

Dimensions of variability in non-native speech
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Listeners are exposed to substantial variability in speech, and the perceptual consequences of this variability has been a long-standing area of interest. Non-native speech can present a particular type of challenge to listeners, and substantial previous work has suggested that one of the primary causes this difficulty is variability.

Non-native speech is frequently characterized as being more variable than native speech (e.g., Baese-Berk & Morrill, 2015; Jongman & Wade, 2007; Wade, Jongman, & Sereno, 2007). This property could be a helpful cue to listeners as a way of constraining the possibility space when encountering non-native listeners; if it is the case that non-native speakers are always more variable than native speakers for all linguistic features, listeners could adjust their category boundaries accordingly, by broadening them, for example. Some recent work, however, has suggested that this characterization is too simplistic, as native speakers may be more variable than non-native speakers in certain cases (e.g. Baker et al., 2011; Morrill, Baese-Berk, & Bradlow, 2016; Vaughn, Baese-Berk, & Idemaru, under review). For example, in Vaughn, Baese-Berk, & Idemaru (under review), we found that native Japanese speakers show more variability in their realization of voiced stops in than non-native speakers. Specifically, non-native speakers used primarily stop closures when producing voiced stops, while native Japanese speakers used a variety of articulations including stop closures, fricatives, and approximants. And, we found that that non-native speakers did not show substantially more spectral variability within vowel categories than native speakers (see Figure 1, from Vaughn, Baese-Berk, & Idemaru, under review). This mixed evidence in production means that the perceptual problem is more complex than previously stated; it seems that listeners can not predictably expect more variability for all features when listening to a non-native speaker, for example.

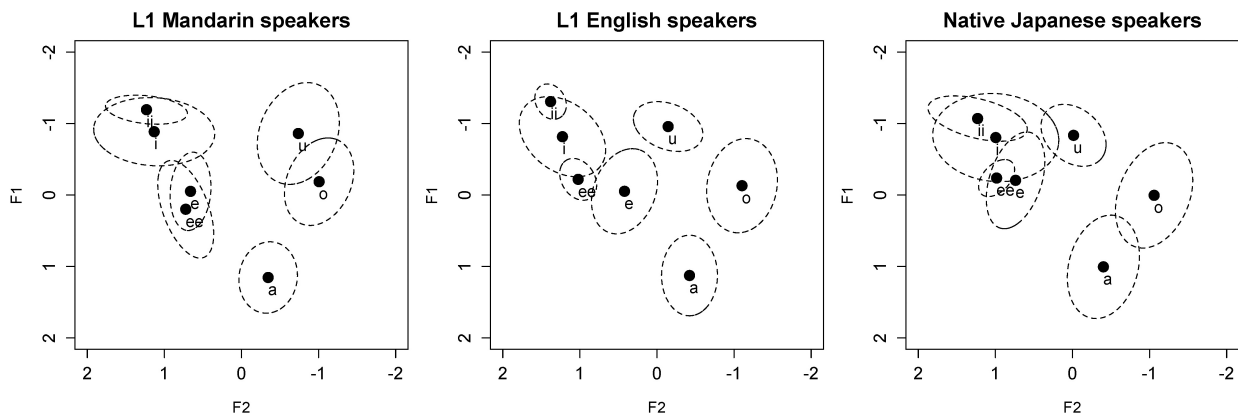


Figure 1. Vowel plots by speaker group (Lobanov normalized). Ellipses represent one standard deviation for each vowel category.

In the current project, we lay out our research program for examining the sources and consequences of variability in native and non-native speech. We describe this program in three parts. First, we extend our previous findings by examining new linguistic features, including the variability in Japanese geminates by native Japanese and English speakers, and, in a different population of speakers, the variability in English /r/ vs. /l/ by native Japanese and English speakers. Preliminary results for /r/ vs. /l/ suggest that non-native speakers are more variable in their realizations of /r/ and /l/ overall. However, a number of factors influence the variability of productions of both native and non-native speakers including the specific production task (e.g.,

reading, repetition, or delayed repetition) and position of the contrast (e.g., onset, intervocalic, or coda). Better understanding individual talkers' and groups of talkers' distributions of linguistic features will provide a more accurate picture of a listener's input, helping to define the bounds of the lack of invariance problem.

Next, drawing on previous work, we attempt to enumerate the range of potential sources of variability, with the goal of delineating factors that influence how variable a given feature will be for a particular speaker, native or non-native. We draw attention to the fact that all variability does not arise from the same source; in fact, it is reasonable to expect that different speakers and groups of speakers, and different linguistic features, will exhibit different amounts of variability. For example, non-native speakers may be more variable in their productions of a difficult sound contrast, while native speakers may be more variable in their productions of a specific feature as a result of reduction, or modulating their speaking style. Potential sources of variability, then, range from the lack of articulatory control in a target language, to mastery of the conditioning constraints on reduction, to the relationship between categories in the source and target languages. We suggest that collapsing many types of variability (inter- vs. intra-speaker variability, distributions within a single category vs. overlap across categories, etc.) under the same heading may mischaracterize important differences between different types of variability in production, and their implications for perception.

Finally, in more closely examining the potential sources of variability, we raise a number of intriguing possibilities for perception. For example, it may be that part of speech perception involves a listener tracking how variable a speaker is, or is likely to be. In other words, the listener may be estimating the distribution of a speaker's productions, in addition to estimating that speaker's mean and the individual deviations from it. Such a prediction process may be one way that listeners constrain the variability they encounter.

References

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