Treating Children with Severe Speech Sound Disorders

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Abstract

This course addresses the theoretical background, research, and treatments used to intervene with children who present with severe speech sound disorders. Models underlying the development of speech and language suggest the children develop phonological representations of speech sounds and store them in memory. When coding a message, the representations are combined or planned and then the message is produced via movement of the oral musculature. Researchers have suggested that breakdowns in the model result in speech sound disorders of various causes. Treatment will vary based on the different causal explanations and will be discussed.

Learning Objectives

As a result of this activity, the participant will be able to . . .

1. Describe the theoretical model underlying the child’s development of speech perception/production.
2. Recognize the speech symptoms associated with the different causes of speech sound disorders.
3. Apply treatments based on the different causal factors.
Introduction

Speech sound disorders is an umbrella term referring to any combination of difficulties with perception, motor production, and/or the phonological representation of speech sounds and speech segments (including phonotactic rules that govern syllable shape, structure, and stress, as well as prosody) that impact speech intelligibility.

Many researchers in the area of speech sound disorders view the development of speech production as consisting of four neural events (Shriberg et al., 2012; Shriberg et al., 2010). First, there is auditory-perceptual encoding, which acts to transform auditory input into phonemic, sublexical, and lexical representations. The representations are then stored in different memory processes for recall and/or modification. When a speaker wants to generate a message, transcoding processes are employed to plan and program the motor gestures used to produce speech and other forms of expressive output. Finally, the planned motor gestures are realized as muscle specific commands, which result in articulate speech. Please see Figure 1 below.

In the conceptualization summarized in Figure 1, there is general agreement in the research literature that partial or poorly constructed representations due to encoding and/or memory limitations are causal agents in explaining language impairment and speech delay or what is commonly referred to as mislearning. This is the largest group of children who have been diagnosed with speech sound disorders. Conversely, transcoding problems are thought to be responsible for the deficits identified in the speech of children diagnosed with CAS. That is, there are problems in the planning and programming of the motor gestures used to produce speech. Disorders of neuromotor implementation would result in a dysarthria with potential involvement of articulation and possibly the other bio-communication systems of respiration, phonation and resonance.

A child with velopharyngeal closure issues (VPI) presents with a structural problem and a plausible explanation is that the problem is at the execution level. Rather than a neurological basis, there is a structural problem that impairs speech production skills. The end result is a speech disorder that may include involvement of both articulation and resonance. Please note that this explanation assumes a phonetic basis to the errors exhibited by children with cleft palate. There is some disagreement in the literature regarding the theoretical characterization of cleft palate speech errors. Some authors have proposed that the sound system errors are phonologically based (Chapman, 1993; Pamplona & Ysunza, 1999), while others have proposed a phonetic explanation for the errors. In this current characterization, was are assuming that errors have a phonetic basis (Golding-Kushner, 2001; Trost-Cardamone & Bernthal, 1993).

In addition to structural VPI, there are also children who present with dental, occlusal and/or lingual problems and the result is often times speech sound distortions.
Moreover, in many cases the structure does not support acceptable placement, and there is a need to intervention from other health care specialists. Doctors, dentists, orthodontists and oral surgeons are often needed to create an oral environment that is conducive to correct speech sound production. Frequently, changes in oral form result in changes in oral function without speech intervention.

Figure 1. Conceptualization of the speech perception/production process.

**Diagnosis/Treatment**

**Suggested Basic Diagnostic Framework-For Summarizing Cases**

<table>
<thead>
<tr>
<th>Case history</th>
<th>Background information</th>
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</thead>
<tbody>
<tr>
<td>Standardized test of speech sound disorders</td>
<td>Speech sound performance data</td>
</tr>
<tr>
<td>Sample of conversational speech</td>
<td>Speech sound performance data</td>
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<tr>
<td>Oral Mechanism Examination</td>
<td>Assessment of structure/function and speech motor control</td>
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<td>Hearing screening</td>
<td>Assessment of current hearing status</td>
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<td>Language status</td>
<td>Presence/absence of language disorder</td>
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</table>

Framework for describing the errors of the different cases.
<table>
<thead>
<tr>
<th>Diagnostic Variables</th>
<th>VPI</th>
<th>CAS</th>
<th>DYS</th>
<th>STR</th>
<th>MISLEARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Speech sound errors</strong></td>
<td>Compensatory errors.</td>
<td>Vowel and consonant distortions.</td>
<td>Sound distortions.</td>
<td>Sound distortions due to dental/skeletal, labial or lingual issues.</td>
<td>Mainly substitutions and deletions.</td>
</tr>
<tr>
<td>Obligatory errors.</td>
<td>Voicing errors.</td>
<td>Reduced strength of articulatory contacts.</td>
<td>The errors are obligatory errors, not responsive to treatment.</td>
<td>Errors may persist and become residual errors.</td>
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<tr>
<td>Nasal emission.</td>
<td>Sound Substitutions.</td>
<td>Nasal emission if VP involvement.</td>
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<td>Groping.</td>
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<td>Intrusive schwa.</td>
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<td>Phonotactic issues.</td>
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<tr>
<td>Problems in achieving initial articulatory configuration or transitioning from one articulatory gesture to another.</td>
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<tr>
<td><strong>Suprasegmentals</strong></td>
<td>Syllable segregation.</td>
<td>Scanning speech.</td>
<td>Reduced rate.</td>
<td>Reduced rate.</td>
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<td></td>
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<td></td>
<td>Reduced diadochokinetictic rates.</td>
<td>Irregular diadochokinetictic rates.</td>
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<td></td>
<td>Lexical stress errors.</td>
<td>Lack of word, phrase stress.</td>
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<tr>
<td><strong>Resonance</strong></td>
<td>Hypernasality, hyponasality, cul-de-sac resonance, or mixed nasality.</td>
<td>Hypernasality.</td>
<td>Hypernasality.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Mixed nasality.</td>
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<tr>
<td><strong>Voice</strong></td>
<td>Hoarseness.</td>
<td>Strained or breathy phonation.</td>
<td>Lound/soft.</td>
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<td></td>
<td>Breathiness.</td>
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<td></td>
<td>Low intensity</td>
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<td><strong>Respiration</strong></td>
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<td>Reduced respiratory</td>
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</table>
I. Case History Information-the purpose is to obtain relevant history information regarding the child’s cognitive, motor, social and linguistic development within the family and other social contexts such as preschool, school etc.

Case history data helps us to understand the child as he/she develops within the environment. We try to understand these variables within the context of a case history. We can discuss these variables with the parents or a significant other. Generally, we will interview the caregiver and collect the information or supplement the interview with a written history collected prior to the assessment. In the schools, information is frequently gathered from existing records, educational personnel accounts, and parental contact. Keep in mind that a number of children with speech sound disorders are from families with histories of speech and language disorders, learning disabilities, and/or reading problems. The interview should examine the following areas:

A. Development
   1. Birth history
   2. Gross motor development
   3. Fine motor development
   4. Neurological development
   5. Dental development
   6. Feeding development

B. Speech/Language development variables
   1. Speech and language development
   2. History of speech/language disorder(s) in family
   3. History of hearing disorder(s)
   4. History of oral problems-dental, T/A
   5. History of treatment speech, hearing and structural problems

C. Psychosocial factors
   1. Family interactions
   2. Peer interactions
   3. General temperament
   4. Parental concern regarding speech disorder
   5. Parent perception of disorder
   6. Impact of speech problem via parent assessment
   7. Parent perception of previous treatment

II. –Standardized Test of Speech Sound Disorders-select your assessment tools.

Generally, the SLP is going to conduct an independent phonological analysis to identify the speech sounds that the child uses in the context of single words whether contrastive or not. This is particularly important for children who have severe speech sound disorders with limited speech sound production inventories. The SLP also conducts a phonemic relational analysis so that she/he can study the child’s emerging system in relation to the adult system. Another key purpose is to provide some type of normative performance comparison, which is an important school-based issue in determining eligibility for services. A list of standardized tests is presented in Appendix A.

In addition to the single word assessment, it is necessary to elicit a sample of conversational speech. A 5-7 minute sample of conversational speech generally provides the SLP with a measure of contextual speech. Size of the speech sample has been quite debatable and in many cases will depend on the severity of the child’s speech sound disorder. If the SLP can elicit at least 50-100 utterances, a contextual sample or picture of spontaneous speech can be obtained. There are a number of ways to elicit a conversational sample that include story telling or retelling, using open-ended questions (Tell me?), or free play. Your elicitation method will depend on the child and what you are comfortable with when conducting an assessment. In addition to the sample providing a contextual picture of speech sound production and prosody, it also allows the SLP to screen for the coexistence of other speech and language disorders.

IIA. Analysis of the sample-classify the pattern of speech sound errors.

After the collection of the data (Speech sound test and conversational sample), you need to analyze the sample, so that you may attempt to understand the speech sound disorder and plan for treatment. After transcribing the child’s responses, you will be carrying out one of the following analyses, depending on the nature of the child’s speech sound disorder:

A. Classify the errors—depends of the involvement of the child.
   1. Individual phonemes—substitution, omission, distortion (Minor Involvement)
   2. Distinctive features—voice, place, manner (Moderate to Severe)
   3. Phonological processes (Moderate to Severe)
      1. Syllable structure processes
         a. final consonant deletion
         b. unstressed syllable deletion
         c. reduplication
1. Cluster reduction
2. Assimilation processes
3. Substitution processes
   a. stopping
   b. fronting
   c. gliding of liquids
   d. vocalization
4. Atypical processes
   a. use of glottals
   b. initial consonant deletion
   c. backing to velars

   1. Identifying hierarchical relationships among phonological units rather than positing segmental strings of sounds.
   2. The hierarchical relationships among units include the analysis of:
      a. features
      b. sounds
      c. syllables
      d. words

IIB. Nonsegmental analysis-check syllable and word shapes.

In the case of children with moderate to severe involvement, study the syllable and word shapes used by the child. Remember that children with phonotactic problems are at risk for higher-level language problems such as morphology and syntax disorders. Treatment may need to include work at different word and syllabic levels and the implementation of language therapy.

   A. Simple syllable shapes-[V, CV, VC, CVC]
   B. Complex syllable shapes-[CCV—CCCCVCC]

IIC. Phonological performance-establish intelligibility, rate severity and collect stimulability data.

   A. Intelligibility
   You can use the contextual sample to make judgments of intelligibility. That is, what is your level of understanding of the child’s speech? Is he intelligible to the average listener, is he difficult to understand, are there situations that seem to positively or negatively affect intelligibility?

