

## On the Disparity between Within- and Cross-Language Segmental Similarity

The concepts of the segment and of segmental similarity have figured prominently in cross-linguistic speech research, which has repeatedly found mutual interference between segment-sized units of different languages that resemble each other in one or more ways (Flege 1995; Best and Tyler 2007). The manner in which talkers determine segmental similarity, however, is not well understood. Although a language-universal notion of perceptual similarity has proven useful in predicting phonological patterns within a language (e.g., the “P-map” of Steriade 2009), recent cross-linguistic research has shown that such a general set of similarity relations is unable to fully account for input-output mappings across languages (e.g., Shaw and Davidson 2011). In this paper I consider possible explanations for this disparity, arguing that segmental similarity between languages differs crucially from segmental similarity within a language because perception of second-language (L2) segments is highly influenced by a paradigmatic phonemic level of analysis that is only relevant cross-linguistically.

The basis of the argument is a distinction between phonemic similarity and two other types of similarity that inform judgments of overall segmental similarity—namely, acoustic similarity and phonetic similarity. While acoustic similarity is language-universal, phonetic and phonemic similarity are language-specific. Phonetic similarity is, moreover, syntagmatic in that it is based on within-language comparisons between segments at the level of contextually defined allophones: two segments are phonetically similar insofar as they are related by a lack of contrast and/or a productive alternation (Johnson and Babel 2010). Phonemic similarity, on the other hand, is paradigmatic, as well as abstract, because it is based on cross-language comparisons between segments at the level of context-free phonemes.

With this distinction in mind, I draw upon an array of findings in L2 speech production, perception, and loanword phonology to demonstrate, first, a dissociation between phonemic similarity and acoustic/phonetic similarity and, second, a consistent preference for relating segments cross-linguistically on the basis of phonemic similarity. For example, English and French both contain the vowel /u/, but English /u/ is acoustically distant from French /u/ and much closer to French /y/. Nevertheless, the French of native (L1) English-speaking L2 learners of French shows influence of English /u/ on French /u/, not on French /y/ (Flege 1987), a result that has been replicated for L1 English–L2 Mandarin (Chang et al. 2011). The same situation obtains for stop production in L1 English–L2 Portuguese (Major 1992), L1 Portuguese–L2 English (Sancier and Fowler 1997), and L1 English–L2 Korean (Chang 2010). The primacy of phonemic similarity is also evident in L2 perception research, which shows that listeners frequently judge an L2 segment to be most similar to the phonemically closest L1 segment as opposed to the acoustically closest one (Polka and Bohn 1996; Strange et al. 2004). Studies of loanword adaptation, moreover, have often shown L2-to-L1 mappings that are phonemically, not phonetically, driven (e.g., LaCharité and Paradis 2005; Kang 2008).

Taken together, these findings suggest that L2 users prioritize phonemic similarity over acoustic/phonetic similarity in determining overall similarity between L1 and L2 segments. In this way, they place phonemic similarity at the center of a fundamental distinction between cross-language and within-language segmental similarity. Only cross-language similarity stands to be influenced by paradigmatic phonemic comparisons that depart significantly from acoustic and phonetic comparisons, and these abstract considerations may explain why effects of a “P-map” seem to be masked precisely in cross-linguistic circumstances.

## References

- Best, C. T. and M. D. Tyler (2007). Nonnative and second-language speech perception: Commonalities and complementarities. In O.-S. Bohn and M. J. Munro (Eds.), *Language Experience in Second Language Speech Learning: In Honor of James Emil Flege*, pp. 13–34. Amsterdam, The Netherlands: John Benjamins Publishing.
- Chang, C. B. (2010). *First Language Phonetic Drift During Second Language Acquisition*. Ph. D. thesis, University of California, Berkeley, Berkeley, CA.
- Chang, C. B., Y. Yao, E. F. Haynes, and R. Rhodes (2011). Production of phonetic and phonological contrast by heritage speakers of Mandarin. *Journal of the Acoustical Society of America* 129(6), 3964–3980.
- Flege, J. E. (1987). The production of “new” and “similar” phones in a foreign language: Evidence for the effect of equivalence classification. *Journal of Phonetics* 15(1), 47–65.
- Flege, J. E. (1995). Second language speech learning: Theory, findings, and problems. In W. Strange (Ed.), *Speech Perception and Linguistic Experience: Issues in Cross-Language Research*, pp. 233–272. Baltimore, MD: York Press.
- Johnson, K. and M. Babel (2010). On the perceptual basis of distinctive features: Evidence from the perception of fricatives by Dutch and English speakers. *Journal of Phonetics* 38(1), 127–136.
- Kang, Y. (2008). Interlanguage segmental mapping as evidence for the nature of lexical representation. *Language and Linguistics Compass* 2(1), 103–118.
- LaCharité, D. and C. Paradis (2005). Category preservation and proximity versus phonetic approximation in loanword adaptation. *Linguistic Inquiry* 36(2), 223–258.
- Major, R. C. (1992). Losing English as a first language. *The Modern Language Journal* 76(2), 190–208.
- Polka, L. and O.-S. Bohn (1996). A cross-language comparison of vowel perception in English-learning and German-learning infants. *Journal of the Acoustical Society of America* 100(1), 577–592.
- Sancier, M. L. and C. A. Fowler (1997). Gestural drift in a bilingual speaker of Brazilian Portuguese and English. *Journal of Phonetics* 27(4), 421–436.
- Shaw, J. A. and L. Davidson (2011). Perceptual similarity in input–output mappings: A computational/experimental study of non-native speech production. *Lingua* 121(8), 1344–1358.
- Steriade, D. (2009). The phonology of perceptibility effects: The P-map and its consequences for constraint organization. In K. Hanson and S. Inkelas (Eds.), *The Nature of the Word: Studies in Honor of Paul Kiparsky*, pp. 151–179. Cambridge, MA: MIT Press.
- Strange, W., E. Levy, and R. Lehnholz, Jr. (2004). Perceptual assimilation of French and German vowels by American English monolinguals: Acoustic similarity does not predict perceptual similarity. *Journal of the Acoustical Society of America* 115(5), 2606.