

The highest level of clinical interpretation relative to diagnostic classification is the decision of whether evaluation results (including assessment of spontaneous behaviors and formal test results) indicate that speech patterns should be considered the *primary* or the *secondary* category for differential diagnosis (see Table 1.1). If the observed speech patterns are considered as the primary diagnostic classification, the implication is that the clinician will be targeting these patterns as the major focus in intervention. In this case, the clinical prediction is that disorders related to developmental speech patterns are the primary diagnosis. After a period of intervention, speech patterns should normalize the child's communication delay or disorder relative to chronological age expectations. In children with conditions of known etiology (e.g., cerebral palsy), however, the primary developmental speech diagnosis may predict that these children's speech patterns will not normalize to age-appropriate expectations for intelligible speech based on the etiology classification.

If the disordered speech patterns observed are clinically judged as a secondary diagnosis, they are not considered to be the foundational classification for differential diagnosis but as clinical symptoms observed in addition to the primary diagnostic category assignment. This secondary level of differential diagnostic classification also has important implications for intervention. If the primary diagnostic category is not developmental speech disorder, intervention will be properly centered on other language and communication issues. Resolution of those symptoms should result in normalization of the child's clinically relevant speech production patterns related to chronological age expectations or severity level.

DEVELOPMENTAL SPEECH PATTERNS AS A PRIMARY DIAGNOSIS

When developmental speech patterns are considered the primary diagnostic category, two major classifications are available to the clinician. The first classification is termed *functional*. A functional developmental speech disorder or delay classification indicates that at the time of the clinical assessment, no known etiology can be pinpointed for clinically relevant behaviors observed. This functional category accounts for the largest group of children with developmental speech disorders when speech is the primary diagnostic classification (Bernthal & Bankson, 2002). In this category, the clinician may implement intervention based on either phonological or phonetic principles, but the underlying cause of the clinical speech patterning is simply not available based on contemporary techniques for diagnosis in communication sciences and disorders.

The second classification in which developmental speech patterns are designated as the primary diagnostic category is termed *etiological* classification. Etiological classification related to differential diagnosis falls into two areas related to *peripheral mechanism* considerations: production system causes and perception system

causes. *Neural* control for speech production or perception may also be implicated as an etiological factor. Finally, *general developmental* issues may be the etiological basis for a diagnosis of primary developmental speech impairment.

In the case of peripheral mechanism etiology, the respiratory, phonatory, or articulatory subsystems of the speech production system can be implicated in a variety of ways directly related to observed speech pattern impairments. For example, respiratory insufficiency is implicated in cerebral palsy, in which energy to support speech production may be insufficient or uncoordinated. In addition, intensity and voicing may be directly involved as well as problems with control of the speech articulation subsystem. Phonation characteristics, may underlie speech production impairment associated with injured vocal folds. Here, voicing and fundamental frequency aspects of speech production patterns may be implicated. The articulatory subsystem may be the major etiological factor in a variety of conditions as diverse as velar insufficiency, cleft palate, or tongue muscle weakness (e.g., dysarthria). These differences in articulatory subsystem structures and functions relate to both articulatory shaping of the sound source and to resonance properties underlying speech production patterns.

Perceptual subsystem factors relevant to etiology for developmental speech disorders relate primarily to characteristics of the auditory system, although other sensory systems, including vision and kinesthetic systems, can also be implicated. Level of hearing acuity has been studied for many years relative to predictions for development of intelligible oral speech production, even when children receive intensive therapeutic intervention. Recent instantiation of universal newborn hearing screening programs adds very young children or toddlers to the category of auditory perceptual etiology that may be a part of the scope of practice in assessment and intervention for the contemporary speech-language pathologist. At this time, relationships between sensory factors other than the auditory perceptual status have not been well documented by data-based research.

