# Instructor's Resource Manual and Test Bank

*for*

Berthnal, Bankson, Flipsen

# Articulation for Phonological Disorders
## Speech Sound Disorders in Children

Seventh Edition

*prepared by*

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## Introduction

This instructor's manual is designed to assist university professors/ instructors who teach graduate or undergraduate courses in speech sound disorders (articulation and phonological disorders). It corresponds chapter by chapter with the Bernthal, Bankson, and Flipsen 7th Edition text. Each chapter is summarized in the form of "Key Points" which will help instructors focus the content of their lectures. Next, each chapter has "Discussion Topics and Instructional Ideas" which give instructors ideas discussion, group work, or take-home assignments. Finally, at the end of this manual, instructors will find possible exam questions for each chapter as well as answer keys. There is a significant amount of reference made to the actual text itself (e.g., "see Table 2.5 on Page 45 for an example), so it is strongly recommended that instructors will obviously need to reference the textbook as one reviews concepts. It is the intention of this manual to aid course preparation and to provide a concise summary of this textbook.

## Chapter 2: Normal Aspects of Articulation

*by Ray Kent*

**Chapter 2 Outline**

**Key Concepts from Chapter 2**

1. The production of speech sounds is a very complex act and is made up of a motor and a linguistic component (Figure 2.1 shows more detail). Phonemes are speech sounds that are combined to create words and meaningful messages. (Page 7).

2. Phonemes are made up of allophones, which are variations in the production of phonemes that do not change the meaning of the word. Allophones are influenced by the surrounding sounds and the position of the phoneme in the word (i.e., the normally un unreleased /p/ at the end of "pop" vs. the released /p/ at the beginning). (Page 7).

3. Phonemes combine to form morphemes and words. Many words are made up of more than one morpheme (e.g., the word "words" has two: "word" and plural "s").

4. The most important articulators are: tongue, lips, jaw, and velopharynx. (see Page 12 for detailed definitions of each articulator).

5. The respiratory system works in conjunction with the larynx to provide the necessary airflow to create vibration of the vocal folds. The vocal tract runs from the larynx to the mouth and nose and is lengthened, shortened, and constricted to produce speech sounds.

6. Vowels are voiced, nonnasal speech sounds that are created by the varying positions of the tongue and lips. They are categorized based on the position of the tongue (front vs. back; high vs. low) and lips (rounded vs. unrounded) and the relative amount of muscular effort needed to produce them (tense vs. lax). (Page 16-17 – lists of vowels and their respective categorization is on Page 17).

7. Diphthongs are related to and produced similarly to vowels. They are dynamic sounds and they are typically produced as a combination of two vowels (on-glide and off-glide, shown in Figure 2.9 on page 18). The diphthongs /38/ and /o7/ are exceptions because they exist in monophthongal forms as well. (Page 18).

8. Distinctive features are a list of 13 features that can be combined to describe any phoneme in any language in the world. Vowels can be described using distinctive features, though distinctive features are typically used primarily for consonants. Table 2.1 on Page 20 displays the various ways in which distinctive features can be used to describe vowels.

9. Consonants can be described using a traditional phonetic description (Page 22) or by using distinctive features (Page 35). In using traditional phonetic description, we think of consonants in terms of place, voice, and manner. Place refers to <u>where</u> in the mouth the articulators are in order to produce the consonant. Voice refers to whether or not the vocal folds are vibrating during the production of the consonant. Manner refers to <u>how</u> the consonant is produced considering the degree of constriction in the vocal tract and any possible movement during production. (Page 22-25; Table 2.2 and 2.3 provide a quick reference for place, voice, and manner).

10. Types of manners: 1) stops – complete closure of the vocal tract at a point in production; 2) fricatives – narrow constriction of the vocal tract; 3) affricates – combination of stop and fricative; 4) nasals – complete oral closure, but the airflow is directed through velopharynx and out of the nose instead of the

mouth; 5) lateral – closure at the midline of the oral cavity, with air flowing around the sides of the tongue; 6) rhotic – the /r/ phoneme can be produced in several ways, most commonly a retroflexed or bunched production; thus "rhotic" is used as an umbrella term to refer to both; 7) glides – always followed by vowels and are produced with a gradually changing articulatory shape (Page 24-25).

