INTRODUCTION

- Children do not always progress abruptly from incorrect, neutralized productions to readily perceivable and transcribable phonological categories.
- Children may go through a stage of 'covert' contrast.
- Covert contrast: A subphonemic difference between two sounds that is not perceptible to adults (e.g., Macken & Barton, 1980).
- Covert contrast for stops and fricatives has been reported in the literature, but there is little work on affricates and consonant clusters.
- Furthermore, there is limited work on covert contrast for languages other than English.

PURPOSE OF THIS STUDY

- To look for covert contrast in word-initial stop-/s/ clusters and the affricate /ts/ in Greek.

METHOD

[Participants]

- 18 monolingual Greek-speaking children (five 2-year-olds, seven 3-year-olds, three 4-year-olds, and three 5-year-olds)
- Typically-developing
- Selected from a larger sample of 60 2-to-5-year-olds
- Selected because they produced correct /s/ in singleton targets, but reduced stop-/s/ clusters and the affricate /ts/ to [s]
- Cluster reduction to [s] in stop-/s/ sequences was a common error pattern (Syrika et al., 2007).
- 15 native Greek-speaking adults were also recorded in the same task.

[Task and Procedure]

- Word-repetition task
- A picture and a digitized recording of the stimulus were presented simultaneously.
- The children were instructed to repeat the word that they heard.
- Children’s repetitions were digitally recorded.

[Stimuli]

- 2- or 3-syllable real words with word-initial /s/, /ps/, /ts/, and /ks/ before each of the vowels /a/, /e/, /i/, /o/.
- All words were stressed on the first syllable.

[Analysis]

- Children’s productions were transcribed by a Greek native speaker/phonetician.
- For the productions of the 18 children analyzed, we paired productions of [s] in cluster reductions to correct /s/ targets in the same vocalic context.
- For example, [sa] in target /paɪs/ (fish) was paired with the same child’s correct production of /saɪ/ in target /paɪs/ (lizard).
- We examined the duration of the fricative [s] for both cluster reductions and correct productions of singleton /s/.
- We performed a spectral moments analysis to compare the fricative intrinsic dynamics of productions of reduced [s] in stop-/s/ sequences to productions of correct singleton /s/.

RESULTS: DURATION ANALYSIS

- Duration of [s] for the cluster reductions tended to be longer than for the target /s/ productions.
- The [s] durations for the cluster reductions were much more variable than for target /s/ productions.
- Range of values for [s] durations:
  - [s] cluster reductions: 233 ms (124 to 358 ms)
  - Correct /s/ singletons: 151 ms (133 to 283 ms)

RESULTS: SPECTRAL MOMENTS ANALYSIS

- Adults:
  - The centroid (first spectral moment) contours for the two clusters /ps/ and /ks/ look remarkably similar to that of the singleton /s/.
  - The different pattern in the centroid contour for /s/ is most likely due to its phonological status as an affricate.
- Children:
  - By contrast to the adults’, the centroid contours of all three target stop-/s/ sequences are similar to each other and different from that of singleton /s/.
  - The peak centroid frequencies are lower for the target stop-/s/ sequences as compared to singleton /s/, suggesting that there is a trace of the “deleted” stop consonant.

CONCLUSION & DISCUSSION

- Covert contrast was observed for Greek-speaking children who were perceived to neutralize stop-/s/ sequences to singleton /s/, suggesting the need to supplement transcription with acoustic analysis.
- The later peak centroid values for the target stop-/s/ sequences suggest that there may be some underlying stop consonant gesture that is not perceptible.
- Future research will focus on a finer-grained analysis of the acoustic data, including an examination of individual subject data and the addition of an amplitude measure to provide a better articulatory interpretation of the above findings.
- Moreover, we plan to examine adult naïve listeners’ perception of these reduced stop-/s/ sequences and singleton /s/.

ACKNOWLEDGMENTS

- This work was supported by NIH/NIDCD grant 02932 to Jan Edwards.
- We thank the children and the adults who participated in this task, the parents who gave their consent, and the schools where the data was recorded.
- We also thank Tim Adkisson, Wengi Chang, Shanding Kong, Karen Kostopoulos, Ariadne Hakansson, and Hani Schilling for their contributions to this project.