

Mechanisms linking phonological development to lexical development – a commentary on Stoel-Gammon’s ‘Relationships between lexical and phonological development in young children’*

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When Roger Brown selected Adam, Eve and Sarah to be the first three participants in the modern study of child language, one of the criteria was the intelligibility of their speech (Brown, 1973). According to the prevailing view at the time, accuracy of pronunciation was a peripheral phenomenon that had nothing to do with the development of language *qua* language. So why not study children who were easy to transcribe? One reason why not, according to Stoel-Gammon (SG; this issue), is that the difficulty of accurately producing sounds influences the words children acquire and the rate at which they acquire them. (It’s true that Roger Brown’s focus was on the child’s acquisition of morphosyntax, but articulation was assumed to be peripheral to everything back then.) This interaction between the articulatory skill of children and phonological properties of words is just one of the mutual influences between phonology and the lexicon SG describes. In her target article, SG brings together data from a wide range of investigations to build an account of how phonology and the lexicon interact in development.

Some words are acquired later than other words because they contain sounds that are more difficult for children to produce, and some children produce words earlier than other children because they are better at the motor task of word production. The evidence SG marshals in support of this account includes very recent findings and findings that have been around for a while but have never been incorporated into a larger explanatory structure. The account SG builds explains why children around the world are more likely to say something that sounds like *mama* rather than something that sounds like *mother* or *madre* as their first word and why mothers who provide labels like *pee-pee* instead of *urinate* aren’t all wrong in their

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tacit theories. SG also brings under this explanatory umbrella Tardif's proposal (Tardif, Fletcher, Liang & Kaciroti, 2009) that phonological differences may explain why some languages seem to be acquired more rapidly by children than others (see also Bleses, this issue).

In Roger Brown's analysis of the order of syntactic development in Adam, Eve and Sarah, he sought clues to the mechanisms that underlie language acquisition. It is worth asking what insights about mechanisms of language acquisition might result from considering the relations between children's articulatory abilities and the order and pace of word learning that SG describes. SG offers some proposals. The insight that language is, among other things, a motor skill makes reasonable SG's proposal that practice is a language acquisition mechanism. Just as the tennis player must master the sequence of movements that puts the ball over the net, the language learner must master the sequence of movements that produces particular sounds. Just as the tennis player refines her movements in response to successes and failures, the language learner refines her articulatory gestures to hit acoustic targets in the ambient language. To the degree that this process proceeds successfully, the infant enters word learning with a repertoire of sounds ready to be attached to meanings. (That having sounds in place benefits word learning has been demonstrated by Swingley, 2007.)

The input-eliciting properties of early vocalizations are part of a second process (if not quite a mechanism) by which infants' early articulatory skills affect the pace of their subsequent language development. Talking about older children, Shatz (1987) used the term 'elicitation operations' for a variety of behaviors that children produce with the effect of eliciting language input from those around them. SG similarly describes prelinguistic infants as eliciting input with their early vocalizations. The evidence SG reviews shows that not only do caregivers respond to infant vocalizations, they respond differently to more advanced, speech-like vocalizations (those with a consonant and a vowel) than to the less-mature open vowel only vocalizations. Thus infants who produce more mature vocalizations elicit more of the caregiver responsiveness that supports further development on the road to acquiring language.

A third mechanism operating within the child is selection. Here SG cites the enviably timeless finding by Schwartz & Leonard (1982): when introduced to novel words in an experimental setting, children are more likely to learn words constructed out of sounds in their current productive repertoire than words constructed out of sounds outside their repertoires. The argument is that children know what they can and cannot produce, and they 'pick and choose' what to say, selecting words they can produce and avoiding words they cannot.

SG also brings input into the story, arguing that input affects articulation and that these effects demonstrate the child's sensitivity to the structure of

the ambient language. This is certainly true, but the study of the relation between input and articulation may reveal even more. One set of findings SG describes comes from the by-now large literature on nonword repetition: sounds and sound sequences that are more frequent in the ambient language are more accurately produced by children. There is growing recognition that nonword repetition accuracy also reflects underlying phonological representations and that the structure of the lexicon influences nonword repetition accuracy because it affects underlying representations (Coady & Evans, 2008; Gathercole, 2006). For example, children are better at repeating sequences that conform to the phonology of their own language than sequences drawn from a foreign language (Thorn & Gathercole, 1999), and bilingual children are better at repeating sequences that conform to the phonology of their stronger language than at repeating nonword sequences that conform to the phonology of their weaker language (Parra, Hoff & Core, *in press*). That, in fact, may be the key to why articulation accuracy is not peripheral – it is not purely a motor phenomenon. Not only short-term memory for sound sequences but also accuracy of the articulation of sounds may reflect underlying phonological representations (Geirut, 1998; Rvachew, Ohberg, Grawburg & Heyding, 2003). The question of the relation between articulation and underlying representations has been raised before – see discussions of the ‘fis’ phenomenon, for example (Berko & Brown, 1960; Butler, 1920/1980; Eilers & Oller, 1976), and SG’s review suggests it may bear further investigation.

Another topic SG raises for us to consider is the well-established relation between nonword repetition accuracy and word learning (Gathercole, 2006). Here again, there may be a larger story of how input effects, nonword repetition accuracy and lexical development are related. It may be that input is used to build phonological representations, which in turn support accurate sound production and accurate memory (both components of the nonword repetition task). The stronger memory skills in turn support children in learning new words from their experience (Hoff, Core & Bridges, 2008). That is, underlying representations and the phonological memory skills they support are the internal links among the observable phenomena of the input children hear, their nonword repetition accuracy and their word learning ability.

In addition to making the case for phonological influences on lexical development, SG also endorses the view that lexical development drives phonological development. She makes two arguments in this regard: (1) that bigger vocabularies are likely to make use of a larger number of individual sounds, thus requiring a larger articulatory repertoire; and (2) that as children’s vocabularies grow they need more fine-grained phonological representations to keep different lexical items distinct, as Walley (1988) and Beckman & Edwards (2000) have argued. It is not clear,

however, how to reconcile this mechanism with the mechanism of selection and avoidance, which SG would also like to include in her overarching scheme. When a child with a limited phonemic inventory meets a word that makes use of sounds outside that inventory, under what circumstances does the inventory expand to acquire the new word and under what circumstances is the word just not acquired?

Another unresolved issue in SG's proposed account is the tricky question of how to reconcile discrepancies between speech perception and word comprehension. It is clear from SG's review that the perception and production data do not quite coincide. In particular, the argument that children initially have whole word representations of the sounds of words and only later develop a representational system that specifies detail at the segmental level is contradicted by evidence from infant studies which show that babies notice when a single segment of a word is altered (Swingley, 2005). More generally, the question of whether this account of phonological influences applies only to the development of a productive vocabulary or also to the development of a comprehension vocabulary is left open. That is, when a child encounters a new word that makes use of phonemes outside her inventory and does not add that word to her productive lexicon, does she also not add it to her receptive vocabulary?

SG's comprehensive empirical review and her account of mutual influences between phonology and the developing lexicon direct our attention to a new source of insight into the processes of early phonological and lexical development. Some pieces of her account fit together so well that it is easy to forget that phonological development was not always considered to be an integral part of the language acquisition process. SG's work reminds us that prelinguistic infants encounter sounds and that language acquisition depends on their finding the meanings in those sounds. An important question for future research concerns how language-learning children coordinate this task of finding meaning in the sounds of others with the task of also producing sounds to communicate their own meanings.

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