Assessing the (un)categorisation of non-native phones to native phonological categories

Michael D. Tyler

Western Sydney University (Australia)
m.tyler@westernsydney.edu.au

Attunement to the native language shapes how consonants [1], vowels [2], and lexical tones [3, 4] are perceived. When acquiring their native language, children learn which phonetic differences signal a phonological contrast (*phonological distinctiveness*) and which differences constitute natural phonetic variability within a phonological category (*phonological constancy*) [5]. This results in rapid and efficient detection of native phonological contrasts, but it may inhibit accurate perception of non-native phonological contrasts. Natively tuned perception may help or hinder non-native speech perception depending on how the non-native phones/tones are assimilated to native phonological categories [1, 2, 6].

Pairs of non-native phones that are each assimilated to different native categories (a *two-category* assimilation) should be discriminated well because the listener detects a natively tuned phonological distinction [6]. If each non-native phone is assimilated to the same native category, with equal phonetic goodness of fit (a *single-category* assimilation), discrimination should be poor. In this case, the phonetic difference between the contrastive non-native phones may be one that is phonologically constant in the L1. That is, listeners may have learned to ignore a phonetic difference that is phonologically distinctive in the non-native language but phonologically constant in the native language. When non-native phones are assimilated to the same native category, but there is a difference in phonetic goodness of fit to the native phonological category (a *category-goodness* assimilation), the listener may benefit from this sensitivity and discriminate the contrast moderately well.

When a non-native phone is not assimilated as any single native phonological category it is uncategorised [6]. An uncategorised non-native phone may be weakly consistent with a single native category (*focalised*), weakly consistent with multiple native categories (*clustered*), or inconsistent with any native category (*dispersed*) [7]. The extent to which natively tuned perception facilitates discrimination of focalised and clustered non-native phones depends on the perceived phonological overlap [8]. For instance, if one clustered non-native phone is perceived as weakly consistent with a set of native phonological categories, and another non-native phone is weakly consistent with a different set of non-native phonological categories, then natively tuned perception should support discrimination. Conversely, if both phones are perceived as weakly consistent with the same set of native phonological categories then discrimination should be poor. When both non-native phones are perceived as dispersed, then the listener should be free of any influence from natively tuned perception, and discrimination should depend only on language-independent phonetic distance.

While most research on cross-language speech perception has focused on consonants and vowels, recent research has begun to consider whether the same principles apply to cross-language perception of lexical tone. Native tone-language listeners appear to perceive non-native tones in terms of their native tonal categories [9]. There is evidence of an influence of natively tuned perception on discrimination performance, but Reid et al. [9] argued that phonetic or acoustic similarity may need to be taken into account to explain the variability in performance. To some extent, non-tone-language listeners are able to categorise non-native lexical tones in terms of their native intonational categories (e.g., English *uncertainty*, *question [yes/no]*) [3, 4], but there is a generally poorer correspondence between categorisation and discrimination for intonational categories than for consonants, vowels, and lexical tones [3, 4, 9].

Perceptual assimilation is usually assessed using a forced-choice categorisation task, where listeners are presented with an auditory stimulus from the non-native language, and then assign it to the closest native phonological category using orthographical symbols and/or keywords [e.g., 2, 7, 8]. To determine whether a contrast is a category-goodness or single-category assimilation, it is necessary to ask listeners to rate the goodness of fit of the auditory stimulus to the chosen category label. Categorisation tasks give an excellent indication of how non-native phones are assimilated to the native language when there is high agreement within and between listeners. That is, the task works well when nearly all of the listeners categorise the non-native phone as the same native phonological category. With investigations expanding into stimuli that are likely to be uncategorised (e.g., vowels and lexical tones), and with category labels that go beyond consonants and vowels, it may be time for a fresh approach. I will argue that the forced-choice categorisation task is poorly suited to assessing cases where a non-native phone is uncategorised. For instance, if natively tuned perception can influence discrimination when a non-native phone is perceived as weakly consistent with multiple native phonological categories [8], then asking participants to select a single category label may not provide a true indication of perceptual assimilation. Furthermore, the use of arbitrary thresholds to determine categorisation is problematic [e.g., 8, 10], and it is not clear how to interpret category goodness ratings when a non-native phone is only weakly categorised. In this talk, I will take stock of the theoretical requirements that a test of perceptual assimilation must meet and sketch a possible best practice for determining the influence of the native language on the perception of non-native consonants, vowels, and lexical tones.

References

[1] Best, C. T., McRoberts, G. W., & Goodell, E. (2001). Discrimination of non-native consonant contrasts varying in perceptual assimilation to the listener's native phonological system. *Journal of the Acoustical Society of America, 109*(2), 775-794.

[2] Tyler, M. D., Best, C. T., Faber, A., & Levitt, A. G. (2014). Perceptual assimilation and discrimination of non-native vowel contrasts. *Phonetica, 71*(1), 4-21.

[3] So, C. K., & Best, C. T. (2010). Cross-language perception of non-native tonal contrasts: Effects of native phonological and phonetic influences. *Language and speech, 53*(2), 273-293.

[4] So, C. K., & Best, C. T. (2014). Phonetic influences on English and French listeners' assimilation of Mandarin tones to native prosodic categories. *Studies in Second Language Acquisition, 36*(2), 195-221.

[5] Best, C. T., Tyler, M. D., Gooding, T. N., Orlando, C. B., & Quann, C. A. (2009). Development of phonological constancy: Toddlers' perception of native-and Jamaican-accented words. *Psychological science, 20*(5), 539-542.

[6] Best, C. T. (1995). A direct realist view of cross-language speech perception. In W. Strange (Ed.), *Speech perception and linguistic experience: Issues in cross-language research* (pp. 171-204). Baltimore: York Press.

[7] Faris, M. M., Best, C. T., & Tyler, M. D. (2016). An examination of the different ways that non-native phones may be perceptually assimilated as uncategorized. *The Journal of the Acoustical Society of America, 139*(1), EL1-EL5.

[8] Faris, M. M., Best, C. T., & Tyler, M. D. (2018). Discrimination of uncategorised non-native vowel contrasts is modulated by perceived overlap with native phonological categories. *Journal of Phonetics, 70*, 1-19. doi:10.1016/j.wocn.2018.05.003

[9] Reid, A., Burnham, D., Kasisopa, B., Reilly, R., Attina, V., Xu Rattanasone, N., & Best, C. T. (2015). Perceptual assimilation of lexical tone: The roles of language experience and visual information. *Attention, Perception, & Psychophysics, 77*(2), 571-591.

[10] Harnsberger, J. D. (2001). On the relationship between identification and discrimination of non-native nasal consonants. *Journal of the Acoustical Society of America, 110*(1), 489-503.