CH. 5: ARTICULATORY-PHONOLOGICAL DEVELOPMENT & DISORDERS

Acquisition of Articulatory & Phonological Skills: Typical Development

Theories of Development, p. 211

Behavioral Theory	● Based on conditioning and learning ● Emphasizes that the child develops the adult-like speech of his or her community through interactions with the caregivers ● Holds that babbling is gradually shaped into adult forms through principles of classical conditioning that occur primarily through caregiver-child interactions ● Some experts argue that this theory does not account for an infant's creativity or capacity to produce new patterns; the evidence is not compelling that caretakers selectively reinforce the child's sounds in the prelinguistic period
Structural Theory	● Jakobson (1968), Chomsky and Halle (1968) ● Phonological development follows an innate, universal, and hierarchical order of acquisition of distinctive features ● Child begins with maximal contrasts of /p/ and /a/ and differentiates and fine tunes them into more subtle contrasts
Natural Phonology Theory	● Stampe (1969) ● States that natural phonological processes are innate processes that simplify the adult target word ● Children learn to suppress processes that do not occur in their languages ● Children represent or store speech forms correctly; what leads to the use of phonological processes is *output constraints*, or constraints on production that lead to simplification of the adult model ● The concept of the universal or innate status of child phonological processes or rules is controversial ● No empirical evidence that children have full and accurate perception from the earliest stages of speech production ● Natural phonology does not account for "nonnatural" simplifications in the speech of children
Generative Phonology Theory	● A theory of the sound structure of human languages ● Two main ideas underlie this theory: o Phonological descriptions are dependent on information from other linguistic levels o Phonological rules map underlying representations onto surface pronunciations ● Has been applied to our understanding of children's speech acquisition because it enables a description of the relationship of children's production to adult pronunciation in terms of phonological rules ● This theory is not broadly applied
Linear vs. Nonlinear Phonology Theories	● Linear o Goals of this theory are to: ▪ describe phonological patterns that occur in natural languages ▪ create rules that account for these systems ▪ identify universal principles that apply to various phonological systems o Based on the premise that all speech segments are arranged in a sequential order, that all sound segments have equal value, and that all distinctive features are equal ▪ No one specific sound segment has control over other segments o Characterized by rules that operate in a domain of linear strings of segments o Assume that phonological properties are linear strings of segments and that sound segments are composed of a bundle of independent characteristics or features ● Nonlinear o Developed as an alternative to account for the influence of stress and tone features in levels of representation independent of segmental or linear representation o Several nonlinear theories exist and they deemphasize processes or rules and focus on prosodic phenomena

	○ Assume that there is some sort of hierarchy that helps to organize both segmental and suprasegmental phonological units ○ Explore the relationships among units of different sizes (acknowledge the fact that syllable structure could affect the segmental level of a child's productions) ○ Clinically, one of the biggest contributions of nonlinear theory has been its attention to multisyllabic words and the way in which therapy is organized

Infant Development: Perception & Production, p. 214

Perception	● Using *high-amplitude sucking paradigm* and *visually reinforced head turn*, research has shown that: ○ 4-17 week-old-infants can discriminate between the vowels [u] and [i], [a] and [I] ○ 2-month-old infants can discriminate between [ba] and [ga] ○ 2 to 3-month-old infants can discriminate between [ra] and [la] ○ 1 to 4-month-old infants can discriminate between [va] and [sa], [sa] and [sha], [pa] and [ba] ○ 6 to 8-month-old infants can discriminate between [sa] and [za] ● Typically, children under one year of age are able to distinguish sounds that are not used in their language ○ This ability declines around 1 year of age
Production	● Structural differences (e.g. a high larynx, a tongue placed far forward in the oral cavity) constrain an infant's productions, especially during the first 4 months of life ● 4-6 months of age: epiglottis and velum grow further apart, the infant becomes capable of producing a greater variety of sounds ● Oller (1980, 2000) proposed approximate, overlapping stages of development of prelinguistic, non-reflexive vocalizations: ○ *Phonation stage* (birth-1 month): speech-like sounds are rare; most vocalizations are reflexive (e.g. burping, coughing, crying); some non-reflexive vowels or syllabic consonants may occur ○ *Cooing or gooing stage* (2-4 months): most of the infant's productions are acoustically similar to /u/; some velar consonants may occur ○ *Expansion stage* (4-6 months): the infant is "playing" with the speech mechanism, exploring his or her capabilities through such productions as growls, squeals, yells, and raspberries (bilabial trills); some CV-like combinations and vowellike sounds may be produced ○ *Canonical or reduplicated babbling stage* (6-8 months): the infant produces strings of CV syllables such as "mamamamama;" although the infant does not have sound-meaning correspondence, the timing of the CV syllables approximates that of adult speech; by about 8 months, children with hearing losses fall behind hearing peers in language development ○ *Variegated or nonreduplicated babbling stage* (8 months-1 year): infant continues to use adult-like syllables in CV sequences, but a variety of consonants and vowels appear in a single vocalization ● During the first 3 years of life, a child's vocal tract anatomy and function change (lip closure improves, larynx moves further down the vocal tract, tongue muscle tone increases, and tongue movements become dissociated from jaw movements)
Typical Articulation Development in Children	● **The articulation approach to normal development looks at children's acquisition of individual phonemes and emphasizes speech-motor control** ● Vowels are acquired before consonants ● The nasal consonants /m/, /n/, and /ing/ are among the earliest to be acquired; usually mastered between 3-4 years of age ● Stop sounds are mastered earlier than fricatives ○ most stops are mastered between 3 and 4.5 years of age ○ the stop /p/ may be mastered the earliest ● Glides /w/ and/y/ are mastered earlier than fricatives; mastered between 2 and 4 years ● Liquids /r/ and /l/ are mastered relatively late (between 3 and 7 years) ● Fricatives and affricates are mastered later than stops and nasals ○ the fricative /f/ is mastered earlier than other fricatives (around age 3) ○ other fricatives are mastered last (between 3 and 6 years)