11. Types of places: 1) bilabial – both lips as in /b/; 2) labiodental – lips and teeth as in /f/; 3) interdental sounds – tip of tongue and teeth as in /'/; 4) alveolar – also known as "lingua-alveolar" – tongue tip to alveolar ridge behind top teeth as in /n/; 5) palatal – blade of the tongue and the hard palate as in /c/ ;6) velar – tongue dorsum and roof of mouth near velum as in /k/; 7) glottal – both vocal folds as in /h/ (Pages 25-33).

12. Distinctive features have been used to describe consonants and vowels. It is a binary system that allows for classification of phonemes based on a list of 15 features. Sounds receive a "+" if they exhibit that feature and a "-" if they do not. As an example /b/ be a + for voicing whereas /p/ would be a -. Table 2.4 on page 35 shows the distinctive feature classifications for a few consonants. It is important to point out that distinctive features are simply a classification system and do not address the reason for the production and thus have limited application to speech sound disorders (Page 34-37).

13. Phonemes and phonetic information exists at the *segmental* level. Information that is provided beyond the individual sound is termed *suprasegmental*. The most common suprasegmentals are: stress, intonation, loudness, pitch level, juncture, speaking rate, and vowel reduction. Though all of these are important issuesfor clinical purposes, stress can be shown phonetically in stressed vs. unstressed vowels (e.g., the unstressed /1/ versus the stressed /4/). (Pages 37-39).

14. Typically developing individuals are capable of controlling their intelligibility through slow and precise articulation (i.e., by using clear speech). All speakers use stress, intonation, and other suprasegmentals to highlight spoken information differently. For instance, when providing new information to a conversation, when contrasting information, by lengthening the final syllable of a phrase, by applying pitch declination, and in applying stress differently in certain lexical items. (Page 40-42).

15. Coarticulation highlights the interaction of phonemes when combined in different words. One type of coarticulation is anticipatory – the articulators prepare for a sound that is coming later in a word. Another kind is retentive – the articulators are holding on to a position used for a phoneme earlier in the word. Allophonic variation greatly affects coarticulation, as allophones are often produced as a result of the surrounding phonemic context (Page 43-47; see Table 2.5 for allophonic variation in the production of phonemes and words).

16. Coarticulation can have implications for clinical treatment. Certain phonemes (or allophones) are more easily elicited from certain contexts. SLPs should be aware of this implication for target selection and instruction (Page 45).

17. Egressive airflow is necessary for speech sound production. Figure 2.27 illustrates the aerodynamics of airflow from the laryngeal region through either the oral or nasal cavity. Although most clinicians will not have access to equipment used to measure airflow, the importance of understanding this concept cannot be undersold. Pressure build up is necessary for most phonemes. Inadequate intraoral air pressure is usually indicative of a faulty velopharyngeal mechanism, the vocal folds, the oral cavity, or the respiratory system (Pages 47-49).

18. Three acoustic parameters are of the utmost importance to speech production. Frequency – the rate of vocal fold vibration; amplitude – strength of a sound; and duration – length of a sound. These acoustic parameters vary across sound classes (e.g., strident fricatives are more intense, but weaker than vowels; stops are weak and of brief duration) and across gender and age in individuals (Pages 50-51).

19. Sensory information is supplied during speech production in the forms of kinesthetic (movement sense), tactile (touch and pressure), proprioceptive (position sense), and auditory (sound feedback). Many impairments can affect one or more of these areas of sensory feedback. (Pages 51-52).

20. Speech is organized in multiple different ways (Table 2.8 on Page 53). It is important for students to understand that these levels of organization do not exist in a vacuum but coexist in symbiotic ways. For example, the segmental features of a sound may change based on the articulatory sequence or the phonemic composition (Pages 53-55).

21. There are many differences in the speech of adults and the speech of children. The amount of intraoral air pressure is greater in children than in adults. Children's speech is usually slower than that of adults and is more variable in accuracy. Patterns of coarticulation are also different. It is important for clinicians to use normative data in the assessment of childrne's speech sound production and, , consider the differences that happen during development (Page 55-57).

