between experimental vs. spelling control condition for /l/ or /r/-items.

Table 2. Summary of accuracy and reaction times

Condition	Sample item	Correct ("NO") responses (%)		Reaction times (ms)	
		Korean	English	Korean	English
/l/ experimental	LOCK-HARD	74.95 [Significant]	96.25	2452 [Significant]	1143
/l/ spelling-control	SOCK-HARD	85.74	93.68	2039	1193
/r/ experimental	ROCK-KEY	79.66 [Significant]	97.5	2189	1145
/r/ spelling-control	SOCK-KEY	90.07	95.56	2173	1127

***Reaction times*:** Following Ota et al., for RT analyses we excluded observations that were errors ("YES" responses) or outliers (RT >10,000 ms), and used median response times to reduce the impact of extreme RTs. In the *Korean speaker group*, there was a significant effect of *Condition* (F1(1,15)=4.985, *p*=.041, n.s. by item): Participants responded slower in the experimental condition (2320 ms) than in the spelling-control condition (2106 ms). There was also a significant interaction between *Phoneme* and *Condition* (F1(1,15)=8.517, *p*=.011, n.s. by item). The RT difference between the experimental condition and the spelling-control condition was greater in the /l/ items than in the /r/ items. Planned paired-samples t-tests showed that the RT in the experimental condition (LOCK-HARD) was significantly longer than in the spelling-control condition (SOCK-HARD) *only in the /l/ items* (t1(15)=-3.045, *p*=.008, n.s. by item), *and not in the /r/ items*. RTs for the *English controls* revealed no significant effects.

Discussion: The accuracy rates revealed that, unlike native controls, L1 Korean/L2 English speakers made more false positive errors (responded that the pairs of words were *related*) in the experimental condition than in the spelling-control condition *with both /l/ and /r/ items.* Furthermore, the latency analysis revealed a finer-grained sensitivity: Korean speakers took *longer* to accurately reject the semantic-relatedness of the experimental pairs than the spelling-control pairs *only in the /l/-items*. That is, they took longer to say that **L**OCK and HARD are unrelated, compared to the spelling-control condition SOCK-HARD – but responses to **R**OCK and KEY were not slower than responses to the spelling-control condition. As a whole, our findings suggest *asymmetrical interference:* We suggest that processing LOCK triggers access to ROCK during online processing, but that ROCK does not interfere with LOCK to the same extent. We propose that English *onset* liquids /l/ and /r/ are more likely to be mapped into a single Korean category of /r/ rather than /l/. In addition, given that the task we used does not rely on auditory input but rather investigates the mental representations activated by written words, we argue, line with [5], that the experiences L2 speakers have with L1 phonology influences not only L2 speech perception *per se* [1], but also L2 lexical representations that do not involve auditory input.

References: [1] Best, McRoberts, Goodell (2001). Discrimination of non-native consonant contrasts varying in perceptual assimilation to the listener's native phonological system. *JASA, 109*, 775-794. **[2]** Ingram, Park (1998). Language, context, and speaker effects in the identification and discrimination of English /r/ and /l/ by Japanese and Korean listeners. *JASA, 103*, 1161-1366. **[3]** Iverson, Sohn (1994). Liquid Representation in Korean. *Theoretical Issues in Korean Linguistics*, 77–100. **[4]** Kim-Renaud (1974). *Korean Consonantal Phonology*. Ph.D., U Hawai'i. **[5]** Ota, Hartsuiker, Haywood (2009). The KEY to the ROCK: Near-homophony in nonnative visual word recognition. *Cognition, 111*, 263-269. **[6]** Pallier, Colomé, Sebastián-Gallés (2001). The influence of native-language phonology on lexical access. *Psych Science, 12* (6), 445-449.