In addition to peripheral mechanism considerations, neural factors may be implicated as an etiological consideration for observed patterns in developmental speech impairments. The advent of more sophisticated instrumentation such as positron emission tomography (PET) scanning and functional magnetic resonance imaging (fMRI) technologies may signal the beginning of an era in which more straightforward links can be made between neurological structure and function and etiology for developmental speech disorders. At present, the proposed diagnostic classification of developmental apraxia of speech is, in some theoretical perspectives, considered as a difference in speech motor planning based on proposed neurological differences (e.g., Hall, Jordan, & Robin, 1993). Instrumentation currently available is not capable of establishing the validity of this proposal, however. Clearly, some

severe categories of developmental speech disorder such as dysarthria are based on underlying neurological damage that can be documented with present instrumentation.

General developmental considerations can also lead to a diagnosis of primary speech delay or disorder. For example, "general motor clumsiness" is a DSM-V (American Psychiatric Association, 2000) category that may also be accompanied by primary developmental speech production impairment (e.g., Hodge, 1998). Profound cognitive delays may stem from a diversity of etiological factors, which result in a primary developmental speech impairment. (This speech impairment may co-occur with primary impairment in language or other areas of communication.) Birth-related risk factors can also constitute a general developmental consideration in which infants experience pre-, peri-, or postnatal birth traumas (Bleile, 1995). These general developmental factors can result in a primary communication disorder affecting typical speech acquisition along with general developmental delays and, potentially, co-occurring primary disorders in other areas of language and communication development.

DEVELOPMENTAL SPEECH PATTERNS AS A SECONDARY DIAGNOSIS

Developmental speech impairment that is clinically relevant based on expectations for a child's chronological age may be a secondary diagnostic classification related to a number of factors (see Table 1.1). In these children, the speech production impairment may either be functional or derive from a known etiological base. In either case, however, clinician judgment will implicate another area as the primary basis for the child's communication or language disorder. In this regard, the developmental speech disorder would likely be at the mild to moderate level relative to age-related expectations for intelligibility. A severe to profound level of developmental speech disorder would more likely, although not always, be considered as the primary clinical classification, even with a co-occurrence of other clinical diagnoses, if the child's intelligibility were extremely low overall.

Developmental speech disorder or delay may be secondary to clinical involvement in other areas of the speech production system. Stuttering or voice disorders, considered aspects of speech production (Kent, 2004), would fit within this category. For example, a child may exhibit stuttering, which is a speech rhythm disorder. The diagnosis of stuttering may be considered the highest priority for clinical classification and planning remediation, even if developmental speech production impairments coexist. A voice disorder affecting the areas of pitch, loudness, rate, or resonance characteristics could also be considered a primary diagnostic category even in the presence of a developmental speech disorder. If the child's voice characteristics are based on etiological factors (e.g., paralyzed vocal fold), a primary diagnostic classification of voice disorder is more likely. As with stuttering, however, the

severity of the child's speech production impairment would be important for the clinician in determining the primary area of clinical diagnosis.

Developmental speech delay may also be secondary to *language* delay or disorder. Differential diagnosis of speech versus language disorder as the primary diagnostic category is based on typical speech and language expectations for a child's chronological age. For example, a 5-year-old child who uses primarily open syllables with some consonantvowel-consonant (CVC) forms (e.g., "cat") and most consonants expected for his age but who demonstrates a mean length of utterance (MLU) of only one to two words might more likely be classified with primary expressive language delay even though his speech production patterns are not considered age appropriate. A 6-year-old with receptive language impairment who does not produce complex word shapes consistently and leaves off some final consonants would receive a primary diagnosis of receptive language delay despite the lack of age appropriate speech production patterns.

A variety of other clinical diagnoses may also include developmental speech production impairment as a secondary diagnostic component for intervention classification. *Socially* based language disorders, such as an autism spectrum disorder, may likely contain a speech production component in children who are considered low functioning, but they would be primarily classified with reference to socially motivated language issues. Children with *cognitively* based language disorders related to intellectual capacity may also exhibit a developmental speech component. The speech patterns would not necessarily be a primary diagnostic focus if the child's language function were significantly impaired.