**Discussion Topics and Instructional Ideas from Chapter 2**

1. The concept of allophones can be very confusing for beginning students. One way to teach the difference between phonemes and allophones is by introducing "families" of sounds. On the board in your classroom (chalk board, dry erase board, Smart board, etc), begin talking about one particular phoneme of your choice (e.g., /k/) and then ask the students to help think of the different contexts in which /k/ can be produced (e.g., initial, medial, or final word position; before a front vowel, before a back vowel; in a cluster, in a singleton; etc). Have students identify as many of the allophones of /k/ (e.g., [$k^h$]) as they can.

2. Develop a list of words with 2 morphemes (e.g., "jumped, walked, bounced, laughed, dogs, houses, books, running, crying, saying, etc.) and have students identify how many morphemes are in each word and what they are. Depending on the level of course being taught, speech anatomy may be new information or students may need a review. In either situation, it is important to show visuals. Figures 2.2 and 2.3 can be helpful in highlighting the primary articulators and organs of speech. Virtual anatomy "tours" are available via various websites. Several interactive DVDs may also be available – these may be useful in reviewing and learning the importance of the primary articulators.

3. As with anatomy, information on basic phonetics (Pages 13-37) and suprasegmentals (Pages 42) may or may not be new to students. In order to highlight the various tongue and lip positions used during vowel production, have students practice saying the vowels in progressive order from front to back or high to low. For example, on page 16, Figure 2.8 uses the following words, starting with front high and ending with back low: beat, bit, bate, bet, bat, boot, book, boat, bought, bomb (and the central and rhotic vowels: Bert, butter, but). Have students develop their own list to assess whether or not they are able to discriminate the different tongue positions. This similar activity can be conducted for diphthong placement, to highlight the onglide and offglide.

4. As suggested on Page 19, play a game of 20 questions using distinctive features. Have students guess which sound (vowel or consonant) is being described.

5. Accurate phonetic transcription for the stressed vs. unstressed segments (e.g., /ˈ/ versus /ˌ/) can be difficult for some students Ask the students to identify on which syllable the stress falls in multisyllabic words. In monosyllabic words, stress is assumed, thus any transcription of a monosyllabic word should include the stressed versions of the IPA symbols. 7. The best way to highlight the effects of coarticulation for students it to have them focus on their own articulators during speech production. If students lightly touch a finger to their lips while producing sample words such as “sneeze” vs. “snooze”, they will feel the lips rounding in preparation for the /u/ vowel in “snooze”, but not in “sneeze”. Other word pairs such as “can” and “cat” will highlight the difference in anticipatory nasality for the /ɑ/ phoneme. A word like “emphasis” also shows coarticulation – the /m/ phoneme is often produced as a labiodental in preparation for the /f/ phoneme. Other examples are found on Page 43.

## Chapter 3: Speech Sound Acquisition

*by Sharynne McLeod*

**Chapter 3 Outline**

RELEVANCE OF UNDERSTANDING TYPICAL SPEECH SOUND ACQUSITION FOR SLPS

MODELS OF SPEECH ACQUISITION
- *Traditional Models of Speech Acquisition*
  - *Behaviorist Models*
- *Linguistic Models of Speech Acquisition*
  - *Generative Phonology*
  - *Natural Phonology*
  - *Nonlinear Phonology*
  - *Optimality Theory*
  - *Sonority Hypothesis*
- *Psycholinguistic Models*

HOW SPEECH ACQUISITION DATA ARE OBTAINED
- *Diary Studies of Typical Speech Sound Acquisition*
- *Large Group Cross-Sectional Studies of Typical Speech Sound Acquisition*
- *Longitudinal Studies of Typical Speech Sound Acquisition*
- *Combined Data-Collection Procedures*