   B. Severity
   You will also use the sample data to make a judgment of severity of the disorder. Is the problem mild, moderate or severe? What is your clinical impression of the severity of the disorder? In addition, one of the more frequently employed measures of severity is the Percentage of Consonants Correct (PCC) and the Percentage of Consonants Correct –Revised (PCC-R) both of which were developed by Shriberg and his associates.
Instructions for scoring a child’s gloss and normative data are contained in Appendix B.

Most children acquire adult levels of consonant production in conversation between 7 and 9 years of age. There are different tools that you can use and they are listed in Appendix B for your use.

C. Stimulability
Stimulability. Error phonemes will be selected and presented to the child. The child will be asked to watch the SLP and imitate a model produced by the clinician. Depending on the child the SLP may probe productions of error phonemes at the isolation, syllable, and word levels, when appropriate. If the client can imitate the models successfully, we say that he/she is stimulable and the prognosis for future treatment is positive. If the child is not stimulable, the converse is true. Current literature is mixed regarding stimulability. Depending of the theoretical orientation, some do not treat stimulable sounds, since it is likely that they will be acquired without treatment. However, others introduce stimulable sounds in treatment. If interested in a formal assessment of stimulability, the SLP may refer to the *Glaspey Dynamic Assessment of Phonology*.  


IID. Suprasegmental features-assess pitch contours, word stress, rate of speech, and phrasing.

Again using your collected data (articulation test and conversational sample), you want to assess the pitch contours, word stress, rate of speech and phrasing of the child. Primarily, we will be using the conversational sample to make such judgments of the variables listed. The child’s productions of pictures (individual words) and spontaneous speech need to be analyzed for prosodic variation. That is, do the word and conversational utterances show appropriate word stress, intonation contours, pause and inflection? In the case of clients with limited production capabilities, it is difficult to assess prosodic variables such as word stress, intonation contours, inflection, etc. Kent (1988) recommends that the child be asked to hum or engage in reiterant speech. For example, the child could be asked to hum a certain stress pattern of a presented utterance such as Happy Birthday, or use a reiterant speech syllable such as /ma/ or /ba/ in reproducing an utterance. Kent’s example of “Twinkle, twinkle, little star” would be reproduced as BAba BAba BAba BA. Do you perceive any differences with respect to pitch contour, word stress, rate of speech of phrasing?

IIE. Coexisting Speech Disorders-voice, resonance, fluency.

Some of our children will show coexisting speech disorders along with their phonological disorder. You must use your articulation test and especially your conversational sample to determine if coexisting voice (pitch, loudness, and quality), resonance (hypernasality,
hyponasality) or fluency (disorders of speech rhythm) disorders exist. Many children exhibit coexisting problems and you need to be aware of this.

III. Speech Mechanism Variables-oral peripheral evaluation, speech motor control and hearing status (acuity).

These performance data will be collected from the administration of other assessment instruments. We will need to administer some test of oral function. We study oral structures and functions to determine if they have some negative influence on speech sound production. Our treatment of the client will differ with respect to the presence of structure/function disorders, because the youngster may need some dental, orthodontic, or surgical intervention prior to speech treatment. There are a number of screening tests available and some that are more in-depth such as the instrument designed by Robbins and Klee. It is presented in Appendix C for your use.

In addition to observations of structure/function, speech motor control will be assessed. Speech motor control involves the coordination of the speech production systems (Respiration, Phonation, Resonation, and Articulation) to produce intelligible speech. This task requires over 100 muscles that are part of five distinct structure/function classes. We will check the integrity of the speech production system through the collection of diadochokinesis, or the repetitive production of speech. It examines the various articulatory points of production and the other speech production subsystems to provide an assessment of speech motor control.

Remember that reliable repetitions are typically obtained with children 5 years of age and older. It can be used with younger children but the SLP must be very cautious with the results. Diadochokinetic rates for single and multi-syllabic syllables are elicited. The child needs to produce the test items in accordance with standardized test data as provided or in relation to a SLP-devised procedure.

Stimuli: puh, tuh, kuh, puhtuh, puhtuhkuh

The SLP is looking for accurate, rapid, sequential productions that are coordinated with appropriate stress across units. Imitate productions for the client prior to a particular stimulus trail. If necessary, use a grapheme to cue the client. The client should be asked for 3 to 5 trails for each stimulus and each trial should be timed to allow at least a 5 second trial. If a child misarticulates a certain consonant stimulus, eliminate it. Generally, the average child produces between 3 and 6 repetitions per second for /puh/; 3 to 5 1/2 repetitions per second for /tuh/; and 3 to 5 per second for /kuh/ and repetition rates of 1 to1 & 1/2 repetitions per second for /puhtuhkuh/.

Many SLPs use diadochokinesis only but others use different maximum performance tasks such as maximum phonation duration. See Rvachew and Brosseau-Lapre (2012) for additional information on maximum performance tasks.
We always need to obtain information concerning hearing status. We will do the screening or have an audiologist do complete testing, since hearing loss can be a negative variable in phonological development. It is also possible that there will be a need to refer to an audiologist for more in-depth testing.

**IV. Supplementary Tests**

There are significant numbers of children with speech sound disorders who also present with phonological processing issues. Remember in the model of speech production and perception that was discussed, it was indicated that the child acquires specific acoustic-phonetic representations for words and different sublexical units. This next series of measures that are listed in Table 2 are used to assess phonological processing. They include measures of speech perception, phonological awareness, and nonword repetition.

<table>
<thead>
<tr>
<th>Speech perception skills</th>
<th>Assess the child’s perception of the target sound versus the production error.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonological awareness and general preliteracy skills</td>
<td>Assess the child’s skills to analyze the sound structure of speech and overall preliteracy skills.</td>
</tr>
<tr>
<td>Nonword repetition skills</td>
<td>Assess the child’s perception, encoding skills, phonological memory, motor planning, and articulation.</td>
</tr>
</tbody>
</table>

*Table 2. Assessment of phonological processing.*

An assessment of speech perception taps into the child’s underlying acoustic-phonetic representations. Most important is to determine the child’s perception of the target sound versus the production error. Are they able to perceive differences between the error sound and target sound or not? There are a limited number of assessment procedures that can be used but one that can be easily employed is the *Speech Production Perception Task* that was developed by Locke (1980). The assessment is presented in Appendix D along with instructions for administering the instrument. There is also an example of an assessment with the results. In addition to the instrument that was developed by Locke, there is the *SAILS* computer program that was originally used for the treatment of speech perception problems but has also been used for assessment purposes. It was developed by Rvachew (1994) and can be obtained by contacting the author at the listed website.

http://www.medicine.mcgill.ca/srvachew

It is important to assess the phonological awareness of some children and their preliteracy skills. Phonological awareness is the ability to analyze consciously the sound structure of speech. Awareness skills such as rhyming, identifying individual sounds in words, segmenting sounds in words, alliteration, and other skills are critical to the
development of phonological awareness. Rvachew and Brosseau-Lapre (2012) summarize awareness skills to include: awareness to rhyme, rhyme identification and contrast, blending and segmenting syllables, identifying the number of phonemes in a word/syllable, phoneme tasks of addition, omission, or displacement.

Phonological awareness is critical to the development to literacy skills (Reading, Writing, & Spelling). Not all children will exhibit phonological awareness problems but those who do should receive treatment. Current information indicates that there is not a strong relationship between severity of the speech sound disorder and phonological awareness skills. That is, the SLP may find some children with mild speech sound disorders and phonological awareness deficits. Other children with speech sound disorders of different severities may have no problems with phonological awareness. There are norm referenced and criterion referenced tests that can be used to assess awareness and additional information is listed in Appendix D.

Children who present with significant phonemic-based speech sound disorders are often at risk for different literacy issues and should be screened to determine if further testing and treatment is necessary. For example, Catts and associates (2001) found that five kindergarten variables predicted reading outcomes as assessed in second grade. They found that letter identification, sentence identification, phonological awareness, rapid naming and educational level of the child’s mother generally predicted reading proficiency in second grade. Consequently, the authors recommend that children with histories of speech and language impairment should be assessed with the above battery when enrolled in kindergarten. If identified with a potential reading problem, the SLP should provide intervention that includes phonological awareness and additional language-based literacy treatment. Literacy activities such as vocabulary development, syntax, pragmatics and other area of treatment should be carried out by the SLP and coordinated with the classroom teacher.

Justice, Invernizzi, and Meier ((2002) discuss subgroups of clients that should be screened for literacy problems. Among those groups they identify are clients with severe phonological impairment with a percentage of consonants correct (PCC) below 50%. In addition, they indicate that children with coexisting language and phonological problems should be screened to determine early literacy skills. In addition to the issues discussed above, there are also some environmental and familial risk factors that may be associated with children who may have coexisting communication and potential literacy problems. For example, the presence of attention-deficit disorder, behavior, and/or conduct problems may be associated with poorer performance on literacy tasks. Finally, familial factors such as limited English proficiency, low-income, lack of education and a family history of reading problems are additional risk factors to be considered. Please refer to Appendix D for some standardized measures and recommendations for constructing SLP devised measures.

Nonword repetition tasks are also an important component of the assessment process,
because such tasks examine a number of phonological processing skills such as speech perception, encoding skills, phonological memory and articulatory production skills. Initially developed to assess children with SLI, the measure has been adapted for children with speech sound disorders. The measure developed by Shriberg and his associates can be downloaded from their website, which is listed in Appendix D.

V. Cognitive-Linguistic Measures

-nonverbal reasoning skills, receptive language, expressive language, and academic achievement.

These data are necessary to understand the overall cognitive-linguistic performance of the child. Such data are particularly important for those children who demonstrate significant disorders of phonology. We may administer tests to study these areas, or in some cases, we may obtain information from other professionals, particularly in the area of cognitive performance. In some cases, SLPs administer measures of nonverbal reasoning skills to provide screening information regarding cognitive performance. Receptive and expressive language measures will furnishes indices of the components (Form, Content, Use) and processes (Comprehension, Production) of language. The language testing may simply be a screening or an in depth assessment. Use the conversational sample to help in guiding you to select the appropriate assessment. In particular, SLI and other language impairments frequently coexist with preschool children. Finally, we also need to be aware of the child’s academic skills and this information can be part of the history via verbal intake or the sharing of academic records.

Appendix A-Tests of Speech Sound Production.


6. Diagnostic Evaluation of Articulation and Phonology (DEAP), Dodd et al. Psychological Corporation,

8. Hodson Assessment of Phonological Patterns (HAPP-3), Hodson, Pro-Ed.


11. Photo Articulation Test (PAT-3), Lippke et al., Pro-Ed.


**Appendix B-Measures of Intelligibility and Severity**

**Speech Intelligibility**

I. Definition - capability of speaker to produce a spoken message and the degree to which other listeners understand it.

A. Measurement

1. Intelligibility is usually measured through some type of discrimination procedure.

2. People understand other people. Intelligibility is made easier since languages have redundant features. People can derive message content from messages that do not contain all available information.

