PEARSON NEW INTERNATIONAL EDITION

Human Communication Disorders
An Introduction

Noma B. Anderson George H. Shames

Eight Edition

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Determinants of Phonological Disorders

Several important linguistic and nonlinguistic factors are related to typical and atypical phonological development. Such information can guide assessment and help us to predict the course of a child's phonological development. Finally, these factors sometimes identify special populations of children who have phonological impairments with unique characteristics that require specialized assessment and intervention techniques.

Motor Abilities

Speech uses the same physical structures as breathing, chewing, swallowing, and other nonspeech oral motor movements. Speech and nonspeech oral motor movements also share neurobiological structures and pathways for sensation, feedback, and movement. However, the neural control of speech involves additional cortical pathways that are not engaged by nonspeech oral motor functions.

General motor abilities (e.g., walking, coordination) are unrelated to speech production, except in generalized neuromuscular disorders such as cerebral palsy (Winitz, 1969). Oral motor abilities are related to speech abilities in a complex fashion. Even rapid alternating movements for certain speech sound sequences, called **diadochokinesis**, are not reliable predictors of speech production. *Diadochokinesis*, which has been the subject of a great deal of research and is often used in assessment, is the movement involved in rapidly saying a series of syllables (e.g., [pʌ, tʌ, kʌ]). Some speech production problems may be revealed in this task. However, the relationship between the rate of producing these syllables and articulatory abilities is unclear. Some people with normal speech production are slower than individuals with disorders. Individuals with speech disorders may be slower because they are more conscious about their speech and about making errors. The relationship between oral motor movements for basic nonspeech functions (e.g., blowing, kissing, swallowing) and speech is even less clear. Intuitively, we think there should be a relationship because they use the same structures and because physiological functions seem to overlap. However, research indicates that speech and nonspeech oral motor behaviors are not related (Moore & Ruark, 1996). There is no evidence that work on nonspeech oral motor abilities has any impact on speech abilities. Speech-language pathologists, however, often work on children's nonspeech oral motor abilities with the goal of improving their speech production. This illustrates the importance of evidence-based practice.

The relationship between speech and nonspeech also comes into play in a condition called **tongue thrust**. Infants and young children swallow by bringing the tongue against the hard palate and pushing the food or liquid forward, instead of propelling food or liquid toward the back of the mouth. Although there is no research evidence, some speech-language pathologists assume that older children with this pattern are delayed in their swallowing development. Tongue thrust is frequently associated with errors in producing [s] and [z] and with dental malocclusion. However, because there is no evidence of a causal relationship, speech-language pathologists do not perform tongue thrust therapy to correct these speech errors. Instead, therapy focuses on the speech errors. Speech-language pathologists do provide intervention for swallowing disorders (dysphagia) and for feeding disorders in children and adults.

One final issue concerning motor abilities is specific to speech. Some children who have phonological disorders seem to have particular difficulty in the motor production of speech. Their speech disorders are typically severe and are resistant to therapy. These children are said to have **developmental apraxia of speech (DAS)** or **developmental verbal apraxia** (see Chapter 10). As with adults diagnosed with *apraxia*, the assumed underlying difficulty involves the sequencing of motor movements to produce speech sounds or syllables. Children identified as having this disorder, however, have not lost any ability due to neurological damage; the disorder is developmental. Speech is characterized by syllable omissions, consonant substitutions, and vowel errors comparable to those seen in other children with phonological disorders. These errors are inconsistent, suggesting that underlying phonological knowledge is intact, but that the implementation of this knowledge in speech production is impaired. Some, but not all, of these children often have difficulty in performing nonspeech oral motor activities. They typically make slow progress in therapy and have difficulty following instructions for sound production. A large-scale, systematic investigation has brought into question many of the assumptions regarding these children (Shriberg, Aram, & Kwiatkowski, 1997a, 1997b, 1997c). These children have a phonological disorder (not a motor planning disorder) characterized by inappropriate stress or prosody that appears to be transmitted genetically. The atypical stress patterns, which previously were not considered systematically, can account for the segmental errors and their apparent inconsistency.