	● Consonant clusters (e.g. *br* in the word *brown*) are acquired later than most other sounds
Typical Phonological Development in Children	● The phonological process approach studies children's acquisition of *patterns and processes* underlying such patterns o Focuses on language knowledge o Posits that children's errors are a way of simplifying the adult model of correct articulation (such simplifications are called *phonological processes*) ● Children may use one or more phonological processes when producing a given word ● Children's phonological processes can be divided into three categories: o *Substitution:* Group of phonological processes in which one class of sounds is substituted for another *o Assimilation:* sounds are changed by the influence of neighboring sounds o *Syllable structure*
Substitution Processes	● *Vocalization*: a vowel (usually /o/ or /u/) is substituted for a syllabic consonant (usually a liquid) o bado/bottle, noodoo/noodle ● *Gliding:* a liquid consonant is produced as a glide; can occur in clusters; children frequently make the following substitutions: o w/l (wamp/lamp) o j/l (jait/late) o w/r (wing/ring) o pweety/pretty ● *Velar fronting:* an alveolar or a dental replaces a velar; usually occurs in word-initial positions o tey/key o doat/goat ● *Stopping:* fricative or affricate is replaced by a stop o to/shoe o dis/this o node/nose ● *Depalatization:* substitutes an alveolar affricate for a palatal affricate, or an alveolar fricative for a palatal fricative o wats/watch o wis/wish ● *Affrication:* an affricate is produced in place of a fricative or stop o chun/sun o choe/shoe o buch/bush ● *Deaffrication:* a fricative replaces an affricate o sip/chip o seese/cheese ● *Backing:* a posteriorly placed consonant is produced instead of an anteriorly placed consonant (velars are substituted for alveolars) o boak/boat ● *Glottal replacement:* a glottal stop is produced in place of another consonant
Assimilation Processes	● *Reduplication:* repeats a pattern *o* wawa/water ● *Regressive assimilation:* (also called consonant harmony), occurs due to the influence of a later occurring sound on an earlier sound *o* guck/duck *o* bip/zip ● *Progressive assimilation:* (also called consonant harmony), an earlier occurring sound influences a later occurring sound *o* kik/kiss *o* boop/boot ● *Voicing assimilation:* can either be *devoicing* or *voicing* *o* pik/pig *o* bad/pad

Syllable Structure Processes	● *Unstressed-* or *weak-syllable deletion*: involves omission of an unstressed syllable o mato/tomato ● *Final consonant deletion:* final consonant is omitted o be/bed ● *Epenthesis:* a schwa back vowel is inserted between the consonants in an initial cluster or after a final voiced stop o taree-tree ● *Consonant-cluster simplification or reduction:* a consonant or consonants in a cluster are deleted o –peed/speed ● *Diminutization:* addition of /i/ to the target form o doggy/dog ● *Metathesis:* production of sounds in a word in reversed order; also known as spoonerism o peek/keep

Speech Sound Disorders

General Factors Related to Speech Sound Disorders, p. 219

Gender	● Some evidence that girls have slightly superior articulatory skills to those of male children ● More boys than girls tend to have speech sound disorders
Intelligence	● Has not been shown to be causally linked to SSDs ● Only associated when intelligence is significantly below average; many children with intellectual disabilities have SSDs
Birth Order & Sibling Status	● Some evidence that firstborn and only children have better articulation skills than those who have older siblings ● Has been suggested that the greater the difference between the siblings, the better the articulation of the younger child
Socioeconomic Status	● SES is not a strong factor in the etiology of SSDs
Language Development & Articulation Performance	● Younger children with severe SSDs are more likely to demonstrate language problems than children with mild-moderate delays ● Young children with SSDs may be at risk for problems with reading and spelling in elementary school years
Auditory Discrimination	● Some children with SSDs have scored poorly on auditory discrimination tests and others have scored within normal limits ● It is believed that there is not a strong relationship between articulation and auditory discrimination skills