3. Important factors that impact on intelligibility are the number and types of sound errors, consistency of the errors, frequency of occurrence of the sound errors and the phonological processes used by the child.

II. Assessment at Intelligibility

A. Open set word identification
   % of words understood in conversational speech, or reading sample. Examiner transcribes the sample to determine the number of words understood. Some data suggest an intelligibility score of 100% by 48 months.
B. Closed-set word identification
% of words understood when spoken from a standardized word list some data suggest that closed set scores of 70% higher suggestive of intelligible speakers. 60% to 70% problematic. Below 60% unintelligible.

C. Rating scales
A listener assigns a rating along an equal appearing interval scale (Interval Scale), or a judgment is made in reference to some standard stimulus (Direct Magnitude Estimation).

III. Examples

A. In an open set procedure, the examiner would have the child talk spontaneously or read a passage. The sample would be audio recorded for scoring. The examiner would then play the recording and identify words understood and words that were unintelligible. A percentage of intelligibility would then be computed. If a child produced 200 words and 180 words were identified by the examiner, the child would have an intelligibility rating of 90%.

B. In a closed set procedure, a word list of some kind would be provided and the client would read or say the words. There are also standardized measures that one can use to obtain an estimate of intelligibility. The intelligibility items would be scored live or from an audio recording. A percentage of intelligibility would be calculated from the data. Some examples include:

Sample of CVC Words

The following is one of the four sets of 20 words used to obtain measures of the adequacy of word and phoneme production. Each of the 20 word sets contains two examples of each of 30 phonemes. The lists from which these words are taken may be found in Boothroyd (1984). The words were spoken and audited in the context “write the word __________ next.”

```plaintext
1. fish  2. duck  3. path  4. cheese  5. race
11. fun  12. will  13. vat  14. shape  15. wreath
16. hide  17. guess  18. comb  19. choose  20. job
```
Sentence Material

The following is one of the 10 sentence sets used to measure the adequacy of production of words in sentences. Listeners were informed of the topic of each sentence. Scores were based on key words, which are underlined.

1. **Weather:** Shovel the snow.
2. **School** What happened at the student council meeting last week?
3. **Clothes:** Polish your shoes.
4. **Family:** Are your grandparents still alive?
5. **Animals:** Bears are very dangerous.
6. **Pets:** Your dog has fleas.
7. **Sports:** Will you play in the softball game Thursday night?
8. **Homes:** My new bedroom has blue wallpaper.
9. **Seasons:** Wait until spring.
10. **Food:** The milk will sour if you don’t put it in the refrigerator.

Standardized Measure


C. Interval scaling and direct magnitude estimation involve rating the child’s intelligibility on a continuum.

Interval Scaling

1 2 3 4 5
with some Difficult Very Understand
limitations

Direct Magnitude

A listener places the sample along a continuum of intelligibility. Prior the listener is provided standard intelligibility samples in which to anchor his/her ratings.

Intelligible Not Intelligible
Severity

Severity is another metric that you may need to use with children who have speech sound disorders. In some agencies, you may need to make severity ratings in order to select children for your caseload. Severity is the impact of the problem on a listener. Shriberg and his associates have developed a measurement tool known as the Percentage of Consonants Correct (PCC) to estimate severity. Some other examples of severity measures are included for your consideration.

Severity Rating

A. Administer a standard phonological test and observe the child during administration. You may not want to score the test so that you may observe and then rate severity. Another alternative would be to have one person score the test and the other rate severity.

Severity rating (single words)

__ normal  __ mild  __ moderate  __ severe  __ profound

B. Listen to a 3-5 minute sample of conversation and rate severity by putting a mark on the line below:

___________________________________________________________

Normal  Severe

C. Rate the severity of the child’s phonological impairment in conversation.

Severity rating (conversation):

__ normal  __ mild  __ moderate  __ severe  __ profound

D. Rate the severity of the child’s phonological impairment considering word and conversational performance.

__ normal  __ mild  __ moderate  __ severe  __ profound

E. One of the more popular measures of severity is the Percentage of Consonants Correct (PCC) and the Percentage of Consonants Correct –Revised (PCC-R) both of which were developed by Shriberg and his associates. The rules include the following:
1. Record a conversational speech sample of at least 100 different words.
2. Transcribe the sample in both standard orthography and phonetic transcription.
3. Score only fully intelligible words—underline them.
4. Consider only intended consonants in the analysis, excluding vowels.
5. Additions of consonants before a vowel are not counted as an error.
6. Postvocalic stressed /r/ is a consonant whereas the vocalic variants are vowels and not counted.
7. Do not score consonants in successive repetitions of a syllable, e.g. ba ballon, score only the first /b/.
8. Do not score consonants in third or successive repetitions of a word unless articulation changes.

Scoring
1. Score consonants as incorrect unless heard as correct.
2. Dialect variations are glossed as intended in the child’s dialect.
3. Fast and casual speech variants are scored as correct e.g. dunno-don’t know.
4. Allophones are scored as correct, e.g. flap in water is correct.
5. Additions to a target consonant are scored as incorrect.
6. Deletion/omission and substitution errors are scored as incorrect, including voicing errors.
7. Omission of /h/ and substitution of /n/ for /ŋ/ are scored as incorrect in stressed syllables only.
8. Distortions of a target consonant, no matter how subtle, are scored as incorrect.

Scoring Modifications for PCC-R
1. Scoring rules 1-7 apply.
2. Distortions are scored correct.

<table>
<thead>
<tr>
<th>Age</th>
<th>Males PCC</th>
<th>Males SD</th>
<th>Males PCC-R</th>
<th>Males SD</th>
<th>Females PCC</th>
<th>Females SD</th>
<th>Females PCC-R</th>
<th>Females SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-3-11</td>
<td>79.4</td>
<td>7.9</td>
<td>92.8</td>
<td>4.2</td>
<td>80.9</td>
<td>7.7</td>
<td>94.3</td>
<td>4.3</td>
</tr>
<tr>
<td>4-4-11</td>
<td>80.2</td>
<td>7.9</td>
<td>93.0</td>
<td>4.2</td>
<td>80.3</td>
<td>7.7</td>
<td>91.4</td>
<td>4.3</td>
</tr>
<tr>
<td>5-5-11</td>
<td>86.9</td>
<td>7.9</td>
<td>92.9</td>
<td>4.4</td>
<td>87.3</td>
<td>7.6</td>
<td>95.3</td>
<td>4.4</td>
</tr>
<tr>
<td>6-6-11</td>
<td>90.9</td>
<td>4.3</td>
<td>94.1</td>
<td>3.0</td>
<td>91.6</td>
<td>4.6</td>
<td>95.0</td>
<td>3.0</td>
</tr>
<tr>
<td>7-7-11</td>
<td>95.7</td>
<td>4.3</td>
<td>96.9</td>
<td>3.0</td>
<td>95.8</td>
<td>4.6</td>
<td>97.2</td>
<td>3.0</td>
</tr>
<tr>
<td>8-8-11</td>
<td>95.6</td>
<td>4.3</td>
<td>97.5</td>
<td>3.0</td>
<td>95.0</td>
<td>4.6</td>
<td>96.9</td>
<td>3.0</td>
</tr>
<tr>
<td>9-11-11</td>
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<td>3.5</td>
<td>97.1</td>
<td>3.5</td>
<td>98.2</td>
<td>1.6</td>
<td>98.4</td>
<td>1.5</td>
</tr>
<tr>
<td>12-17-11</td>
<td>97.5</td>
<td>2.6</td>
<td>98.0</td>
<td>2.3</td>
<td>98.9</td>
<td>1.0</td>
<td>99.2</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Please see [http://www.waisman.wisc.edu/phonology for additional information](http://www.waisman.wisc.edu/phonology for additional information).


**Appendix C**

**Oral Motor Examination**

1. **Oral and Speech Motor Control Protocol**

<table>
<thead>
<tr>
<th>Lips (CN VII)</th>
<th>Speech Function:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure at rest:</td>
<td>38. Elevation to alveolar ridge:</td>
</tr>
<tr>
<td>1. Symmetry</td>
<td>/n/, /t/, or /l/</td>
</tr>
<tr>
<td>2. Relationship (open vs. closed) Oral function:</td>
<td>39. Touch lateral edges of tongue to teeth:</td>
</tr>
<tr>
<td>3. Rounding</td>
<td>/s/ or /l/</td>
</tr>
<tr>
<td>4. Protrusion (blowing)</td>
<td>40. Interdental: /O/</td>
</tr>
<tr>
<td>5. Retraction</td>
<td>41. Posterior tongue to palate:</td>
</tr>
<tr>
<td>6. Alternate pucker/smile</td>
<td>/k/ or /g/</td>
</tr>
<tr>
<td>7. Bite lower lip</td>
<td>42. Symmetry</td>
</tr>
<tr>
<td>8. Lip seal</td>
<td>43. Uvula</td>
</tr>
<tr>
<td>9. Puff cheeks</td>
<td>44. Tonsils</td>
</tr>
<tr>
<td>10. Open-close lip</td>
<td>45. Vault height</td>
</tr>
<tr>
<td>Speech function:</td>
<td>46. Palatal juncture (palpate) Oral function:</td>
</tr>
<tr>
<td>11. Rounding /o:/</td>
<td>47. Blow on cold mirror</td>
</tr>
<tr>
<td>12. Protrusion /u:/</td>
<td>48. Suck through straw</td>
</tr>
<tr>
<td>13. Retraction /i:/</td>
<td></td>
</tr>
<tr>
<td>14. Alternate /u/, /i/</td>
<td></td>
</tr>
</tbody>
</table>
15. Bite lower lip /f/
16. Open-close lips /m /
Mandible (CN V)
Structure at rest:
17. Symmetry
18. Occlusion
19. Size (re: facial features)
Oral function:
20. Excursion (click teeth 5x)
Maxilla
Structure at rest:
21. Symmetry
22. Size
Teeth
23. Decay
24. Alignment
25. Gaps
26. Missing
27. Occlusion (re: maxillary teeth)
Tongue (CN XII)
Structure at rest:
28. Symmetry
29. Carriage
30. Fasciculations
31. Furrowing
32. Atrophy
33. Hypertrophy
Oral function:
34. Protrusion
35. Elevation to alveolar ridge
36. Anterior-posterior sweep
37. Interdental

Speech function:
49. /a:/
50. /ha.ha.ha/
Larynx-Respiration (CN X)
Structure at rest:
51. Posture during quiet breathing
Oral function:
52. Cough, laugh, or cry
Speech function:
81. Maximum phonation time
(in seconds): /a:/
53. Pitch variation
54. Loudness variation
55. /ha.ha.ha/
Coordinated speech movements
56. (82)a /p / repetitions
57. (83)a /t / repetitions
58. (84)a /k / repetitions
59. (85)a /p r k k/
repetitions
60. (86)a patticake repetitions
61. you
62. top
63. beef
64. fume
65. cowboy
66. band-aid
67. half time
68. banana
69. kitty cat
70. puppy dog
71. communicate
72. 1950
73. potato head
74. Winnie the Pooh
Speech sample
Prosody:
75. Rate
76. Intonation
Voice:
77. Pitch
78. Loudness
79. Quality
Nasal resonance

Items 56-60 are scored for articulatory accuracy, and Items 82-86 for mean number of repetitions per second over 3 s.