OVERALL SEQUENCE OF SPEECH SOUND ACQUISITION

PHASE 1: LAYING THE FOUNDATIONS FOR SPEECH
- *Development of the Structure and Function of the Oral Mechanism*
  - *Anatomical Structures Supporting Speech Acquisition*
  - *Anatomical Functions Supporting Speech Acquisition*
- *Infant Perception*
  - *Infant Auditory Perception*
  - *Infants' Visual Perception*
- *Infant Production*
  - *Developmental Summaries of Early Speech Production*
  - *Babbling and Speech*

PHASE 2: TRANSITIONING FROM WORDS TO SPEECH
- *Young Children's Consonant Inventories*
- *Phonological Knowledge and Vocabulary Acquisition*

PHASE 3: THE GROWTH OF THE INVENTORY
- *Intelligibility*
- *Age of Acquisition of Speech Sounds*
  - *Consonants*
  - *Consonant Clusters*
  - *Vowels*
- *Percentage Sounds Correct/ Percentage Sounds in Error*
  - *Consonants*

**Key Concepts from Chapter 3**

1. It is imperative that SLPs have a strong foundational understanding of speech sound development. Key clinical decisions are made daily based on this information. Specifically, seven main areas require comprehensive knowledge of speech sound acquisition: referral, assessment, analysis, diagnosis, selecting intervention targets, intervention, and dismissal/ discharge (Pages 58-59).

2. There are many models that have been used to try to account for normalspeech sound acquisition: behaviorist, generative phonology, natural phonology, nonlinear, optimality theory, sonority hypothesis, and psycholinguistic models. Each one has a different way of categorizing and thinking through the innate mechanisms that contribute to speech sound development. It is important that students understand that there is really no right or wrong model – but more that each model contributes unique information that combines to form our understanding of speech sound acquisition (Pages 59-60).

3. Behaviorist models have their roots in the early work of Pavlov and Skinner. While they are not necessarily accepted as a model that supports how children acquire speech sounds, they have many principles that are used in speech sound treatment. As an acquisition model, the behaviorist does not allow for development that occurs outside of parental or environmental reinforcement. However, during speech sound treatment, clinicians can utilize the stimulus + feedback procedure – operant conditioning – to elicit and shape correct speech sound production (Pages 60-61).

4. Generative phonology has its roots in the work of Chomsky. The primary tenants of this model suggest that a combination of underlying phonological representations and surface articulation form the structure of sounds. Additionally, there are multiple linguistic factors, such as syntax and semantics, which contribute to phonological descriptions. This has not had a broad application to the field of speech language pathology (Pages 61-62).

5. Natural phonology is a theory based on the collective works of Stampe and Ingram. This theory has contributed significantly to the field of speech language pathology as it is the foundation for what we now refer to as phonological processes or phonological patterns. These patterns are either universal across languages or typically occurring in young children. Based on this theory, a version proposed by Shriberg and colleagues includes eoght natural phonological processes: final consonant deletion, velar fronting, stopping, palatal fronting, liquid simplification, cluster reduction, assimilation, and unstressed syllable deletion.

6. Nonlinear phonology is a hierarchical model of speech acquisition. It posits that speech production is more than just a line of phonemes but rather is made up of many elements on many levels. Nonlinear phonology consists of two main tiers: the prosodic tier (made up of the word, foot, syllable, onset-rime, skeletal, and segmental tiers) and the segmental tier (made up of segments and speech sounds and the features of them). Intervention focuses on speech production beyond the consonant and into the syllable shapes and stress patterns (Pages 65-66).

7. Optimal theory relies on the idea of constraints. Specifically, markedness constraints – which refer to limitations on what sounds and features that can be produced and faithfulness constraints – which refer to sounds and features that must be preserved (Pages 66-67).

8. Sonority hypothesis refers to the quality of relative loudness within a speech sound. Sounds that are produced with more loudness are produced with a more open vocal tract, such as vowels and glides. These sounds are more sonorous. Sounds with more constriction of the vocal tract and less loudness are less sonorous, such as stops and fricatives. Based on this hypothesis, researchers have found that children who reduced word initial consonant clusters left the most sonorous consonant and deleted the least sonorous (Pages 67-68).