PHONETIC OR PHONOLOGICAL CLASSIFICATION OF DEVELOPMENTAL SPEECH DISORDERS

One contemporary issue related to classification of developmental speech disorders relates to the dichotomy between phonetic and phonological designations for patterns observed in children who are evaluated clinically. Briefly, *phonetic* perspectives relate to the operation of the motor and sensory processes used to support speech production as well as to neurally instantiated brain-behavior relationships known to support speech production and perception. This dimension of description has been termed the *performance* aspect of speech production (Chomsky & Halle, 1968). In short, an example of performance is what a child does with her body to learn to speak and what the child or adult speaker does to produce speech. In contrast, *phonological* designations relate to what a child or adult speaker *knows* about the phonemic categories and sequence restrictions in the ambient language that allow construction of linguistic messages. Phonological *competence* underlies coding of meanings in a language community.

At present, systems of clinical assessment and intervention in speech-language pathology fall into either phonetic or phonological categories, depending on the background and orientation of the clinician/researcher. Cases in which the etiology is clearly known have been described using the type of classification that is prominent in the professional community, regardless of whether the implication of a phonetic or phonological basis is well founded. For example, the phonological process classification (Stampe, 1979) was used in the 1980s for all types of etiologies, including children with hearing impairment, dysarthria, or cleft palate, despite the clear basis for natural phonological processes within phonological theory. In short, the descriptive utility of clinical speech patterns using phonological descriptors dominated, even in cases in which a clear phonetic or peripheral mechanism etiology was present.

In general, the history of diagnostic classification has represented a pendulum swinging back and forth from predominantly motor-based classifications to primarily phonological classifications for developmental speech involvement. One prominent early classification system for developmental speech disorder or delay was based on Van Riper and Irwin's (1958) original "substitution," "distortion," and "omission" descriptors related to a proposed motor basis for observed speech symptoms. Succeeding that classification system were the linear distinctive feature systems of the 1970s, largely based on the Chomsky and Halle (1968) feature descriptions for underlying phonological competence. Some competence-based feature classifications are still available to contemporary therapists (e.g., Lowe, 2003; Yavas, 1998). In the 1980s and early 1990s, phonological processes (e.g., Hodson & Paden, 1994) were used as the predominant classification system for clinical diagnosis and treatment of developmental speech disorders. As new phonological theories became increasingly predominant in linguistics to replace some of the inadequacies of linear distinctive feature systems, new applications of these theories have emerged in systems of classification available within communication sciences and disorders. Two prominent representatives of these theoretical orientations can be found in nonlinear phonology (e.g., Bernhardt & Stoel-Gammon, 1994) and optimality theory (Pater, 1999). In contrast, contemporary systems of classification based on motor speech theoretical orientations (e.g., Yorkston, Beukelman, Strand, & Bell, 1999) suggest classification based on principles of motor learning with the implication that many developmental speech disorders can be appropriately understood with respect to motor programming and motor planning designations for observed impairments.

The variety of classification systems employed since the 1970s in speech pathology for description of developmental speech disorders reflects a "borrowing" process. Researchers and therapists borrow from available theories in linguistics or motor learning to describe patterned regularities in children diagnosed with developmental

speech impairments relative to expectations for their chronological ages. At present, no consensus exists on how to make principled decisions about the proposed phonetic or phonological basis for children's observed clinical impairments. Combined with the situation in which the largest category of children is designated with functional bases for clinical patterns observed, the state of contemporary speech pathology practice in this area of communication sciences and disorders is founded on the clinician's or researcher's theoretical orientation rather than on any objective basis for classification of speech patterns as phonetic or phonological. This "noisy" status of classification relative to the possibility of performance or competence bases for observed clinical symptoms remains a challenge to precision in clinical classification in our speech-language pathology.

Excerpted from Chapter 1 of **Phonological Disorders in Children: Clinical Decision Making in Assessment and Intervention**, edited by Alan G. Kamhi, Ph.D., & Karen E. Pollock, Ph.D.

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