Appendix D Assessment of Phonological Processing

The SLP presents via live voice the test materials to the child. In the example above the child presents with an /r/ speech sound error. The error is contrasted with the correct target and a control sound with similar features. There are six presentations of each item. The SLP shows the child a picture of a rake and follows by saying “Is this a rake?, Is this a wake?, Is this a lake?. The items are presented in random order and performance score used to determine if a processing problem exists.

Phonological awareness is a skill that enables the speaker to identify and manipulate the sounds of the language. It is an important skill and one that comes into play during the child’s acquisition of basic literacy skills such as reading. Tasks such as segmenting speech into words, syllables, onset/rime groupings and isolating individual sounds are phonological awareness tasks.
The practitioner can assess phonological awareness through informal means or use a standardized test. Tasks for assessing phonological awareness include:

1. Word rhyming skills
2. Identifying words that begin with the same speech sound
3. Blending individual sounds together to make a word
4. Segmenting sounds that make-up individual words
5. Phonological Awareness tasks may be used to create an awareness and focus on the therapy targets to be covered.
6. Awareness tasks are categorized as implicit and explicit awareness tasks.
   a. Implicit tasks have the child respond to phonemic change in the context of communication and sound play. Activities such as reciting nursery rhymes or providing comments that a word is “hard to say” are examples of implicit activities.
   b. Explicit tasks involve the conscious analysis of phonemic tasks like identifying the number of syllables in a word or grouping words by specific phoneme.
7. Implicit tasks consist of the following:
   a. Identify words that differ by a single phoneme.
   b. Recite nursery rhymes.
   c. Generate words based on rhyme.
   d. Commenting on the difficulty of a word.
   e. “Rehearsing” the production of a word.
   f. Spontaneously segmenting a word into syllables.
   g. Spontaneously producing “made up” word sequences.
8. Explicit tasks consist of the following:
   a. Selecting rhyming words from a group of words.
   b. Segmenting phrases and clauses.
   c. Identifying the number of syllables in a word.
   d. Categorizing groups of words by initial consonant.
   e. Sound blending words containing 4-5 phonemes.
   f. Deleting initial consonants from words and later doing the same with final consonants and cluster segments.
   g. Create novel word sequences through sound play.
   h. Can engage in sound substitution tasks.

There are a number of measures of phonological awareness that are available for the SLP and they include:
When screening emerging literacy skills in 4-5 year olds, the following areas should be examined:

A. Written language awareness: Client is aware of basic book use such as pointing to a word, identifying the book cover, title, identifying logos, identifying linguistic units such as words, phrases etc.

B. Phonological awareness: See above materials.

C. Letter name knowledge: Client can recite the alphabet and knows the name of some individual alphabet letters.

D. Grapheme-phoneme relationships: Client can produce a sound when presented with the letter.

E. Literacy motivation: Client demonstrates interest in books and other print materials.

F. Home literacy: Degree of home literacy is identified via survey or home visit.

Some general early literacy tests available are:


Satisfactory performance on the nonword Syllable Repetition Test (SRT) requires the processing operations that were discussed previously and are presumed to be neural skills involved in language learning, including transforming the acoustic-phonetic sequence into its constituent phonemes, maintaining the ordered and phonologically coded string in working memory, and organizing the articulatory output. The SRT is an 18-item task that consists of nonsense words in 2, 3, and 4 syllable combinations that the client is instructed to imitate. It includes only the early developing consonants /b, d,
m, n/ paired with the vowel /a/. There are comparison data for normal speakers, speakers with speech sound disorders and normal language and those with speech sound and language disorders. Specific problems in test performance suggest speech-processing constraints that may be identified through different error analyses. A technical report with performance data and a PowerPoint presentation of the Syllable Repetition Task (SRT) can be downloaded without cost from the Technical Reports section of the Phonology Project Web site at http://www.waisman.wisc.edu/phonology.

Summary Sheet

Client: _________________________ Date: ___________  DOB: _________

I. Case History:
   A. Development: ____________________________
   B. Speech and Language: ____________________________
   C. Psychosocial Factors: ____________________________

II. Speech Sound Disorders Assessment:
   A. Test: ____________________________
   B. Conversational Sample: Yes  No  Elicitation Mode: _________________
   C. Analysis Method: ____________________________

Phonetic Inventory:
   Nasals: ________ Liquids: ________ Glides: ________ Stops: ________
   Fricatives: ________ Affricates: ________

Phonemic Inventory:
   Nasals: ________ Liquids: ________ Glides: ________ Stops: ________
   Fricatives: ________ Affricates: ________

Vowel Errors:
   Front: ____________ Central: ____________ Back: ____________
   Comments: ______________________________________________________
   ___________________________________________________________________

D. Syllable and Word Shapes
   Simple Syllable shapes: ____________________________
   Complex Syllable shapes: ____________________________
   E. Rate Intelligibility: ____________________________
   F. Rate Severity or Compute PCC: ____________________________
   G. Stimulability:
   Sounds Assessed: ____________________________
   Isolation: ____________________________ Contextual: ____________________________
   Sounds Stimulable: ____________________________
   H. Suprasegmental Features:
   Pitch contours: ____________________________ Word Stress: ____________________________
   Rate: ____________________________ Phrasing: ____________________________
I. Coexisting Speech Disorders:
Voice: __________  Resonance: __________  Fluency: __________
Language Recommendations:  Screening: ______  Comprehensive Testing: ______

III. Speech Mechanism Variables:
Structure Variations: ____________________________________________
Function Variations: ____________________________________________
Speech Motor Control: ____________________________________________
Hearing Acuity: ______________________  Further Testing Recommended: ___

IV. Phonological Processing:
Speech Perception: ____________________________________________
Phonological Awareness:  Test: _______________________  Score: __________
Nonword Repetition Test:  Scores: ____________________________________________

V. Cognitive-Linguistic Measures:
Language Recommendations:  Screening: ______  Comprehension Testing: ______
Nonverbal Reasoning Skills:  Test Score: ______________  Consult Information: __________

VI. Summary and Recommendations: ____________________________________________
_____________________________________________________________________
_____________________________________________________________________

Prior to discussing specific treatments, we can say that motor-based approaches focus on developing the client’s phonetic performance, while linguistic approaches focus on developing the client’s phonological knowledge (Williams, 2003). There is treatment effectiveness evidence to support both approaches (Gierut, 1998); however, the SLP has the ultimate responsibility for selecting, implementing, and evaluating the client’s response to the treatment chosen. The actual data for the decision making process is based on the speech sound disorder presented by the individual client. Additionally, SLPs must also be aware of two additional qualifiers to this discussion. First, clear definitive distinctions between phonetic and phonemic-based sound system disorders cannot always be established (Davis, 2005; Kahmi, 2005). Second, some SLPs have developed treatment approaches that incorporate both phonetic and phonemic features (Bowen, 2015; Bowen & Cupples, 1999; Rvachew, 2005). The typical treatment implementation process is summarized in Figure 1.

Figure 1. A summary of the typical process employed in the selection and implementation of a treatment for a sound system disorder.

_____________________________________________________________________

1. Carry out a comprehensive assessment of the child’s sound system disorder.
   a. Phonetic analysis.
b. Phonemic analysis.
2. Consider other relevant client, clinician, and caregiver factors.
3. Select the treatment approach appropriate for the client.
4. Develop appropriate terminal goal(s) for the period of treatment.
5. Baseline goal(s) to determine pre-treatment levels of performance.
6. Implement the teaching approach.
   a. Introduce treatment activities appropriate for the client.
   b. Establish response accuracy criteria to establish mastery of individual training activities.
   a. Collect daily performance data.
   b. Carry out periodic generalization assessments.
8. Introduce supplemental activities such perceptual training, metalinguistic awareness, and/or pre-literacy activities, if needed.

Restructuring the Child’s Sound System

In this section, specific treatment applications will be discussed. Keep in mind that clients are very diverse in terms of their speech sound disorders; consequently one treatment may be more beneficial than another. The SLP must consider all relevant assessment variables and available evidence to select a treatment that will be most beneficial for a client. During administration of the treatment, design and delivery data will assist in determining if the treatment is working or not. The treatments presented herein all have a certain amount of data to support their use, but there is no superior treatment that has been identified to date. The SLP needs to make the ultimate treatment decision based on an assessment of the client’s speech skills.

1. Integrated Multimodal Intervention

This is a relatively recent treatment that has been developed for clients with severe speech sound disorders (King, Hengst, & DeThorne, 2013) who communicate with an augmentative system but are thought to have the potential for some degree of verbal communication. It is a communication-focused approach that encompasses a variety of communication processes and a number of different communication stimulation techniques. Presently, there is not a strong evidence base, since it is an evolving treatment. The components of the treatment include:

1. Augmentative communication input. Client is using an augmentative system with communication partners, so that both the augmentative model and verbal input are available during various communication exchanges.
2. Target redundancy. Multiple stimulation is provided by the SLP to facilitate verbal interactions.

3. Naturalistic milieu language treatment techniques. Different client-oriented facilitating techniques are used to promote verbal communication.


5. Cuing procedures are employed. Different cuing procedures are used to assist the client in achieving correct sound placement.

A typical session would consist of the following components:

1. Storybook reading activity. The storybook is used to set the theme of the treatment session and introduce different topics and vocabulary. The SLP reads to the client and discusses in simple terms the components of the story, while emphasizing the vocabulary containing the target or target sounds. Storybooks are chosen on the basis of target sounds, contained topics and themes interesting to young children, and are at a linguistic level suitable for treatment purposes (10-20 minutes).

2. Natural speech target drill. The SLP shows the client different word cards to elicit word approximations from the client. Various stimulation techniques are used to assist the client such as recasting, buildups/breakdowns and other eliciting techniques. Treatment pictures used to elicit target sound responses were selected based on treatment goals. The actual pictures can be downloaded from different internet sites (5-10 minutes).

3. Structured play. This activity allows the child to take the lead in producing target sounds that were introduced during the storybook reading activity. The SLP provides materials the contain exemplars of the target (s) and follows the child’s lead in stimulating the child to respond. Different games and activities are employed that are of interest to the client. For instance, games such as concentration, GoFish etc. were used.