9. Psycholinguistic models consider the input of speech that a child hears and the output of speech that a child produces. The processes that take place in between the input and the output are of particular interest as are the specific details of what might be in the child's phonological representations within the lexicon. For example, there have been debates as to whether the lexicon is best represented by the idea of a single "black box" or lexicon which would contain information relating to both the child's perception and production of speech sounds. Alternatively, a two lexicon model allows for the child's perception and/ or production of the speech sound to differ from the adult form.

10. There are three primary ways in which speech sound acquisition data are obtained: diary studies, cross-sectional studies, and longitudinal studies. Dairy studies refer to the study of a single case/ child and provide a detailed account of that child's speech/ language acquisition over time. In many of the "famous" diary studies in our field, the researcher is the parent. Diary studies allow for an in-depth examination of speech sound development, but are limited in how that information may generalize. Large cross-sectional studies are possibly the most common form of speech acquisition data collection and certainly provide the mostly commonly used normative data. These studies allow for examination of large amounts of children via standardized measures, but only examine the abilities of each child at one time point. Longitudinal studies involve following a select group of children over time to examine speech development. These studies allow for examination of specific individual variation in development but may not necessarily represent the large population from which the participants are drawn. A combination of these three strategies may provide the best overall picture of speech sound acquisition (Pages 72-76).

11. McLeod divides the normal process into four phases. Phase 1 of speech development includes laying the foundation for speech. This occurs through the development of anatomical structure and function. Infants' anatomical structure and function changes rapidly over time. This includes the length of the vocal tract, placement of the larynx, development of the respiratory system, development of the neurological system, and precision and coordination of the tongue, lips, and jaw. This development begins early in gestation and continues through infancy through adolescence.

12. In addition to anatomical development, speech perception is an important piece of fetal and infant development that lays the foundation for speech production. A human fetus can detect sound as early as 19 weeks gestation. Infants can detect minute changes in speech production very early after birth. They are sensitive to their mothers' vocal inflection while still in utero. Behavioral responses to these changes have been detected via heart rate (in fetuses) and sucking reflexes (in infants). This perception develops rapidly during the first year of life as babies are beginning to categorize speech sounds into meaningful units for their ambient language (Pages 79-81).

13. As infants develop, their vocal productions progress from vegetative and reflexive sounds (burping, growling, crying, groaning) to more speech-like sounds (cooing, quasi-vowel production, CV canonical babbling). Each step should be thought of as practice for the motoric and linguistic act of speech. Box 3.1 on Page 82 lists specific typologies of this development. The relationship between babbling and speech has been much debated, but there is now a well establish connection between the sounds and patterns in babbling and the sounds and patterns in early speech production. Babies who are typically developing have been shown to babble earlier, more frequently, and with more complexity compared to babies who are not typically developing (e.g., babies with hearing loss or those who become late talkers, etc; Pages 83-84).

14. Children's first 50 words typically consist of small syllable shapes (CV, VC, CVCV) with a few front consonants (/m, n, p, b, t, d/). Often, final consonant deletion, reduplication, and cluster reduction are common processes seen early in speech production. The kinds of sounds that a child can produce are directly related to the kind of vocabulary they use (Also see Table 3.1; Pages 85-86).

15. Intelligibility is an important predictor of speech development. Children are expected to be intelligible to strangers approximately 80% of the time by the age of 3; by their parents approximately 80% of the time by age 2.

16. Age of acquisition data comes from the normative information collected by researchers over the years. Researchers vary greatly in their conclusions in terms of when specific sounds should be fully acquired. For example, the /s/ phoneme has been reported to be acquired as early as 3 but as late as 9 with several other ages in between also suggested.

17. Vowels are acquired earlier than consonants and consonant clusters. Children are anticipated to have mastered all non-rhotic vowels by the age of 3 years.

18. A popular index of speech sound acquisition is percentage of consonants correct (PCC). This is calculated by dividing the number of consonants correctly produced by the total number of consonants possible. This is elaborated on in Chapter 7. See tables 3.5 and 3.6 for normative data. Additionally, some researchers will calculate the percentage of vowels correct (PVC), though this is much less common, especially clinically (Pages 96-98).