Speech Perception and Hearing

Because the acquisition of phonology directly depends on exposure to the language of the environment, normal hearing is crucial. Phonological deficits in children with hearing impairments vary with the type and the severity of the hearing loss, the child's age when it occurs, the child's age when intervention (e.g., amplification, speech [lip] reading) begins, and the child's ability to utilize residual hearing (see Chapters 17 and 18). Because of all these factors, it is difficult to generalize about phonological acquisition in children with hearing impairments. However, aspects of speech that are least visible (e.g., vowels, nasal versus non-nasal sounds, [r] and [l]) and that are least salient perceptually (e.g., unstressed syllables, voiceless fricatives, voiceless vowels) and prosody pose challenges for these children. The earlier children are diagnosed and are provided with amplification, the better the speech and language outcome. Many children with severe to profound hearing loss now receive **cochlear implants**. These are surgically implanted devices designed to provide electrical stimulation to the auditory nerve through the cochlea. The most remarkable application of cochlear implants is for children who are congenitally deaf or have lost hearing at a very early age. Such children now routinely receive implants before age 2, with some children receiving implants as early as 12 months. Cochlear implants and hearing aids must be accompanied by intensive therapy to achieve maximum success. For infants and toddlers who receive amplification, the goal is to help them create a phonology and lexicon as rapidly as possible.

Other children with hearing impairments are those with chronic **otitis media** (OM). This is an infection of the middle ear that is often accompanied by fluid (effusion), resulting in a conductive hearing loss. Clinicians often note that many children with language disorders (particularly phonological disorders) have histories of repeated episodes of OM. Otitis media may be a causal factor in some phonological disorders and language impairments. However, research is complicated because these episodes may differ in their severity and their impact on hearing. The fact that many children have such a history without any obvious negative effects on their speech and language development clouds the picture. Another problem with research in this area is that many episodes go undetected. Despite this controversy, the risk of a speech delay for a 3-year-old child with a history of chronic OM with effusion and an average hearing level above 20 decibel between 12 and 18 months of age is 33 percent (Shriberg, Friel-Patti, Flipsen, & Brown, 2000). In a large longitudinal study of 150 children (R. G. Schwartz, Mody, & Petinou, 1998), children (0–12 months) who had frequent episodes of OM produced more consonants that are more visible (e.g., [b], [p]) than consonants that are less visible (e.g., [t], [d]) than did children without this history. At 2 years, these children had greater difficulty producing words or syllables with final consonants than did children who did not have frequent middle-ear infections.

Speech perception in children with normal hearing has a less clear relationship to speech production. Though it seems safe to assume that perception is better than production, this is not always true. Some perceptual errors may cause production errors, and sometimes production appears to be accurate with inaccurate auditory perception (e.g., when there is visible information such as [b], [p], or [m]). When perception testing focuses on the child's specific production errors, approximately a third of the children tested evidenced errors in discriminating their error production from the target (Locke, 1980b). It does not mean that the misperception caused the production error or that remediating perception for these children should be the primary focus of intervention, but it should be considered in intervention planning.

Speech perception, as measured by discrimination (i.e., judging whether two syllables are the same or different), identification of speech sounds, or judgment of syllable sequence, appears to be related to children's overall language abilities. Children with language disorders (including phonological disorders) typically have difficulty in such tasks. However, the specific nature of perception deficits and their relationship to language acquisition remain controversial.

Dentition

The relationship between dentition and speech production has often been overestimated. Studies of normal speakers indicate that the articulatory mechanism is highly adaptable. We can produce reasonably intelligible speech while chewing gum, while chewing food, and even after receiving local anesthetic at the dentist. Therefore, minor dental abnormalities rarely cause significant deviations in speech production. Severe dental abnormalities resulting from malocclusion or from deviations in jaw alignment, however, may lead to speech errors. This may be important for children with cleft palate and other craniofacial anomalies when dentition is severely affected.