*Note that participants have access to their augmentative devices during treatment, if they desired to use it in any of the above activities.

2. Evidence-Based Strategies for Eliciting Speech-Like Vocalizations

The following was developed by DeThorne and associates (2009) for children with severe speech and language delays.

1. Use of AAC assists in the development of relevant semantic and syntactic networks (i.e., it provides a meaningful structure for the production of new words, syllables, and
sounds), and in the case of voice output devices, provides a timely auditory model.

**Example**
Prepare a “core vocabulary book” for the client: a small album that includes photos of meaningful objects, people, and places can be used.

**Strategy**
2. Minimize the pressure to speak, since anxiety and stress can have a negative impact on motor performance.

**Example**
Utilize puppet play to model target sounds or movements.

**Strategy**
3. Imitate the child as imitation may serve as a model for eliciting imitation itself.

**Example**
If the child babbles “baba,” repeat it and use it to begin the song “Baa Baa Black Sheep.”

**Strategy**
4. Employ exaggerated intonation and slowed tempo. It is possible that neural mechanisms of melodic production can be used to “bootstrap” speech production.

**Strategy**
Produce meaningful words and phrases with exaggerated prosody, such as an elongated rising intonation for the word more when used as a request.

**Strategy**
5. Supplement auditory, visual, tactile, and proprioceptive feedback when available to do so.

**Example**
Children with speech sound disorders may be less able to capitalize on the sensory feedback typically available. Enhance visual/tactile feedback by providing a light tap on your own or the child’s lips while modeling production of a /b/ sound.

**Strategy**
6. Avoid emphasis on nonspeech-like articulator movements: focus on function.

**Example**
Sensory motor control for speech is different from nonspeech oromotor behaviors. If alveolar speech sounds are being targeted, incorporating tongue clicks into meaningful play would be more app han tongue wagging or protrusion.

### 3. Stimulability Intervention

Stimulability Intervention was developed by Miccio with the purpose of improving stimulability for young children with very limited sound inventories (Williams and Miccio, 2010). That is, they have a number of sounds missing from their phonetic inventories and they are not stimulable for those sounds. It is designed as a short-term treatment to assist in developing stimulability and enhancing the child’s phonetic repertoire. Typical applications describe a series of approximately 12 sessions. It functions as a base for the introduction of other treatments to refine further the child’s speech sound production skills in context.
Prior to and during treatment, stimulability probes are elicited from the child. The stimulability probe consists of all consonants presented in isolation when possible and with the vowels /i, u, a/ in the context of prevocalic #i, intervocalic V__V, and postvocalic i#. During treatment different speech sounds are presented in isolation for continuants (f....) or in vowel contexts for stops and glides (puhpuhpuh).

The actual treatment is delivered via game type activities to target sounds that are not stimulable. For example, Go Fish, guessing game, board games, spinner games and other activities may be used to introduce sounds that are not stimulable. Each sound is associated with a particular character name and specific hand movement (See Figure 5). Consequently, the SLP presents the character name, auditory model, and specific hand movement. The child is encouraged to produce the target sound but it not required to do so. The SLP can also flood the child with the target such as “Sam sees the snake, See Sam, See the snake.” The different sounds and associated movements are presented. Go to www.brookespublishing.com/williams/miccio.htm for pictures of the characters.

**Figure 5. Stimulus characters used to elicit consonant production**

<table>
<thead>
<tr>
<th>Character</th>
<th>Associated motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>/p/</td>
<td>Putt-Putt Pig</td>
</tr>
<tr>
<td></td>
<td>Glide hands in a skating motion</td>
</tr>
<tr>
<td>/b/</td>
<td>Baby Bear</td>
</tr>
<tr>
<td></td>
<td>Pantomime rocking a baby</td>
</tr>
<tr>
<td>/t/</td>
<td>Talkie Turkey</td>
</tr>
<tr>
<td></td>
<td>Raise pretend phone receiver to ear</td>
</tr>
<tr>
<td>/d/</td>
<td>Dirty Dog</td>
</tr>
<tr>
<td></td>
<td>Make digging motion with hands</td>
</tr>
<tr>
<td>/k/</td>
<td>Coughing Cow</td>
</tr>
<tr>
<td></td>
<td>Place hand near the top of throat</td>
</tr>
<tr>
<td>/g/</td>
<td>Goofy Goat</td>
</tr>
<tr>
<td></td>
<td>Roll eyes toward ceiling</td>
</tr>
<tr>
<td>/f/</td>
<td>Fussy Fish</td>
</tr>
<tr>
<td></td>
<td>Fussily push hand away from body</td>
</tr>
<tr>
<td>/v/</td>
<td>Viney Violet</td>
</tr>
<tr>
<td></td>
<td>Move arm up as a winding vine</td>
</tr>
<tr>
<td>/o/</td>
<td>Think Thumb</td>
</tr>
<tr>
<td></td>
<td>Move thumb in a circle</td>
</tr>
<tr>
<td>/s/</td>
<td>Silly Snake</td>
</tr>
<tr>
<td></td>
<td>Move finger up arm</td>
</tr>
<tr>
<td>/z/</td>
<td>Zippy Zebra</td>
</tr>
<tr>
<td></td>
<td>Zip coat</td>
</tr>
<tr>
<td>/ʃ/</td>
<td>Shy Sheep</td>
</tr>
<tr>
<td></td>
<td>Clutch hands together and push down</td>
</tr>
<tr>
<td>/tʃ/</td>
<td>Cheeky Chick</td>
</tr>
<tr>
<td></td>
<td>Move hand sassily toward cheek</td>
</tr>
<tr>
<td>/dʒ/</td>
<td>Giant Giraffe</td>
</tr>
<tr>
<td></td>
<td>Move hand upward in stair steps</td>
</tr>
<tr>
<td>/m/</td>
<td>Munchie Mouse</td>
</tr>
<tr>
<td></td>
<td>Push lips together and rub tummy</td>
</tr>
<tr>
<td>/n/</td>
<td>Naughty Newt</td>
</tr>
<tr>
<td></td>
<td>Shake finger in scolding motion</td>
</tr>
<tr>
<td>/w/</td>
<td>Wiggly Worm</td>
</tr>
<tr>
<td></td>
<td>Shiver</td>
</tr>
<tr>
<td>/j/</td>
<td>Yawning Yoyo</td>
</tr>
<tr>
<td></td>
<td>Yawn and move hand as to suppress it</td>
</tr>
<tr>
<td>/h/</td>
<td>Happy Hippo</td>
</tr>
<tr>
<td></td>
<td>Laugh and shake shoulders</td>
</tr>
<tr>
<td>/l/</td>
<td>Lazy Lion</td>
</tr>
<tr>
<td></td>
<td>Stretch arms in L shape</td>
</tr>
</tbody>
</table>
A typical treatment session would consist of the following components:

1. Initiate the session by first administering a portion of the stimulability probe. Each consonant would be assessed in the context described above with a single vowel /i, u, or a/. The next session would include the second vowel and the third vowel, so that an entire probe is given across every three sessions (5 minutes).

2. The different character cards are presented for the child as a review. Each picture along with an auditory model and hand movement is presented. The child is encouraged but is not required to imitate the different target sounds (5 minutes).

3. This is the actual treatment portion of the session, wherein games are introduced with the picture cards. Following the model, the child is encouraged to imitate the different sounds that are produced. As the child attends to the task, she/he is asked to watch and listen, then produce the target. Placement cues are also given when thought to be appropriate for the therapy context (30 minutes).

4. Following the treatment portion, a sound probe is administered. It consists of the following items that are administered to the child in imitative fashion (5-8 minutes):

   Pop, Bob, tot, dad, Coke, gag, fife, Viv, sis, zazz, shush, Cheech, judge, mom, none, Lil, roar.

4. Phonemic Contrast Approaches

There are a number of treatments with the primary aim of developing the phonemic distinctions of a language through sound contrast (Barlow & Geirut, 2002). One of the earliest is minimal pairs (Weiner, 1981), and it was used initially from the perspective of phonological process analysis. However, it has also been part of treatment from feature analysis and productive phonological knowledge viewpoints. Minimal pairs are words that differ by a single phoneme thus signaling a meaning difference. The minimal pair /so-toe/ illustrates two words, which have the same vowel but are different in reference to the prevocalic consonant and signal different lexical meaning. A traditional distinctive feature analysis of the consonants shows that they differ in terms of the manner of production; /s/ is a fricative and /t/ is a stop. The two phonemes also share features, because they are both produced at the alveolar point of articulation and are both voiceless. The minimal pair /so-go/ differs on all three feature dimensions; there are differences in reference to voicing, place of articulation, and manner of articulation. A client may substitute or delete sounds and create homonymy (Bernthal et. al., 2009). That is, there is a collapse of phonemic contrast(s) and the collapse may have an effect
on the client’s intelligibility. For example, a client who uses /t/ in appropriate lexical contexts and also substitutes /t/ for /s/ exhibits homonymy. The words “so-toe” are produced as “to-toe”. In attempting to restructure the client’s sound system the child would be confronted with minimal pairs to create meaning differences, thus fostering a restructuring.

There are variations of minimal pair treatment that are also used to restructure a client’s sound system (Gierut, 2005; Williams, 2003). These refinements in phoneme contrast are designed to increase the efficiency of intervention by facilitating widespread change in the child’s phonemic system. Williams (2003) developed the multiple opposition treatment, which addresses multiple phoneme collapse, and Gierut (2005) and her research associates created maximal opposition. Maximal opposition is designed to confront clients with phonemic contrasts that differ according to major class features.

**Selecting Treatment Targets**

Explicit in the linguistic approaches are also specific selection criteria for the development of treatment targets that are based on linguistic complexity (Gierut, 2001; Williams, 2003). That is, treatment directed to more complex linguistic properties is purported to result in greater system change for the client. The notion of using linguistic complexity differs from traditional phonetic approaches that use less complex selection metrics in their target selection criteria (Bernthal et al., 2009). Traditional approaches generally target early acquired sounds that are absent from the child’s sound inventory and are stimulable; whereas, linguistic approaches factor in linguistic variables such as markedness, lexical, and phonetic/phonemic complexity.

**Markedness.** It is recommended that marked phonological features be taught before unmarked features (Gierut, 2001; Williams, 2003). Markedness is a linguistic property of language. A marked feature in a language implies an unmarked feature. For example, voicing is a marked feature and implies an unmarked feature of voicelessness. That is, all languages have voiced sounds and in most cases voiced/voiceless sounds, but there are no languages with just voiceless sounds. Consequently, voicing is a marked feature. Some marked properties to consider in treatment selection are:

- Treating voiced obstruent sounds may facilitate the acquisition of voiceless obstruent sounds.
- Treating fricatives may facilitate the acquisition of stops.
- Treating affricates may facilitate the acquisition of fricatives.
- Treating liquids may facilitate the acquisition of nasals.
- Treating clusters may facilitate the acquisition of singleton consonants.
- Treating later developing clusters may facilitate the acquisition of early developing clusters.

