

Effects of Phonemic Length Contrast on Perception of Lengthened Sounds:
A Cross-Linguistic Study

Minji KANG (Yonsei University) and Inkie CHUNG (Sogang University)

1. Introduction. Kawai et al. (2007) and Park et al. (2018) claim that English and Korean listeners perceive a continuum of lengthened fricative /f/ and /s/, respectively, in a gradual manner. Although speech sounds are generally thought to be perceived in a categorical manner (Eimas et al. 1971; Liberman et al. 1957), it is not yet clear why such gradual mode of perception is observed with lengthened sounds, and whether the same results will hold for other languages. The current study examines Japanese listeners' judgments on the abnormality of digitally lengthened /s/ sounds. The perceptual results are compared to those of Kawai et al. (2007) and of Park et al. (2018) to show the effect of phonemic length contrast on listeners' perception of lengthened sounds.

2. Methodology. Sentence Stimuli and Length Manipulation. A single stimulus sound, Japanese fricative /s/, in two different phonological contexts were prepared: /s/ in the word-initial position (/saNka/ 'participation') and word-medial position (/hasaN/ 'bankruptcy'). The latter context (potentially) exhibits phonemic length contrast between singleton vs. geminate consonants (/hasaN/ vs. /hassaN/). Meanwhile, the word-initial /s/ cannot exhibit such contrast, as Japanese geminates do not appear word-initially. Two sentence stimuli in which /saNka/ and /hasaN/ were embedded were recorded by a native speaker of Japanese. Following the method of Park et al. (2018), each stimulus was lengthened by 20 ms increment for 20 times, creating total 21 stimuli with a varying frication duration of /s/. **Participants and Experiment Procedure.** Six native speakers of Japanese (six females, mean age = 25.1, SD = 4.2) listened to a series of sound files (where Japanese fricative /s/ varied along with its frication duration) and rated with 1-100 rating scales [1: normal, 100: abnormal] how normal (or abnormal) the fricative /s/ sounded. The participants rated each of the 21 stimuli for 5 different times in a random order. The curvilinear regression analysis was made for the perceptual results.

3. Results and Conclusion. On the curvilinear regression graph, the word-initial /s/ exhibits a sigmoidal curve, similar to the results of English /f/ in Kawai et al. (2007) and of Korean /s/ in Park et al. (2018). On the other hand, the word-medial /s/ shows a sharply increasing slope near 70 ms. Such discrepancy may be due to the following difference between the two phonological contexts: (1) English and Korean fricatives in general and Japanese word-initial /s/ do not exhibit phonemic length contrast, and such absence would make the durational information of a speech sound marginal (or phonologically irrelevant). On the other hand, (2) in the case of Japanese word-medial /s/, the duration becomes the primary cue in determining the phoneme status of segmental duration and thus a word's meaning. Hence, we argue that the linguistic relevance (or meaningfulness) of a speech sound's segmental duration (which is determined by the phonological context which exhibits or does not exhibit phonemic length contrast) plays a crucial role in determining listeners' sensitivity in their judgments on the abnormality of lengthened sounds.

References. Eimas et al. 1971. Speech perception in infants, *Science*, 171. Kawai et al. 2007. Listeners' identification and discrimination of digitally manipulated sounds as prolongations. *J. Acoust. Soc. Am.* 122. Liberman et al. 1957. The discrimination of speech sounds within and across phoneme boundaries. *J. Exp. Psychol.* 54. Park, et al. 2018. Comparison of perception of the prolonged /s/ in Korean by average adult listeners and speech-language pathologists. *Audiol. Speech Res.* 14.