Oral Mechanism

Adequate oral structure and physiology along with adequate respiration are required for speech production and for phonological acquisition. A variety of physical and physiological deviations in the mechanism for speech production may occur. The most common group of deviations is the result of craniofacial anomalies referred to commonly as cleft palate (see Chapter 9). The phonological deficits associated with cleft palate include hypernasality, nasal emission, and poor production of sounds that depend on intra-oral breath pressure (stops and fricatives). Some children with cleft palate incorrectly produce sounds at the back of the oral cavity, in the pharynx, or at the glottis to compensate for their inability to produce these sounds at the appropriate place of articulation. These error patterns are complicated further by the fact that almost all of these children have chronic OM with effusion accompanied by hearing loss.

Intelligence and General Development

For many decades, children and adults with intellectual disability have been described generally as having speech that is imprecise, slow, and inaccurate with inappropriate rhythm. In adults with intellectual impairment, consonant omissions are the most common phonological error, and although errors are inconsistent (i.e., target sounds are produced correctly on occasion), the error types are similar to those of children with phonological impairments (Shriberg & Widder, 1990). Because of the inconsistencies, the cause is not likely to be a deficit in the motor execution of speech production. Instead, the errors are the result of cognitive limitations in one of the stages of speech production.

One special subgroup of children with developmental disabilities is those with **Down syndrome**. In Down syndrome, there is a complex interaction of motor deficits that affect speech production, perceptual limitations attributable to a very high incidence of chronic OM with effusion along with transient hearing loss, and phonological acquisition that reflects their developmental delay. In particular, these children are delayed in the onset of canonical babbling. Their early vocal behavior suggests a high degree of variability with some particular difficulties with high/low distinctions in vowels and front/back distinctions in consonants and vowels in speech production. A variety of speech disorders are common among individuals with developmental disabilities of unknown origin. Some of these disorders appear to have a neurological basis and are dysarthrias or apraxia (see Chapter 10). These disabilities may also be associated with genetic syndromes, some of which also involve hearing impairment.

A final group of children has Pervasive Developmental Disabilities (PDD), also referred to as autism spectrum disorders. This is a category of severe developmental impairment affecting social, cognitive, language, and communicative abilities. Children vary widely in their degree of impairment and their specific behavioral symptoms. The vast majority of these children have moderate to severe cognitive and linguistic deficits and may not have basic, functional language skills. Approximately 20 percent of these children do have IQs within the average range and functional language (American Psychiatric Association, 1994). These children are "high functioning" or have a related disorder called Asperger's Syndrome. A number of these children and adults have residual articulation errors indicating earlier phonological impairments, inappropriate stress, fluency, and resonance (Shriberg, McSweeney, Kiln, & Cohen, 2001). The latter errors appear to co-occur with limitation in pragmatic skills and sentence formulation.

Language

As discussed above, phonology is an integral part of language and is related to other language components. Infants rely on prosodic and segmental information in the speech of adults to identify word and syntactic phrase boundaries. There is an interaction between phonology and other language components in their synchronous development. Young children who are Late Talkers or have identifiable syntactic deficits (low mean length of utterance) are likely to have comparably delayed phonological abilities. Children with Specific Language Impairment have deficits in the perception of grammatical morphemes (e.g., third-person singular, past-tense endings) that may underlie their deficits in syntax and morphology (L. Leonard, 1998). In other children, the acquisition of morphology is impaired because of a phonological deficit that affects certain segments (e.g., [s], [z]), final consonants in general, or unstressed syllables (R. Paul & Shriberg, 1982; Shriberg & Austin, 1998; Shriberg, Tomblin, & McSweeney, 1999).

Complexity is another aspect of this relationship. Length and structural complexity determine what children produce under certain circumstances. As syntactic complexity increases, children may revert to simpler phonological forms, and errors may increase. Increases in phonological complexity may result in decreases in syntactic complexity or decreases in syntactic errors. Accuracy of production in children less than 3 years of age also appears to be influenced by the syntactic category of words. Nouns are produced more accurately than are verbs, perhaps because of the conceptual complexity.

There also is an interaction between pragmatics and phonology involving the distinction between **new information** (changing aspects of a situation or things that are not known to the listener) and **old information** (static aspects of a situation or things that are known to the listener). Children produce words that refer to new information more accurately than they do words that refer to old information. This is also true for adults. In conversation, the first production of a word is longer in duration and is produced more clearly than subsequent productions of that word.