**Lexical Complexity.** Investigators have examined different properties of words that
make up one’s lexicon (Gierut, 2001). In particular word frequency and neighborhood density have been the subject of study (Morrisette & Gierut, 2002). Word frequency is the regularity that particular words occur in a language (Kucera & Francis, 1967), and studies indicate that subjects identify high-frequency words more readily than low frequency words. Neighborhood density is a metric of the number of words that differ minimally in phonetic makeup from a specific word in terms of a single phoneme substitution, deletion, or addition. For example, “tea, stow, and doe” are neighbors of “toe”, since they vary in terms of a single phoneme difference. Research findings indicate that words from low-density neighborhoods, which have limited phonetic linkages, are easier for subjects to identify than high-density words. Preliminary findings reported by Morrisette and Gierut for preschool children with severe sound system disorders indicate that using high-frequency words in treatment facilitates greater generalization than low-frequency words. Use high frequency words in the treatment paradigm.

**Phonetic/Phonemic Complexity.** A number of research investigations summarized by (Gierut, 2001) have studied different phonetic and phonemic factors in treatment and the overall findings suggest the following considerations in treatment selection:

- Treat sounds that are not stimulable.
- Treat sounds that are acoustically undifferentiated.
- Treat sounds that are absent from the child’s inventory of sounds.
- Treat sounds that are developmentally later acquired rather than earlier acquired sounds.

**4A. Minimal Pairs**

A training plan for a client utilizing minimal pairs consists of several steps that are designed to establish the phonemic contrast through perception and production activities. Implementation would consist of the following steps:

1. **Perception:** Select 4 to 8 sets of minimal pairs that can be displayed via picture. If it is difficult to generate a sufficient number of pictures, nonce items may be used. Meaning may be introduced by associating a pictorial shape with the nonce item. For discussion, assume that the child is using /t/ in substitution of /s/, and the minimal pairs selected are “two-sue, toe-sew, tea-sea, tap-sap, and tip-sip.” The pictures of each are introduced to the child and named by the clinician prior to introducing the perceptual task, so that the child is familiar with the treatment items. The client would then be engaged in the perceptual task. The clinician displays the pictures and provides stimulus cues. (e.g., “I want you to show me the picture that I say. Show me sea.”). The client’s response is to identify the correct item. This is an optional step that may or may not be included in treatment. In some applications of minimal pairs, an introductory perceptual step is not part of the minimal pair treatment (Weiner, 1981).

Some authors also utilize imagery to create distinctions between minimal pairs. Klein (1996) describes imagery as a cognitive process that is used to develop a phonological
contrast through the use of semantic anchors or descriptions. Descriptive terms are used to label the feature contrast undergoing treatment. In the previous example of a stop being used in place of a fricative, the distinction between “sounds that are long sounding” and “sounds that are short sounding” might be introduced. The fricative would be the “long sounding” and initially presented in a slightly prolonged manner within the target words. The stop sound or “short sounding” sound could be portrayed as a very quickly articulated sound as produced in words. Imagery is also used in other phonemic approaches that will be discussed later in the handout.

2. **Phonetic Production**: This step is also an optional step, but used by some SLPs when the client does not have the phonetic skills to produce the target sound. Bernthal and his associates (2009) recommend that the clinician probe the client’s phonetic production skills and teach placement of the target sound, if necessary, so that the client has imitative control of the target sound in words. Tyler, Edwards, and Saxman (1987) also provide a word imitation step with words containing the target sound. The client must demonstrate imitative control of the target in words, before advancing to actual minimal pair contrast. Some authors do not include phonetic practice as a precursor to the introduction of minimal pairs (Weiner, 1981). For example, Klein (1996) indicates that minimal pairs are designed to present the client with phonemic contrasts; consequently, phonetic teaching procedures such as placement instructions and imitative cues are not part of a “pure” linguistic teaching approach.

3. **Minimal Pairs**: The minimal pairs are presented individually, and the client is instructed to produce each of the items. For example, the clinician presents pictures of the minimal pair /tea-sea/ and instructs the client to identify spontaneously each picture. (e.g., “I want you to name the picture that I point to. Ready, name this picture.”). Tyler (2005b) describes a variation wherein the clinician plays “Go Fish” with the client. The SLP has pictures of the minimal pairs and the client is given only pictures of the target words. The client is instructed to produce the target words in order to receive the picture match from the clinician. If the client errors in production, the picture representing the minimal pair contrast will be given to the client rather than the target word match to create a communication mismatch. This places the client in a communication interaction that is unsuccessful and can facilitate the development of the appropriate phonemic contrast. There are a number of different ways that can be used to present the minimal pairs and elicit the responses spontaneously.

At this level of treatment it is important that the SLP have an operational definition of a correct response. Some authors provide the client with positive feedback for the elimination of the error, not the specific target sound (Saben & Ingham, 1991), while others define the response as the specific phoneme (Tyler, Edwards, & Saxman, 1987). For instance, a client may delete fricatives in the postvocalic position and the minimal pair /my-mice/ may be utilized. If the child’s response to /mice/ contained a postvocalic fricative other than /s/, positive affirmation would be given, since the client is learning the rule. However this aspect of minimal pair treatment remains
controversial. Tyler (2005b) indicates that the client should have imitative control of the target in some words before using minimal pairs. If not, the minimal pair activity may be frustrating, since the client does not meet with success. SLPs should be cognizant of this issue when introducing the actual production of minimal pairs and determine the most beneficial option for the client. It may be necessary to include an imitative step prior to having the client produce the pairs spontaneously.

4. Minimal Pairs in Context. The final step is to incorporate the minimal pairs in contextual practice material. This is generally accomplished by incorporating the pairs in stereotypic carrier sentences. (e.g., “I see a ______ and a ______.”). When the client achieves the predetermined response accuracy criterion, practice may shift to individual use of the targets in carrier sentences. (e.g., “I am pointing to the ______.”). It is possible that other activities may need to be introduced such as conversational practice but the breadth of activity will depend in large part to the generalization of the client. As discussed, measurement of generalization is critical to evaluating the success of the treatment and determining if certain treatment activities are needed.

4.B Multiple Oppositions

Williams (2003, 2005, 2006, 2010) has conducted substantive treatment research and studied clients who present with severe phonological disorders. Some of the clients demonstrated multiple phoneme collapse. That is, one phoneme is used in place of many phonemes. Rather than target a single contrast as in minimal pairs, Williams reasoned that it would be more beneficial to target multiple phoneme collapse through treatment designated as multiple oppositions. That is, it is postulated that a general rule is operating; consequently, therapy should be directed to the rule and not subsets of the rule. For example, a client who uses /t/ for /s/, /k/, and /ʃ/ would benefit from an integrated treatment of the phoneme collapse rather than individual minimal pair sets. Multiple opposition sets such as “two-sue, two-coo, two-shoe” would be used to address multiple errors that stem from a single rule. The client is exposed to the gestalt, so that she/he may reorganize the phonological system in a structured, systematic, and efficient manner.

1. Introductory Phase. The initial or introductory part of the treatment contains three components. The first component is designed to present the rule that is being taught, the second is to introduce the vocabulary to be used, and the third is production of the sound contrasts.

The first step in this treatment is presentation of the phonological rule by contrasting what the child does with what they need to do. Keep in mind that the contrast may be abstract for the child, so the clinician needs to structure this activity at the child’s level. The idea is to present the rule in a concrete manner. One way of achieving this goal is to use imagery as discussed under minimal pairs. For example, a child needing to
develop the continuant feature in place of the stop feature might be exposed to the “pouring sound” versus the “dripping sound.” The clinician could contrast a spigot with “pouring water” to introduce the fricative with a spigot of “dripping water”, which represents the stop feature. Place feature errors could be anchored for the child by drawing a distinction between “sounds made in the front of the mouth” and sounds made in the “back of the mouth.” Sound deletions associated with final consonants might be presented as “whole words” versus part words. A visual anchor of small blocks representing each sound could be contrasted with a missing block to signal the missing sound. There is no completion criteria for this step. Williams (2003) indicates that the client should be involved actively in this step to make certain that the concept (phonological rule) is understood by the child. It is estimated that the activity should require approximately fifteen to twenty minutes.

The next step is introduction of vocabulary, in order that the child becomes familiar with the pictures that represent the desired treatment pairs. It is an identification phase for the client, so that she/he is totally familiar with the practice stimuli. Williams (2003) recommends that each picture be displayed and the item produced by the SLP. The author feels that is also helpful to tell a short story about each item to assist the child in associating the picture with the desired vocabulary items.

The final part of the introductory phase is actual production of the stimuli imitatively. The SLP provides an imitative model of the contrastive pairs “tea-sea”, while also providing the pictorial references. The client is required to produce the word pairs. Linguistic feedback is provided to the child concerning the accuracy of the productions. For example, if the above pair was produced as “tea-tea”, the clinician might say, “We drink tea (pointing to the picture of tea), but the boat floats in the sea (pointing to the picture of the sea).” Williams (2003) cautions that in some cases, the SLP may need to break down the pairs and practice the words separately. After the child can produce the stimuli separately, the contrastive word pairs are re-introduced.

There are no accuracy criteria that the client must meet for any of the three steps. The purpose of the introductory phase is to (1) develop an awareness of the rule that is being taught, (2) present the paired treatment items that contain the treatment contrasts, and (3) elicit imitative production of the treatment pairs. The primary goal is to build a foundation for the phases that follow.

2. Second Phase. This phase is a production phase that is designed to elicit imitative responses of the contrasts and then shift to spontaneous production. Interactive play situations that focus of the target contrasts are also incorporated into this phase. Williams (2010) stresses the need for the child to concentrate on the contrasts and not be distracted from the treatment through the use of board games. The author recommends that clients should produce between 60-100 responses per 30-minute session. This is a time for clinical focus on the part of the child. Moreover, this phase of treatment frequently takes the most time, since the client is developing the contrasts. In
a typical practice session, pictures of the word pairs are introduced by the SLP and then practiced. As the child begins to produce the contrastive pairs, the SLP varies the order of the pairs to stress the salience of the contrasts and minimize simple articular repetition. For instance, the pair “tip-sip” would also be presented as “sip-tip”. The pairs are practiced under both imitative and spontaneous conditions. First, the child practices the pairs via imitation until a criterion of 70% accuracy has been established for two consecutive training sets. A training set is a block of responses that are used to measure the client’s response to the treatment. If the client were practicing four multiple opposition contrasts “tip-kip, tip-sip, tip-ship, tip-chip,” and each pair was presented five times, there would be a total of 20 presentations in a training set. The client would need to achieve 70% accuracy (at least 14 of the contrasts would need to be judged correct) in each of two consecutive training sets in order to shift from imitative to spontaneous practice. The spontaneous practice is completed when the child achieves an accuracy criterion of 90% across two consecutive training sets. The author indicates that a training set consists of 20-50 responses; the number of responses depends on the number of contrasts that are being taught.

