SYNOPSIS This study begins with the observation that sonorant geminates are disfavored in many phonological systems. Podesva (2000) hypothesizes that the dispreference against sonorant geminates exists because these geminates are easily confused with corresponding singletons. This confusability problem arises because sonorants have blurry transitions into and out of flanking vowels, and consequently their constriction durations are difficult to perceive. We report perception experiments that test this hypothesis. The stimuli were non-speech sounds which mimicked the spectral properties of geminate contrasts in stops, fricatives, and sonorants. The results show that spectral continuity in sonorants makes the singleton-geminate distinction less distinct. We conclude that the phonological dispreference against sonorant geminates has its root in the perceptual imperative to avoid segments that are confusable with other segments.

EXPERIMENT I: METHOD The first experiment was a same-different discrimination task, using non-speech stimuli which mimicked the spectral properties of geminate contrasts in stops, fricatives, and sonorants. Vocalic intervals were anharmonic complexes of sine waves, consisting of 50 sine waves ranging from 100Hz to 16kHz, with decreasing energy in higher frequency ranges. Consonant intervals were created as follows: silence (stop), white noise filtered between 2kHz and 22kHz (fricative), same as the vocalic interval with half of its peak energy (sonorants). Short consonantal intervals were 100ms and long consonants were 150ms. All vocalic intervals were 100ms. The stimuli consist of four pairs of combination of S(hort) and L(ong) stimuli with 400ms ISI: SS (same), LL (same), SL (different), LS (different). Twenty native speakers of English judged whether given stimuli were same or different. We calculated d'-values to access the discriminability of each contrast.

EXPERIMENT I: RESULT AND DISCUSSION Each scatterplot in Figure 1 compares d'-values in two different conditions. Each point within a scatterplot shows a pair of d'-values for each participant. Any point that is to the left of the diagonal axis shows that the listener had a higher d'-values for the condition represented in the y-axis; any point that is to the right of the diagonal axis shows that the listener showed a higher d'-values for the condition that is represented in the x-axis.

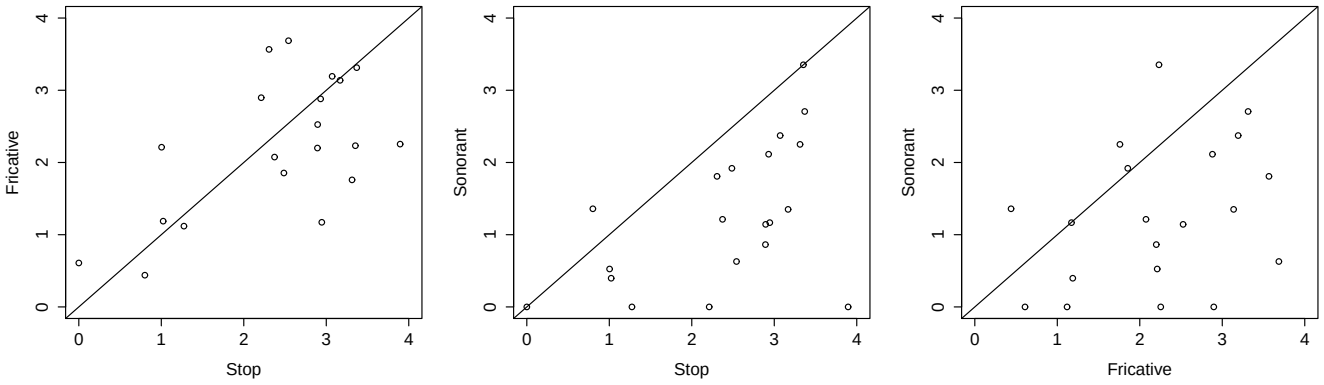

Figure 1: The distributions of d'-values in each condition

In the stop-fricative comparisons, some listeners showed higher d'-values in the stop condition

while the others showed the opposite pattern ($t(18) = 0.88, n.s.$). In the other two panels, we observe that most if not all listeners showed lower d'-values in the sonorant condition than the stop condition ($t(19) = 5.09, p < .001$) or the fricative condition ($t(19) = 3.78, p < .01$). Based on the results, we conclude that (i) sonorantal spectral continuity does make the short-long pair less discriminable, and that (ii) whether the perception of silence is more difficult than that of noise depends on individual listeners.

EXPERIMENT II: METHOD The second experiment was an identification experiment, using the same set of stimuli as Experiment I. Listeners learned two categories (A=short and B=long) in the practice phase, and were tested how well they learned each category. Each type of stimuli (stop, fricative, and sonorant) was blocked into smaller, separate sessions. Since we expected that the order of learning these three categories might influence their performance, the order of the presentation of the three blocks was controlled by a Latin Square design. A total of 24 native speakers participated in the experiment.

EXPERIMENT II: RESULT AND DISCUSSION Each scatterplot in Figure 2 compares d'-values in two different conditions in the identification task. Each point within a scatterplot shows a pair of d'-values for each participant.

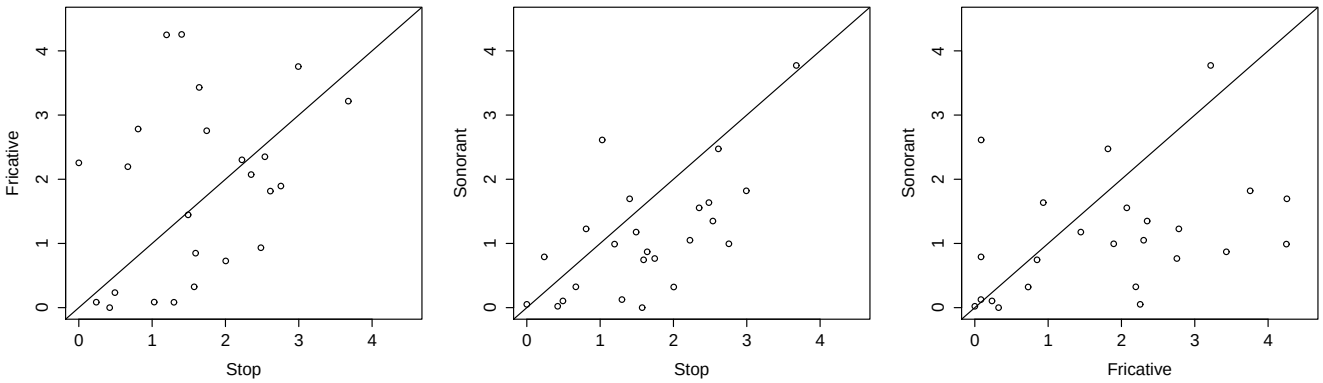

Figure 2: The distributions of d'-values in each condition

As with the discrimination results, listeners differed in whether the stop contrast or the fricative contrast was more perceptible ($t(23) = -0.73, n.s.$). On the other hand, d'-values for the sonorant condition was generally lower than those for the stop condition ($t(23) = 3.29, p < .01$) or the fricative condition ($t(19) = 2.68, p < .05$). These results show that a duration contrast that is spectrally continuous with surrounding intervals is harder to learn than contrasts that are spectrally not continuous.

SUMMARY Our experiments show that a duration contrast that relies on consonant intervals that are spectrally continuous with surrounding vowels is both difficult to discriminate and difficult to learn. These results support the hypothesis that phonological dispreference against sonorant geminates may have its root in the confusability of geminacy contrasts in sonorant consonants.