2 PHONOLOGICAL DEVELOPMENT

From birth, children are exposed to a variety of noises in their environment. Before they can begin to acquire language, they must first separate nonspeech noise from speech sounds. The rudiments of this ability seem to be present at birth, since newborns respond differently to human voices than to other sounds and can recognize their mother's voice within a matter of weeks.

From around one month of age, children exhibit the ability to distinguish among certain speech sounds. In one experiment, infants were presented with a series of identical [ba] syllables. These were followed by an occurrence of the syllable [pa]. A change in the children's sucking rate (the normal reaction to a new stimulus) indicated that they perceived the difference between the two syllables, and were therefore able to distinguish between [p] and [b].

Despite this early sensitivity to contrasts among speech sounds, children initially cannot distinguish between meaningful words. The emergence of this ability has been examined in a task in which children are presented with two toy animals named *bok* and *pok* and are asked to respond to sentences such as *Show me pok*. To respond correctly, children must not only hear the difference between [p] and [b] but also recognize that this difference is linguistically significant—that it is used to distinguish between words in their language. Children under eighteen months have little success in this type of task.

2.1 BABBLING

Even before children master the phonemic contrasts of their language, they begin to develop the articulatory movements needed to produce these distinctions in speech. Although there is considerable variation in the pattern of phonological development, a number of general trends can be identified.

The emergence of articulatory skills begins around six months of age, with the onset of **babbling**. It is likely that babbling provides children with the opportunity to experiment with and begin to gain control over their vocal apparatus—an important prerequisite for later speech. Children who are unable to babble for medical reasons can subsequently acquire normal pronunciation, but their speech development is significantly delayed.

Despite obvious differences among the languages to which they are exposed, children from different linguistic communities exhibit significant similarities in their babbling. The tendencies in Table 12.1 are based on data from fifteen different languages, including English, Thai, Japanese, Arabic, Hindi, and Mayan. (We focus here on consonant sounds, for which the data are somewhat more reliable than for vowels.)

Such cross-linguistic similarities suggest that early babbling is at least partly independent of the particular language to which children are exposed. In fact, even deaf children babble, although their articulatory activity is somewhat less varied than that of hearing children.

Table 12.1 Cross-linguistic similarities in babbling

Frequently found consonants	*Infrequently found consonants*
p b m	f v θ ð
t d n	ʃ ʒ tʃ dʒ
k g	l r ŋ
s h w j	

2.2 THE DEVELOPMENTAL ORDER

Babbling increases in frequency until the age of about twelve months, at which time children start to produce their first understandable words. Babbling may overlap with the production of real words for several weeks before dying out. By the time children have acquired fifty words or so, they begin to adopt fairly regular patterns of pronunciation.

Language acquisition researchers have expended a good deal of effort trying to determine the order in which speech sounds are mastered in production and perception. Although this work has been hindered by difficulties in determining precisely when a contrast has been acquired and by a shortage of reliable data from a sufficiently broad range of languages, some general trends seem to exist.

- As a group, vowels are generally acquired before consonants (by age three).
- Stops tend to be acquired before other consonants.
- In terms of place of articulation, labials are often acquired first followed (with some variation) by alveolars, velars, and alveopalatals. Interdentals (such as [θ] and [ð]) are acquired last.
- New phonemic contrasts manifest themselves first in word-initial position. Thus, the /p/-/b/ contrast, for instance, will be manifested in pairs such as *pat-bat* before *mop-mob*.

By age two, a typical English-speaking child might have the following inventory of consonant phonemes.

Table 12.2 Typical consonant inventory at age two

Stops	*Fricatives*	*Other*
p b m	f	w
t d n	s	
k g		

By age four, this inventory is considerably larger and typically includes the following sounds.

Table 12.3 Typical consonant inventory at age four

Stops	*Fricatives*	*Affricates*	*Other*
p b m	f v	tʃ dʒ	w j
t d n	s z		l r
k g ŋ	ʃ		

Still to be acquired at this age are the interdental fricatives [θ] and [ð] and the voiced alveopalatal fricative [ʒ].

In general, the relative order in which sounds are acquired during the language acquisition process reflects their distribution in languages of the world. The sounds that are acquired early are generally found most widely in the world's languages while the sounds that are acquired late tend to be less common across languages.

2.3 Early phonetic processes

The sound patterns found in child language are quite different from those used by adults in terms of both the segments they contain and the phonotactic combinations they allow. These differences are the product of a limited number of universal phonetic processes that replace certain sounds with others that children find easier to produce and/or perceive. In discussing examples of these processes, we will assume that children's mental representation of a word's pronunciation is close to that of an adult even though its spoken form may be quite different.

