phonology in infancy and early childhood: implications for theories of language learning

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introduction

Jakobson (1941/1968) proposed that: (i) infants babble the sounds of all languages; (ii) there is discontinuity between babbling and first words; and (iii) phonemes are acquired in a universal order. Since then, all of these hypotheses have been rejected on empirical grounds and the importance of the prelinguistic foundations of phonology has been recognized. However, questions about the relationship between babble and words, the timing and extent of the impact of the ambient language on early speech perception and production, and individual differences in phonological development continue to energize research. General cognitive as well as purely linguistic foundations for phonological development, not directly addressed by Jakobson, have also been the source of fruitful recent investigations thanks to methodological advances in psycholinguistics and neurolinguistics. These issues have important implications for phonological theory, which must account for developmental as well as adult data. Claims about innate knowledge versus learning must refer to the processes by which the child develops and manifests a phonological system. Yet certain well-documented phenomena that are highly characteristic of child phonology remain to be integrated into theories of adult phonology. The goal of this chapter is to elucidate the state of the art with respect to issues and questions in child phonology, including recent findings, research methodologies and theoretical models.
In the first half of the chapter we review prelinguistic and early linguistic foundations for phonology, highlighting universal versus language-specific and child-specific aspects of phonological emergence. We then address aspects of child phonology that pose particular challenges for phonological theory. Next, neurocognitive theories are reviewed, with a focus on recent findings that shed important light on human language learning capacities. Finally, we provide brief overviews and critiques of key phonological theories. The chapter ends with a proposal for an integrated model of phonological development that embraces both neurocognitive capacities and the full range of universal, language-specific, and child-specific phenomena.

**prelinguistic perceptual and vocal behaviors**

Infants discriminate and produce sounds that are absent from the languages they are hearing. The non-native sounds they produce during the first six months are mainly traceable to physiological factors, such as incomplete consonantal closure and natural physiological linkages of tongue and jaw position; these effects have some impact in later stages as well (Davis and MacNeilage, 1995; Kent, 2000). Physiology also has a profound effect on the sound systems that infants must learn. For example, the consonant-vowel (CV) co-occurrence patterns found in babbling have also been identified as statistical tendencies for consonant-vowel pairs in most of the world’s languages (MacNeilage, Davis, Kinney, and Matyear, 2000). The most characteristic, or unmarked, features of phonological systems, such as labial stops [b,p], are not only more common in languages, but are also generally acquired earlier than marked ones such as interdental fricatives [θ,ð] (Locke, 1983). Unmarked features include common sound combinations (phonotactic or distributional patterns) as well as individual sounds and sound classes, such as:

- stops, nasals, glides
- coronals (dentals or alveolars)
- CV syllables
- two-syllable words

Universal markedness patterns are largely predictable based upon the principles of articulatory ease and perceptual discriminability (Liljencrants and Lindblom, 1972; Stevens, 1989). For example, voiced fricatives (e.g., [v,z]) are less common and later learned than voiceless fricatives (e.g., [f,s] because they are more difficult to produce for aerodynamic reasons