19. Phonological patterns (also called processes) are common patterns used by children, sometimes as a part of normal development, in which certain sounds or sound features are systematically deleted or substituted from speech. Table 3.8 provides definitions and examples of common phonological patterns. Table 3.10 provides an excellent table of many common and not-so-common substitutions (Pages 102-104).

20. Speech perception, prosody, stress, and intonation all develop throughout childhood. Often the child will produce a sound that is inaccurate but the child will be unable to perceive his/ her own error. Similarly, the child may produce an error that is so close to the target that others cannot perceive it (but it could be identified acoustically).

21. Along with speech production, perception, and suprasegmental development, children are also developing phonological awareness skills as they grow. Phonological awareness is the ability to manipulate sounds within the language and has been shown to be a strong predictor of later literacy success. Children with speech production and perception deficits typically struggle with phonological awareness (and, thus, also with literacy). Examples of phonological awareness are rhyme knowledge, onset-rime awareness, blending

and segmenting phonemes, and manipulation of phonemes. These skills develop along a continuum and can be easily incorporated into speech sound treatment (see Chapter 12 for more details; Pages 106-107).

22. There are many factors that influence how children acquire speech production skills. Gender – girls often acquire speech faster than boys. Socio Economic status – depending on how it's measured, children from high SES tend to acquire speech and phonological awareness skills earlier than children from low SES. Language development – typically, as language ability increases, so does speech production abilities. Thus, children with good language will likely have better speech production skills than children with poor language. Individual variability – this accounts for the many differences that children will experience during the course of their development; from the environment they are raised in to the places they go on vacation to the amount of family they encounter daily, etc the differences are limitless. (Pages 110-112).

**Discussion Topics and Instructional Ideas from Chapter 3**

1. It is important for students to understand the origin of the data that are currently used to define and describe speech sound acquisition. Based on these data, many current practices determine when and how a child should or should not receive treatment (i.e., a 4–year-old who misarticulates the /r/ phoneme may not be eligible for services whereas an 8-year-old with the same speech pattern may be eligible. For budding clinicians, this information may seem "black and white". Discussing the gray areas is where good clinical judgment is developed. Thinking through the ways in which speech acquisition data are obtained (Pages 71-77), discuss with students the importance of being critical consumers of research. While all types of research play a crucial role in contributing to our knowledge base, each has its limitations as well. For example, a longitudinal study may be ideal for studying speech development, consumers must consider where, geographically, the study takes place as regional dialects and other factors may contribute to the development seen in that particular sample. Additionally, a diary or case study may only be based on one child but may contribute a significant new finding that may apply to multiple children.

2. As a means of class discussion, or perhaps as a group activity or assignment, ask students to find the original article of a diary study mentioned on Page 72 as well as the original article of a cross-sectional and/ or longitudinal study. Ask the student(s) to read the original work and compare what they know about the advantages and disadvantages of each. The results of their work could be shared as group presentations or via a written report.

3. There are several videos available online via YouTube that provide examples of early speech perception in babies. Currently, two examples are: http://www.youtube.com/watch?v=USIgSFgzwww and http://www.youtube.com/watch?v=CSMjKDZvNWA (If these links are unavailable, search "infant speech perception" for other examples).

4. Discuss age of acquisition data as seen in Tables 3.3 and 3.4. How can clinicians be sure that they are using the correct norms? How can clinicians determine when research is "right" or "wrong"? How do clinicians determine what age a sound should actually be acquired if some research says 3 and some says 9? Use this opportunity to discuss the various sources of data (as discussed in points 2 and 3 above) and how clinicians should be cautious when interpreting the findings. Understanding that speech develops along a continuum is also important – using evidence based practices is the best approach.

5. Although phonological patterns are expanded upon in later chapters, it is important to highlight that many of these can overlap. While this activity may be better saved for a more in-depth discussion specifically

related to phonological patterns, it is helpful to give examples of the patterns co-occurring. For example, "dod" for "dog" could be examples of assimilation *and* fronting. The best way to determine which is happening is to collect an appropriate speech sample and determine what the pattern is. This can be introduced here and expanded upon when the discussion turns to assessment procedures (Chapter 6 and 7)..