Syllable simplification

One frequent process in children's speech involves the systematic deletion of certain sounds in order to simplify syllable structure. In the following data, typical of the speech of two- and three-year-old children, consonant clusters are reduced by deleting one or more segments.

Table 12.4 Reduction of consonant clusters

[s] + stop (strategy: delete [s])
stop → [tɑp]
small → [mɑ]
desk → [dɛk]

stop + liquid (strategy: delete liquid)
try → [taj]
crumb → [gʌm]
bring → [bɪŋ]

fricative + liquid (strategy: delete liquid)
from → [fʌm]
sleep → [sijp]

nasal + voiceless stop (strategy: delete nasal)
bump → [bʌp]
tent → [dɛt]

Another common deletion process in early child language involves the elimination of final consonants. Initial consonants, in contrast, are typically retained if they precede a vowel.

1)

dog → [dɑ]
bus → [bʌ]
boot → [buw]

Both the reduction of consonant clusters and the deletion of final consonants have the effect of simplifying syllable structure, bringing it closer to the CV pattern that is universally favored by children and that is the most widely found pattern in human language in general.

Substitution

One of the most widespread phonetic processes in early language involves substitution—the systematic replacement of one sound by an alternative that the child finds easier to articulate. Common substitution processes include **stopping**, the replacement of a fricative by a corresponding stop; **fronting**, the moving forward of a sound's place of articulation; **gliding**, the replacement of a liquid by a glide; and **denasalization**, the replacement of a nasal stop by a nonnasal counterpart. These processes are illustrated with the help of English examples in Table 12.5.

Table 12.5 Substitution in early speech

Process	*Example*	*Change*
Stopping (continuant → stop)	sing → [tɪŋ]	s → t
	sea → [tij]	s → t
	zebra → [dijbrə]	z → d
	thing → [tɪŋ]	θ → t
	this → [dɪt]	ð → d, s → t
	shoes → [tuwd]	ʃ → t, z → d
Fronting	ship → [sɪp]	ʃ → s
	jump → [dzʌmp]	dʒ → dz
	chalk → [tsɔk]	tʃ → ts
	go → [dou]	g → d
Gliding	lion → [jajn]	l → j
	laughing → [jæfɪŋ]	l → j
	look → [wʊk]	l → w
	rock → [wɑk]	r → w
	story → [stowij]	r → w
Denasalization	spoon → [buwd]	n → d
	jam → [dæb]	m → b
	room → [wuwb]	m → b

Assimilation

Still another widespread phonetic process in child language is assimilation—the modification of one or more features of a segment under the influence of neighboring sounds. In the following examples, initial consonants have been voiced in anticipation of the following vowel.

2)

tell	[dɛl]
pig	[bɪg]
push	[bʌs]
soup	[zuwp]

Assimilation is also observed in children's tendency to maintain the same place of articulation for all of the consonants or vowels in a word. This can lead to the pronunciation of *doggy* as [gɑgij] (with two velar stops) or as [dɑdij] (with two alveolar stops). Other examples of this include [fɛlf] for *self* (with identical consonants) and [bibi] for *baby* (with identical vowels in both syllables).

2.4 Production versus Perception

As noted at the beginning of Section 2, children are initially unable to use phonemic contrasts to distinguish between words in their language. Do children develop the ability to perceive the phonemic contrasts of their language at the same time as they learn how to produce them, or do perceptual skills emerge first? According to one study, a young boy who could not produce a distinction in his own speech between *mouse* and *mouth*, *cart* and *card*, or *jug* and *duck* was nonetheless able to point to pictures of the correct objects in a comprehension task. Evidently, this child's ability to perceive the phonemic contrasts in question exceeded his ability to produce them.

Another indication that children's perceptual abilities are more advanced than their articulatory skills comes from their reaction to adult speech that fails to respect the normal phonemic contrasts. The following report describes one such incident.

> One of us, for instance, spoke to a child who called his inflated plastic fish a *fis*. In imitation of the child's pronunciation, the observer said: "This is your *fis*?" "No," said the child, "my *fis*." He continued to reject the adult's imitation until he was told, "That is your fish." "Yes," he said, "my fis."

The child's reaction to the adult's initial pronunciation of *fish* shows that he could perceive the difference between [s] and [ʃ] even though he could not yet produce it himself.