Description of Articulatory Errors, p. 220

Articulatory Errors	● These errors involve mis-productions of specific phonemes ● The child is motorically unable to produce the erred phoneme, so treatment must involve teaching correct production and emphasizing speech-motor control
Substitutions	● An incorrect sound is produced in place of a correct sound o tink/think
Omissions or deletions	● Required sounds are omitted in words o bo-/boat
Labialization	● Sounds are produced with excessive lip rounding
Nasalization	● Oral sounds (especially oral stops like /g/) are produced with inappropriate, usually excessive, nasal resonance
Pharyngeal fricative	● Fricatives such as /h/ are produced in the pharyngeal area
Devoicing	● Voiced sounds are produced with limited vocal fold vibrations or without vocal fold vibrations o dok/dog
Frontal lisp	● Sibilant consonants are produced with the tongue tip placed too far forward (between or against the teeth); /s/ and /z/ are the sounds most commonly involved

Lateral lisp	● Sibilant sounds such as /s/ and /z/ are produced with air flowing inappropriately over the sides of the tongue
Stridency deletion	● Strident sounds are omitted o -top/stop
Unaspirated	● Aspirated sounds are produced without aspiration
Initial, medial, final position errors	● Errors in the production of a beginning, medial, or final sound of a word
Prevocalic, intervocalic, postvocalic errors	● Errors occur with reference to consonant position in syllables o dabdelion/dandelion o gog/dog

Organically Based Disorders, p. 221

Oral Structural Variables	● Ankyloglossia (tongue tie) o Occurs when the *lingual frenum*, which attaches the tongue to the base of the mouth, is too short and tongue mobility is limited o Research has shown that tongue tie is not a frequent cause of misarticulations, and children with short lingual frenums can have normal articulation ● Dental Deviations o *Malocclusion* refers to deviations in the shape and dimensions of the mandible and maxilla (*skeletal malocclusion)* and the positioning of individual teeth (*dental malocclusion)* o 3 categories of malocclusions: ▪ *class I malocclusion:* the arches themselves are generally aligned properly, but some individual teeth are misaligned ▪ *class II malocclusion:* the upper jaw or maxilla is protruded and the lower jaw or mandible is receded (AKA *Overbite*) ● *Overjet* occurs when the child has a Class II malocclusion and the upper teet from the molars forward are positioned excessively anterior to the lower teeth ▪ *class III malocclusion:* the maxilla is receded and the mandible is protruded
Oral-Motor Coordination Skills	● Frequently assessed through tests of *diadochokinetic rate* (maximal repetition rate of syllables in rapid succession) ● The relationship between diadochokinesis and speech sound production in conversational speech is unclear ● Research has not substantiated the hypothesis that poor oral-motor coordination skills lead to articulation problems
Orofacial Myofunctional Disorders (Tongue Thrust)	● Current definition of OMDs encompasses any anatomical or physiological characteristic of the orofacial structures that interferes with normal speech, physical, dentofacial, or psychosocial development ● This includes swallow, labial and lingual rest, and speech posture differences ● Usually, a child with OMD exhibits deviant swallows o In a normal swallow, the tongue tip is placed behind the alveolar ridge and the body of the tongue pushes the fluid or solid back for swallowing o In the deviant swallow, the tongue tip pushes against the front teeth; the tongue tip may protrude between the upper and lower teeth and come in contact with the lower lip ● During speech production, the tongue also may exert some force against the front teeth, and even at rest, the tongue may be carried more forward in oral cavity this can contribute to an anterior open bite ● OMD causes errors in production of s, z, sh, ch, y, t, d, l, and n o Thus, some SLPs perform *oral myofunctional therapy* to correct the deviant swallow
Hearing Loss	● Profound hearing loss difficulties with both consonant and vowel productions, making many substitutions, distortions, and omissions of phonemes

	● Mild hearing loss (10-30 dB) omissions of high-frequency voiceless sounds (s, t) are common; may use phonological processes of final consonant deletion, stridency deletion, and fronting

