Cross-Linguistic Acquisition of Voiceless Lingual Fricatives

Laura Slocum, M.A., CCC-SLP, Ohio State University, Jan Edwards, Ph.D., University of Wisconsin-Madison, Mary E. Beckman, Ph.D., Ohio State University

ABSTRACT

This study investigated the effects of phoneme frequency on the emerging phonology of typically-developing children from four linguistic communities: English, Greek, Japanese, and Cantonese. To this end, it compared cross-linguistic production accuracy of voiceless fricatives in a variety of vowel contexts in the initial position of words. A total of 81 preschool children (ages 2-4.5 months) representing four language groups participated in a word-production task designed to elicit production of target word-initial, consonant-vowel sequences. It was predicted that children would have difficulty in producing accurate voiceless fricatives regardless of their native language. Furthermore, it was predicted that these differences in production accuracy would be related to differences in phoneme frequency within and across language communities. The results support this prediction. Cross-linguistic analyses were conducted using existing adult online lexicon databases for each language.

INTRODUCTION

The notion of a “universal grammar” of phonological acquisition (Jakobson, 1941; Hockett, 1958) has been challenged in recent years by empirical research, which has evidenced cross-linguistic differences in the sounds produced in infant babble and subsequent first words (DeBoer & Beattie, 1987; Vihman, 1981; Vihman, 1993). However, current theories of child phonological and lexical development do not adequately address what we know about frequency effects and how they affect speech and language learning.

A BRIEF REVIEW OF THE LITERATURE

• The frequency of sounds within the adult lexicon of the ambient language affects the order of phoneme acquisition in the developing child. Cross-linguistic phonological studies have found that /t/ and /d/ were produced earlier by children whose native languages had higher frequencies of these sounds in child lexicons (Pye, Ingram, & List, 1987; Ingram, 1988). Production accuracy is affected by lexical phoneme frequency and vowel sequence frequencies as well (Edwards, 1995). /s/ is less frequent than /t/ in the adult lexicon and in child-directed speech. Furthermore, research has found that /s/ was produced more accurately than /t/ by young children acquiring these two languages (Vorster, Barbenkord, & Edwards, 2003; Nicosiale, Edwards, Barbenkord, & Ferdinand, 2006). Phoneme sequence frequency affects production accuracy. Children produced high-frequency diphthong sequences more accurately than low-frequency sequences and the frequency effect interacted with vocabulary size – the larger the vocabulary, the more accurate children were (Edwards, Beattie, & Ferdinand, 2006; Vodopivec, Edwards, & Beattie, 2006). Phoneme sequence frequencies influence lexical acquisition. Children more quickly learned novel words which contained high-frequency sequences than those which contained low-frequency sequences (Brick, & Rogoff, 1999; Beattie, 2003). Production accuracy of voiceless lingual fricatives by young children may be influenced by frequency. For example, /t/ is typically acquired later than /s/ in English and is much less frequent.

PURPOSE OF THIS EXPERIMENT

To study the influence of phoneme frequency on the production of voiceless lingual fricatives in the word-initial position across four languages (English, Greek, Japanese, and Cantonese).

RATIONAL

• The phonological inventories of English, Greek, Japanese, and Cantonese provide for an interesting series of cross-linguistic comparisons with respect to word-initial voiceless lingual fricatives. Cross-linguistic phonological studies have found that /t/ and /d/ were produced earlier by children whose native languages had higher frequencies of these sounds in child lexicons (Pye, Ingram, & List, 1987; Ingram, 1988).

• The frequency of sounds within the adult lexicon of the ambient language affects the order of phoneme acquisition in the developing child. Cross-linguistic phonological studies have found that /t/ and /d/ were produced earlier by children whose native languages had higher frequencies of these sounds in child lexicons (Pye, Ingram, & List, 1987; Ingram, 1988). Production accuracy is affected by lexical phoneme frequency and vowel sequence frequencies as well (Edwards, 1995). /s/ is less frequent than /t/ in the adult lexicon and in child-directed speech. Furthermore, research has found that /s/ was produced more accurately than /t/ by young children acquiring these two languages (Vorster, Barbenkord, & Edwards, 2003; Nicosiale, Edwards, Barbenkord, & Ferdinand, 2006). Phoneme sequence frequency affects production accuracy. Children produced high-frequency diphthong sequences more accurately than low-frequency sequences and the frequency effect interacted with vocabulary size – the larger the vocabulary, the more accurate children were (Edwards, Beattie, & Ferdinand, 2006; Vodopivec, Edwards, & Beattie, 2006). Phoneme sequence frequencies influence lexical acquisition. Children more quickly learned novel words which contained high-frequency sequences than those which contained low-frequency sequences (Brick, & Rogoff, 1999; Beattie, 2003). Production accuracy of voiceless lingual fricatives by young children may be influenced by frequency. For example, /t/ is typically acquired later than /s/ in English and is much less frequent.

MEASURES

The relative log frequencies of each consonant and consonant-vowel combination for each language were calculated using existing adult online lexicon databases for each language.

ANALYSES

PERCENT CORRECT BY AGE

These results mirror the frequency data for English /s/ is the most frequent sound and is produced more accurately than /t/ and /d/ even by the youngest children. However, cross-linguistic comparisons are needed to establish that these results are related to relative phoneme frequency and not to differences in inherent difficulty of the sounds.

CONCLUSIONS

• Young children’s production accuracy of voiceless lingual fricatives varies across languages. For example, while /t/ and /d/ were produced more accurately than /s/ in English, /s/ was consistently produced more accurately than /t/ in Japanese.

• Cross-linguistic comparisons show that lexical phoneme frequency may affect accuracy of production. For example, /t/ was produced more accurately than English-speaking children across all vowel contexts, and /d/ was produced more accurately than English-speaking children across all vowel contexts and /s/ was produced more accurately in Japanese.

• Production accuracy of voiceless lingual fricatives by young children may be influenced by frequency relative to child-directed adult speech. For example, /t/ was produced more accurately than /s/ in adult-directed speech in Japanese.

ACKNOWLEDGMENTS

This research was supported by NIDCD grant #02932 to Jan Edwards and Mary E. Beckman from the National Institutes of Health. Special thanks to Kiwako Ito, Giorgos Tserdanelis, Peggy Wong, Jeff McCune, and Kyuchul Yoon.