In addition to the contrastive word practice, interactive play with the targets is carried out following practice of the contrasts. Interactive play is utilized to provide a more naturalistic context for practice of the targets. That is, the play is designed to simulate actual conditions wherein the client needs to use the target contrasts appropriately. Williams (2010) explains that the child needs opportunities to help develop the new phonological rule and also use the target contrasts in more naturalistic contexts. An activity that enables the clinician to model treatment targets and furnish opportunities for the client to produce their practice targets in words should be employed. For example, the SLP might read a book to the child and stress the production of words that contain the target words. The child would be prompted to produce some of those targets, which have been introduced in treatment. Other SLP directed activities such as interactive play (art work, pretend, etc.) might be used to create other conversational conditions.

3. Third Phase. At this stage of treatment, the child has achieved spontaneous production of the contrasts; consequently, practice shifts to activities that promote spontaneous use. It is no longer necessary to use the paired contrasts, since the activities provide contexts for use of the newly acquired phonological targets. The aim is to provide different opportunities in more naturalistic contexts that are typically appealing for young clients. For example, the child and the clinician may take turns and engage in games such as matching contrastive pairs (Go Fish, concentration), or the client “instructs” the SLP to point to different pictures that she/he identifies. Feedback is an important component that is continually provided, so that the client is made aware of correct and incorrect productions.

There is no response completion criterion for Phase 3 practice activities as employed in Phase 2, rather completion is based on response generalization data that have been
collected throughout treatment. Williams (2003) recommends that generalization probes of ten words for each target sound in the position treated be constructed and administered at every third session to assess response generalization. If the child achieves an accuracy of 90% for a generalization probe, Phase 3 is completed. A conversational probe to assess use of the contrasts in spontaneous speech follows the achievement of the generalization criterion. Using criteria advocated by Fey (1986), therapy is concluded for the treatment opposition, if the client achieves 50% accuracy or higher for the phonological contrasts being taught.

4. Fourth Phase. This is a phase that is employed for clients who are not generalizing the target sounds to spontaneous conversation. The clinician engages the child in conversation and employs recasts of the child’s error productions as adapted from the work of Camarata (2010). The recasts are immediate and contingent on the error productions of the child as monitored through conversational interchanges, but they are not to distract from the spontaneity of the conversational interchange. The linguistic feedback furnished to the client is a correct model provided immediately after an incorrect production and a positive verbal affirmation for correct productions. For example, the client might say “I want a potato tip” and that would be followed by the clinician saying, “Yes, a potato chip.” In the example the clinician’s response immediately follows the error but it does not detract from the conversational interchange. Similarly, a response such as “I put a check mark on it” would be followed by the clinician’s “Yes, you are correct.” There are no direct requests for imitation during conversational sessions. It is important that the SLP utilize activities and materials, which allow for numerous response opportunities. Response generalization probes of words continue during this phase with the goal of achieving the 90% criterion. Achievement of the criterion would be followed by a conversational probe and termination of the treatment opposition, if the 50% spontaneous conversational probe criterion was met.

5. Other Linguistic-Based Approaches

There are substantial numbers of clients who present with sound system disorders and coexisting problems in other aspects of language such as morphology and syntax (Tyler, 2002; Tyler & Haskill, 2010). While we do not know specifically the exact relationship among structural, semantic, and pragmatic components of language, interactions with phonology cannot be ignored. It follows that phonology is not independent from other components of language, and treatment should be directed not only to phonology but other components that are also at variance with developmental expectations. Note that the approaches to be discussed focus on the totality of the language impairment, not sound system errors specifically. These approaches are not to be confused with naturalistic elicitation techniques that focus on sound system errors such as conversational recasting, a treatment technique developed by Camarata (2010) and discussed previously. In her cogent discussion of language-based treatment, Tyler (2002) indicates that such an approach may be suitable for clients with language
impairment that include sound system errors produced on a variable basis. That is, clients who are inconsistent in their production of sound system targets may be candidates for a language-based approach. Implicit with such a treatment approach is that there will be interactions among the language domains, and therapy for a language domain such as morphology will have a positive influence on the client’s sound system errors. That is, there will be a top-down effect.

5A. Language-based Treatment-Morphosyntax

An example of such a language-based treatment is that formulated by Tyler, Lewis, Haskill, and Tolbert (2002). The components of the treatment include: (1) auditory awareness of linguistic targets, (2) focused stimulation and (3) elicited production of language targets. Auditory awareness is employed to enhance the client’s consciousness of the language targets that are being introduced, while the focused stimulation technique provides numerous exemplars of language targets in natural communicative contexts. Finally, elicitation tasks are employed to facilitate practice of the language structure (s). The different activities utilized for each component are based on different topics such as animals, community helpers, different events and other such themes that may be of interest to the client. All three components are carried out in a treatment session; the authors do not set accuracy performance criteria but rather introduce a new language structure at each session. The treatment is a session by session immersion of a specific goal. Written scripts are prepared to guide the SLP in the conduct of treatment.

1. Auditory awareness. Books and songs are used to create an awareness of the language target. For example, if the SLP were introducing regular comparative adjective forms (er), a book and/or song would be chosen that contains exemplars of the intended target such as “The dog is bigger than the cat.” with emphasis on the comparative form. Other examples would also be introduced, so that the child is exposed to numerous exemplars of the language target.

2. Focused stimulation. The clinician presents the client with numerous examples of the language target in appropriate and functional contexts (Fey, 1986; Proctor-Williams, 2009). The child is not prompted to respond but the clinician attempts to structure the stimulation in a way that promotes the child’s production of the language target. In the context of a focused stimulation vignette, different elicitation techniques such as expansions, expatiations recasting, and making false assertions are utilized. See Focused Stimulation techniques discussed previously.

Clinician: “My dog is bigger than yours.” Looking at pictures together, the clinician makes a false assertion about the size of the dogs.

Client: “My doggie bigger.”

Clinician: “Yes, your doggie is bigger.” Expansion employed to add additional linguistic information.

Client: “Yeah.”
**Clinician:** “Are you sure, your doggie is bigger?” Sentence is recast in question form for the client.

**Client:** “Yes, my doggie is bigger.”

3. **Elicited production of language targets.** This component involves the production of the target in structured elicitation models that range from high to low-level SLP prompting. As the child acquires a language structure, SLP support can be altered from high to low support. High support consists of a forced choice model that obligates the client to use the desired target (“Is this man in the picture taller or shorter than the other one.”). The cloze procedure is an intermediate level of support that is utilized. The client is provided with information and then must complete the request for the missing language structure (“This cow is big, but this cow is __________.”). The final elicitation model is that of preparatory sets (Paul, 2001). This type of intervention activity is designed to heighten the client’s awareness of the treatment goal and prepare she/he for use of the target in different contexts. The client has been exposed through the three treatment components to the specific language goal with the idea of transfer to more naturalistic settings. The SLP demonstrates indirectly the target, so that the client uses it in a more natural communicative interaction. For example, the SLP might provide a number of exemplars of the target and then have the child produce the targets in sentence-level responses. “Billy, look at the book, this dog is bigger than that dog. Look over here. The boy is taller than his brother. Look at this. These girls are all bigger than their sister. Now, you take your book and tell me a little story. What is happening?” “That cow is bigger than the calf and the baby pig is smaller than its mommy.” “Yes, you are right. What’s happening in this picture?”

SLPs who use this treatment may adapt various aspects of it for a specific client who exhibits interactions among the sound system other language components. There are no specific response accuracy criteria that are set for the completion of different treatment goals. Accordingly, testing for generalization is an important adjunct to measure the effectiveness of the treatment, since it will furnish data regarding use outside of treatment.

**5B. Language-based Treatment-Conversational Dialogues**

Hoffman and Norris have developed remediation procedures for treating sound system disorders in the context of naturalistic language situations (Hoffman, 1992; Hoffman, Norris, & Monjure, 1990; Norris & Hoffman, 1990; Hoffman & Norris, 2010). They have stressed that phonology is one aspect of language and that treatment should be conducted within the milieu of language (Hoffman & Norris, 2005; Norris & Hoffman, 2005). Goals of treatment are general in that they specify expansions to the client’s phonetic inventory or improving the percentage of consonants that are used correctly. They do not delineate specific sounds or sound classes, because treatment change is attributed to the reorganizing properties of the client’s neuro-network. That is, the child receives linguistic input that is dealt with via a language processing model.
proposed by the authors and based on theoretical principles of connectionism and dynamic systems. It is proposed that the language processing variables are mutually interactive, and this enables the client to change his/her language of which phonology is an important component. The treatment is particularly geared for children in the chronological age range of 3-4 years.

Treatment is conducted within the context of clinician/client interactions that are conducted in simulated language situations (Hoffman, 1992). Acting out play schemes, forming narratives about different event and activities, and reading story books form the basis for language input to the client. During the presentation of the activities, the clinician guides the client in processing the verbal and nonverbal input through various scaffolding techniques. The scaffolding techniques assist the client in developing more complex language including improvements in phonology. In addition, the SLP provides appropriate action and language following each of the client’s communicative turns to reward the client for engaging in different speech acts and endeavors to elicit more complex language than the client currently uses in conversational speech. An example of the treatment by Hoffman, Norris, & Monjure (1990) is summarized for the reader:

1. **Language activities.** An activity is presented that is of interest to the client by the SLP. For example, the SLP might present a storybook with illustrative pictures and read the story to the client. The SLP uses the pictures and may point to printed words to talk about the story. The characters are introduced, events are described and the outcome or conclusion of the story is presented to the client through the use of a variety of different language forms. The child is then asked to retell the story to the SLP or in the discussion by Hoffman and associates (1990) retell by talking to a puppet. During the story retelling, the clinician provides different forms of feedback contingent on each conversational turn.

A. If the child’s response is not accurate, uncertain, or inadequately stated, the SLP presents a request for clarification. Pertinent information is then provided by the clinician in a restatement using different language forms and generally expanding on the client’s original response. The child is then asked to restate what she/he had originally said.