Neuropathologies, p. 223

Dysarthria	● A speech-motor disorder caused by peripheral or central nervous system damage o Damage causes paralysis, weakness, or incoordination of the muscles of speech ● In children, it can be caused by cerebral palsy, head injury, degenerative diseases, tumors, and strokes ● All speech production systems are affected: phonation, resonation, respiration, resonance, and articulation ● Dysarthric speech usually associated with monotonous pitch, deviant voice quality, variable speech rate, and hypernasality o Reduced intelligibility the key feature* o Often sounds "slurred" ● Children with dysarthria often have the following common articulatory error patterns: o voicing errors, especially those that involve devoicing of voiced sounds o bilabial and velar sounds are easier than alveolar fricatives and affricates, labiodental fricatives, and palatal liquids o stops, glides, and nasals are easier than fricatives, affricates, and liquids ● Treatment o Typically very repetitive and structured o Involves increasing muscle tone and strength, increasing range and rate of motion, and treating other parameters that affect intelligibility o Involves intensive and systematic drill, modeling, phonetic placement, and emphasis on accuracy of sound production o For children who aren't able to achieve intelligibility, compensatory strategies are often used to assist in communication (prosthetic devices, AAC)
Apraxia	● Described as a *motor programming disorder* o Caused by central nervous system damage o No weakness or paralysis; CNS damage makes it difficult to program the precise movements necessary for smoothly articulated speech ● *Childhood apraxia of speech (CAS)* o For some children, it is congenital as they have not experienced any overt damage; other children with CAS have a known neurological impairment o Demonstrate sensorimotor problems in positioning and sequentially moving muscles for the volitional production of speech ▪ Frequently show groping behaviors and poor intelligibility due to inconsistent and multiple articulation errors ▪ Inconsistent errors the hallmark of CAS* o Children with CAS typically demonstrate the following characteristics: ▪ slow, effortful speech ▪ prolongation of speech sounds ▪ repetition of sounds and syllables ▪ most difficulty with consonant clusters followed by fricatives, affricates, stops, and nasals ▪ more frequent occurrence of omissions and substitutions ▪ voicing and devoicing errors ▪ vowel and diphthong errors ▪ unusual errors of articulation including metathesis (deks/desk) and addition of phonemes ▪ difficulty with volitional, oral, nonspeech movements ▪ groping and silent posturing of the articulators ▪ deviations in prosody (rate, stress) ▪ problems with hypernasality and nasal emission (possibly due to poor velopharyngeal control) ▪ history of feeding problems

	▪ history of tactile aversions or sensitivities (e.g. very defensive when the clinician attempts to put a tongue depressor in the mouth) ▪ substantially delayed speech production ▪ limited sound inventory ▪ inconsistency in sound productions o Research indicates that children with CAS may have deficits in phonological representation; for example, they often have difficulty with rhyming and with identifying syllables; they are often at risk for language, reading, and spelling problems ● Treatment for CAS is similar to treatment for adults with apraxia; it should progress hierarchically from easy to difficult tasks o Treatment should be multimodal, involving extensive drills stressing sequences of movement involved in speech production, imitation, decreased rate of speech, normal prosody, and increased accuracy in the production of individual consonants, vowels, and consonant clusters o CAS therapy often produces very slow gains; therefore, treatment should be intensive o Home practice and self-monitoring are essential components of CAS treatment

Adults Who Speak English as a Foreign Language, p. 239

Assessment	● When conducting assessment, it is important for the clinician to understand exactly the types of English articulation errors that clients will make based upon previously learned languages ● The following procedures are also recommended: o Determine which important persons the client's environment have difficulty understanding their English and first-language (LI) skills o Make a high-quality recording of the client's conversational speech and transcribe the recording thoroughly; determine the percentage of vowels correct and the percentage of consonants correct o Have one or two unfamiliar listeners listen to the sample, and from this determine the percent of intelligible words o List the client's speech-sound errors completely, using a phonemic inventory for both consonants and vowels o Determine the client's speaking rate o Assess word-level and sentence-level stress and prosody o Perform an oral-peripheral exam o Carefully assess other factors that may be contributing to lack of intelligibility (e.g. very soft vocal volume, glottal fry, etc.)
Principles of Accent Training	● For the EFL (English as a foreign language) client, the term *accent training* is preferable to *treatment* or *intervention* ● Many factors determine which parameters clinicians should target in training clinicians should select those parameters to target that are contributing the most to reduced intelligibility ● Clinicians should select consonants and vowels that the client rarely produces correctly in English and that contribute to lack of intelligibility ● Clinicians should use training activities and materials that are culturally sensitive and compatible with the client's interests ● Many EFL clients benefit from increased exposure to English through more interactions with Americans as well as listening to American TV, radio, or both ● It is usually ideal to use a multimodal approach in accent training, involving visual cues, tactile cues, and auditory cues o Many clients benefit from use of the VisiPitch because they can see and hear precise feedback about their productions of various vowels and consonants o Many clients also appreciate receiving CDs containing training targets so they can practice outside of training sessions