

## Vowel devoicing in infant-directed Japanese

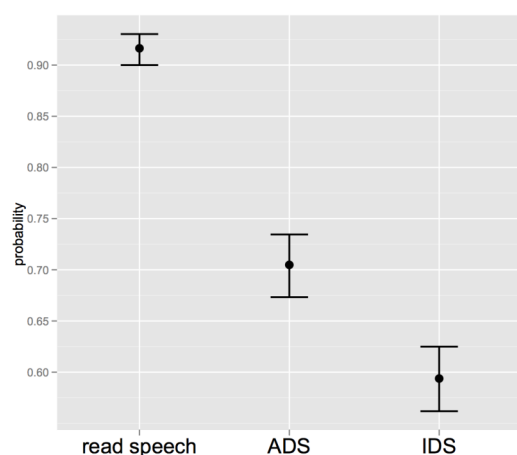
Parents often exaggerate phonetic distinctions when speaking to infants. This infant-directed speech (IDS) style has been described as a form of *hyperspeech* (Fernald, 2000), which may be motivated by speakers' desire to increase intelligibility. Although phonological rules in IDS have been little studied, the hyperspeech theory makes the prediction that if such a rule reduces intelligibility, it should be implemented less often in IDS than in adult-directed speech (ADS).

We use the rule of high vowel devoicing in Japanese, in which /i/ and /u/ are devoiced between voiceless obstruents, to test this prediction. Beckman and Shoji (1984) show experimentally that native speakers are poorer at identifying vowels in nonsense words when they are devoiced, suggesting that the devoicing process could hinder infant learners of the language who lack the lexical knowledge that adults can use to aid in vowel identification. Using a corpus of infant- and adult-directed Japanese, we show that when speaking to infants, Japanese mothers do in fact devoice high vowels less often than when speaking to adults, lending support to the IDS-as-hyperspeech view. Surprisingly, however, the same speakers devoice non-high vowels, which are not typically targets of the rule, *more* often in IDS. These results imply that a single-dimensional hyper- to hypospeech continuum is not sufficient to capture the ways in which speakers modify their speech to infants.

Our corpus consists of recordings of 22 Japanese mothers in three conditions: speaking to their own infants (IDS), speaking to an adult experimenter (ADS), and reading a list of prepared sentences (read speech). Every vowel which occurred between voiceless obstruents was extracted from the corpus and coded for voicing ( $N=10,278$ ). We constructed two generalized linear mixed effects models, one for high and one for non-high vowels, with voicing (i.e., voiced or devoiced) as the dependent variable, and speech style (IDS or ADS), speech rate (moras/second), preceding consonant, following consonant, accentual status, breathiness (H1-H2), and vowel (/i/, /u/, /e/, /o/, or /a/) as fixed factors. Speaker and word were included as random factors.

The estimated coefficients for speech style resulting from these models were converted to probabilities (Figs. 1, 2). They show that for high vowels, devoicing is more likely in read speech, less likely in ADS, and least likely in IDS. For non-high vowels, this trend is precisely reversed. These results suggest that what appears on the surface to be a single phenomenon—vowel devoicing—is actually two distinct processes, and that these processes respond differently (indeed, in opposite directions) to extralinguistic factors. We will discuss the implications of these findings for theories of the possible functions of infant-directed speech, as well as how and why our results differ from an earlier study (Fais et al., 2010).

**Figure 1.** High vowel devoicing probability



**Figure 2.** Non-high vowel devoicing probability