Although syntax and phonology may be closely related in development, intervention for syntactic disorders does not lead to spontaneous improvements in phonology (M. Fey et al., 1992). Children with syntactic and phonological deficits need intervention that focuses on each component of language.

Reading

The emergence of literacy involves learning an orthographic (i.e., alphabetic) system for writing and reading that corresponds to oral phonology, learning a set of words that can be recognized on sight, and learning strategies to read words that are not recognized on sight (see Chapter 13). In a general sense, all aspects of phonology are prerequisites for reading. A child cannot learn about sound–letter correspondences without certain basic knowledge about consonants, vowels, syllable structure, phonological rules, or constraints. Although children acquire phonology without being able to express this knowledge consciously, reading is more directly dependent on **metaphonological** abilities (also referred to as **phonological awareness**).

Metaphonological abilities are a subset of metalinguistic abilities. Metalinguistics is the aspect of language that includes the general ability to make judgments about language (e.g., whether sentences are grammatical or not) and to perform tasks that require conscious examination of language (e.g., providing synonyms). In phonology, this includes tasks that require children to provide rhymes, to identify beginning and ending sounds of words, to break words into syllables, and to pronounce words without beginning (e.g., <u>s</u>lip—“lip”) or ending (boa<u>t</u>—“bow”) sounds. Performance on metaphonological tasks predicts later reading and writing abilities. Phonological working (or short-term) memory is also related to reading abilities and to spoken language performance. Phonological working memory is often measured with nonword repetition. In this task, children are asked to repeat nonsense words of increasing length (one to four syllables). By 5 years of age, children can repeat most two-syllable words correctly, but even 7-year-old children may have some difficulty with longer words. When children are asked to repeat a list of phonologically similar (e.g., rhyming) words, they have more difficulty producing the list accurately than they do a list of phonologically dissimilar words (Marton, Schwartz, & Braun, 2005).

Phonologically related reading disabilities, termed **dyslexia**, are language-based disorders. Children with dyslexia have great difficulty with metaphonological tasks. They also may have syntactic and speech perception deficits. Even if they have compensated for these deficits in oral language, children with phonological disorders are likely to demonstrate reading impairments.

Assessment

There are different steps in assessment. **Screening** is used to determine whether there is reason to suspect a disorder. **Identification** involves the use of norm-referenced tests and other measures to determine whether or not a child who failed a screening actually has a phonological disorder. Once that determination is made, a **diagnosis** involves specifying the nature of the disorder, its severity, the prognosis, and the recommended course of treatment. It is important to focus on those aspects of a child's phonology that will be most relevant for intervention. Each assessment procedure should be undertaken with a specific intervention goal in mind. Phonological assessment is an ongoing process that is not limited to a single diagnostic session. The initial assessment provides a starting point for intervention, with information added as intervention proceeds.

Screening

A number of screening instruments are commercially available. Typically, they include the sounds that children are most likely to produce incorrectly and are most predictive of the presence of a phonological disorder. The stimuli may be pictures, single words that the child imitates, sentences or passages that are read, or a set of questions that the child must answer. Some commercially available screening tests have norms and cutoff scores. An alternative method is to elicit a short sample of spontaneous speech by asking a child to tell a story (e.g., a favorite movie or book) or to relate an event (e.g., a birthday party). Clinicians then determine whether a given child has passed or failed the screening. They also make judgments about the number and type of errors and overall intelligibility in light of their knowledge of typical development. Clinicians may also consider concerns expressed by parents or teachers, the types of errors (some errors are less likely to disappear without intervention), the consistency of errors, and the child's ability to correct errors with some minimal instruction. Children who fail the screening are referred for further testing. Children with a small number of potentially developmental errors may be rescreened after 6 months.

Screening tests sometime yield *false positives*, children who fail the screening, but who do not have a phonological disorder, and *false negatives*, children who pass the screening test, but who actually have a phonological disorder. Screening tests also can be characterized in terms of their sensitivity and specificity. Sensitivity is the success rate in identifying all of the children who truly have a disorder, whereas specificity is the success rate in identifying only the children with disorders (no typically developing children fail by mistake). Ideally, a test will have high sensitivity and high specificity, but for screening,