Acquisition of stop burst cues in English, Greek, and Japanese
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INTRODUCTION AND RATIONALE
• In English and many other languages, children acquire stop burst consonants later than alveolar stop consonants.
• "Valve freezing" (the substitution of audible for velar stop) is a common error pattern in typical phonological development and in phonological disorder.
• One possible explanation is that valved stop consonants are constrained in a gradient way by the tongue position for the following vowel (Birds et al., 1999).

Aims of the cross-linguistic study:
• We can use spectral analysis to examine the place of articulation for the stop burst.

QUESTIONs OF THIS STUDY
1) Is velar stop production dependent on the following vowel in a gradient way (as opposed to categorical allophony)?
2) Are there cross-language differences in the effect of following vowel context on velar stop production for adults?
3) If yes to 2, at what age are these cross-language differences observed in child production?

METHOD
• Languages: English, Greek, Japanese
• All data recorded in each country with a native speaker as the experimenter.
• Participants: 6 adults, 10 2-year-olds, 10 5-year-olds for each language.
• All adults and children typically developed with no known hearing impairments.
• Stimuli: Continuous /k/ and /k/ placed in word-final position in familiar words in the following vowel contexts: /a/, /e/, /i/, /o/, /u/.
• Three word forms for each vowel context.
• Photographs of each word were accompanied by a digitized recording (spoken by a female native speaker).
• Word repetition task: Participant was asked to repeat each word, given visual and auditory prompts.
• Transcription analysis: native speaker transcribed all initial CV’s.

RESULTS
• Figure 2 compares percent correct for /k/ for the 2-year-olds and 5-year-olds in all three languages.
• It can be observed that for all languages, 5-year-olds produced /k/ more correctly than 2-year-olds.
• No consistent differences in /k/ accuracy were found across languages for either age group.

DISCUSSION AND CONCLUSION
• These same language-specific effects of vowel context were observed in the correct productions for children as young as 2 years.
• The effect appears to be more gradual in Greek and Japanese than in English.
• More detailed analysis of error patterns across vowel contexts is necessary in order to reveal any possible language-specific differences.
• This explanation would have predicted a stronger vowel effect on /k/ production for English children.
• The effect of vowel context on the /k/ burst is gradient in Greek and Japanese, while it is categorical in English.

Stop burst analysis: Adults in three languages
• Figure 6 shows the average spectra of burst for all vowel contexts for each of the three languages, averaged across the 10 adult native speakers for each language.
• The effect of vowel context on the /k/ burst differs in Greek and Japanese, as compared to English.
• The effect of vowel context on the /k/ burst is gradient in Greek and Japanese, while it is categorical in English.

Stop burst analysis: Children in three languages
• Figure 5 shows peak amplitude frequency for /k/ in all five vowel contexts, for adults, 5-year-olds, and 2-year-olds, with acoustic plots for each language.
• Language-specific patterns are observed for both 2-year-olds and 5-year-olds in all three languages.
• In English, the 2-year-olds show a categorical effect of vowel context on peak amplitude frequency for the /k/ burst.
• In Greek and Japanese, even the 2-year-olds show a gradient effect of vowel context on peak amplitude frequency for the /k/ burst.

Stop burst analysis: Averaged spectra
• Figures 4 and 7 show the average spectra of bursts for two vowel contexts (/u/ and /i/) across all adults (Fig. 6) and 2-year-olds (Fig. 7) within a language, with the dotted lines denoting the variation around the mean.
• The data from the 2-year-olds reflect overall adult-like patterns, varying similarly in peak amplitude frequency across language and vowel context.
• However, spectral shape differs with respect to kurtosis (compactness) of these amplitude peaks: 2-year-olds produced velar stops of lower compactness.

REFERENCES
• Thanks to Hyunju Chung, Junko Davis, Fangfang Li, Sarah Schellinger, Laura Slocum, Anima Stryka, and Hanka Shier for their work on data collection, native speaker transcription, and data analysis.
• Thanks also to the children who participated in the study, the parents who gave their consent, and the schools who let us access their facilities for testing.