**SLP:** The SLP presents a picture that is part of a story. It depicts a boy helping his father wash the car.

**Client:** “That boy driving.”

**SLP:** “No that’s not what is going on. The little boy is helping to clean the car so the family can ride in the car. When the boy is big, he can drive, but he can’t drive now. Let’s look at the picture again and you tell what is happening.” If the client continues to experience problems with the story line, additional restatements are made by the SLP, but direct prompting statements like “No, say, he is washing the car.” are not used in the treatment paradigm.

B. When the client describes an event appropriately, the SLP follows with a request to
describe another event related to the story.

SLP: “Yes, the boy is helping his dad clean the car. After they clean the car, they will go for a ride.” Where will they go if they take a ride?”
Client: The client continues to discuss features of the story using various language structures.
SLP. If the client is able to describe individual story events in the conversational interchanges, the clinician introduces prompts to facilitate the construction of responses that incorporate multiple events. For example, the SLP might identify potential associations among and between different events or characters, discuss cause and effect, speculate what might happen in the story, or talk about the internal feelings of the characters.
Client: “The daddy is washing the car and the little boy is helping.”
SLP: “Yes, you are right. They are both cleaning the car. When they finish, the family will go for a ride. Tell me some other things about that part of the story.”

The rationale underlying this treatment is to provide language input to the child that will foster the development of novel utterances. In each exchange, the SLP provides language data that the client must process and then create novel utterances. The authors suggest that this process helps the child develop more complex syntactic, morphological and phonological units that should culminate in improved language. Stories and other language-rich activities may be recycled to promote more complex language and new activities introduced during treatment. There are no set pass/fail criteria for treatment activities; consequently, generalization assessments are an important adjunct to measure the effectiveness of the treatment for the client’s sound system disorder.

6. Phonological Processing Approaches

Besides the linguistic approaches discussed, there are also treatment programs that target phonological processes (Dean, Howell, Waters, & Reid, 1995; Hodson, 1989; Prezas & Hodson, 2010). Some classify the treatment of processes as a phonemic approach, while others argue that it is simply a labeling of client’s errors in different terminology (Bernthal et. al, 2009). That is, phonological process analysis is a descriptive approach that does not identify whether the process is phonetic or phonemic-based. Kamhi (2005) suggests that a causal explanation from a phonological process rationale is not possible, since this type of analysis does not differentiate between errors, which may be phonetic or phonemic-based. The phonological process approach targets processes or patterns that the child uses on a consistent basis. Treatment of a process is proposed to effect generalization across a wide class of sounds that are affected by the process. Advocates of phonological process treatment suggest that processes which most interfere with intelligibility should be early goals of therapy.
The description of processes may differ due to the specific framework but process errors may be classified under three primary categories that include syllable structure processes, features contrast processes and harmony or assimilation processes (Bernthal et. al., 2009). Syllable structure processes are operations that alter the composition of a word or syllable, whereas feature contrasts are substitutions of place and/or manner features. Finally, harmony or assimilation is a context sensitive or coarticulatory change in word or syllable structure. One segment influences the change of another segment, so that there is phonetic symmetry. A listing of common processes by category is presented for the reader.

**Syllable structure processes:** deletion of final consonants, glottal replacement, weak syllable deletion, and cluster reduction.

**Feature contrast processes:** stopping, affrication, gliding of fricatives, fronting, and denasalization.

**Harmony or assimilation processes:** prevocalic voicing, final consonant devoicing, velar assimilation, labial assimilation, alveolar assimilation.

### 6A. A Cycles Approach to the Treatment of Phonological Processes

This treatment was formulated by Hodson and her associates and has been very popular for children with severe sound system disorders (Hodson, 1989; Hodson & Paden, 1983; Prezas & Hodson, 2010). The underlying principle is that cycles are used to develop patterns of intelligible speech. Cycles are time periods, which are used to remediate phonological processes or patterns in succession. The authors suggest that the treatment cycles more closely approximate normal phonological acquisition than traditional treatment approaches, because it is a gradual process that is somewhat specific among clients. Phonemes within targeted patterns are practiced to achieve acquisition of a particular pattern. Hodson (1989) indicates that the treatment facilitates the formation of new auditory and kinesthetic images that lead to improved client self-monitoring; the purpose is not to establish a motor pattern.

It is recommended that a phoneme within a pattern be treated individually for at least 60 minutes in a cycle, prior to treating another phoneme of the same pattern. When all phonemes on that pattern are treated, another phonological pattern is introduced. Only one phonological pattern is covered during a single session, thereby enabling the client to focus on the major treatment pattern. At least two hours is allotted for a pattern per cycle. The cycle could be anywhere from 5 to 16 weeks in length depending on the number of patterns or processes which require treatment. The first cycle is to establish productive control of a pattern. After all patterns have been targeted in a cycle, a new cycle is introduced. In succeeding cycles, the child further stabilizes the patterns, and transfer activities to other speaking contexts are utilized. Usually 3 to 6 cycles are employed for a client.

The ordering of the patterns depends on the stimulability of the child. That is, the stimulable targets are chosen first for training, so that the client will experience initial
success with the treatment. Hodson (1989) indicates that there are primary patterns that should be treated first to assist the client in improving intelligibility. After acquisition of the primary patterns, intervention is directed to secondary targets. A listing of the targets is presented in Figure 8. Primary targets are early goals of treatment, since they have a significant affect on the client’s intelligibility. Secondary targets are introduced after the client has suppressed the primary targets; however, the authors indicate that treatment of secondary patterns is frequently unnecessary for preschool clients, because they exhibit significant phonological generalization. If treatment is necessary for secondary patterns, Hodson recommends that minimal pairs be used. There are also advanced target patterns that some clients in the elementary years may exhibit such as the production of multisyllabic words. Treatment may be directed to this pattern by noting problematic words and helping the client breakdown and then combine the segmental components of the problem words, which is a phonotactic skill. Finally, Hodson recommends that there are some patterns that should not be considered as primary targets in the cycles approach. These include treatment of voiced final obstruent sounds, postvocalic/syllabic /l/, weak syllable deletion and the lingua-dental fricatives /θ, δ/.

Figure 8. Phonological patterns that may be targeted in the cycles treatment program (Hodson, 1989).

Primary Targets-Stimulable Sounds

1. Syllable structure: Treat syllable structure patterns if client can’t sequence syllables (e. g., baseball, chimney). Treatment is directed to syllable combinations, not exact consonant productions.
2. Prevocalic singleton consonants: Treat initial consonant deletions, if early appearing nasals /m, n/, stops /p, b, t, d/, and the labio-palatal glide /w/ are deleted.
3. Postvocalic singleton consonants: Treat postvocalic consonant deletions if voiceless stops /p, t, k/ and/or nasals /m, n/ are deleted.
4. Additional word structures: Treat cvc (e. g., boat) and vcv (e. g., abby) if problematic for the client. The same consonant configuration may facilitate cvc combinations (e. g., babe).
5. Fronting/Backing: Treat velar stops /k, g/ if substituted by alveolar stops /t, d/, or treat alveolar stops is substituted by velar stops.
6. /s/ clusters: Treat /s/ clusters if missing. /s/ clusters should be treated before singleton /s/ in cases of substitution of /t/ for /s/.
7. Liquids /r, l/: The liquids should be stimulated during each cycle if not used by the client.

Secondary Targets
1. Prevocalic voicing: Voice onset time (VOT) associated with prevocalic voiceless stops is problematic (e.g., dough for toe).
2. Vowel neutralization: The neutral vowel is used place of other vowels (e.g., putt for pat, peat, etc.)
3. Assimilation: Context sensitive pattern errors (e.g. men for pen).
4. Idiosyncratic patterns: Pattern errors that are reflective of the individual client.

1. **Cycles treatment session.** The first step in a treatment session is generally a review of the target items that were used during the previous session (Hodson, 1989). For example, if the client was working on the stopping of fricatives pattern, she/he reviews the practice item pictures from the last session and is introduced to new practice items for this session. Each item is presented via picture and the client produces the items individually. Feedback regarding response accuracy is given by the clinician. If a new pattern is being introduced, the previous practice items from a different pattern will not be reviewed. They may be saved and used with other practice items during a later cycle.

2. The second step is an auditory perceptual step that is known as auditory bombardment. The practice items for the session are presented to the child through mild amplification. The list of items consists of about 10 to 12 practice words. The child is asked to listen, while the clinician presents the items for a short period of time. The clinician also simulates the error pattern and contrasts it with the intended target during the auditory bombardment. After the auditory bombardment has been completed, the clinician may request that the client produce one or two potential target items into the microphone of the amplifier. The target items are not from the list of 10-12 practice words, but rather items that may be introduced in another session.

3. The client is engaged in a creative activity during the third step. She/he draws, colors, or pastes three to five pictures on index cards that have been selected by the clinician. The items are examples of the pattern that is undergoing treatment. The client produces each item before creating the picture, so that the SLP may evaluate the item and determine if it is suitable for inclusion as a treatment item. The SLP prints the name of each picture on the index cards so that others such as parents may be able to identify the items.

4. After the picture preparation has been completed, the client is introduced to more concentrated production practice through experiential-play activities. Such activity is designed to motivate the client, provide a more natural context for speech, and permit the clinician to cue the client when targets are produced incorrectly. The monitoring of training trials through charting and graphing performance is not recommended, because the author feels that such activity interferes with the naturalness of the experiential-play activities. This step generally requires the largest amount of time within a treatment session.
The clinician needs to select games and activities that are appealing to the client and provide avenues for the production of target items that were introduced previously. For example, a board game that requires the production of target items can be employed. The experiential-play activities can be varied and more than one activity may be employed in a session. It is important that models and other cues be given to facilitate success on eliminating the target pattern. Models and cues help the client to attain correct production, thus eliminating the target pattern. This step is crucial to the success of the treatment regimen. The clinician should also provide opportunities for the client to engage in conversation, so that phonological patterns can be monitored for use in spontaneous contexts.

Hodson cautions that practice words should be chosen carefully, particularly during early cycles to ensure success. Nominals and action words can easily be incorporated in activity themes or games. Initially, monosyllables with facilitative phonetic contexts (Kent, 1982) should be selected. Words with phonemes at the same place of articulation as the pattern substitution should not be employed during early cycles. Words that may trigger assimilation effects should also be avoided.

5. Stimulability probes are conducted following experiential-play to identify target patterns for the next session. For example, if /s/ as part of stopping for fricatives is the next target phoneme of pattern suppression, the clinician would select a group of /s/ words to be used for probing. The child would be asked to watch and listen and then try to say each individual word. Those /s/ words found to be stimulable serve as practice items for the next session.

6. Introduce phonological awareness activities that are geared to the needs of the client.

7. The auditory bombardment employed in step 2 is repeated with the same word items that were used.

8. The child’s caregiver or a school assistant conducts short daily practice sessions with the client. The caregiver reads the list of words that were used in auditory bombardment treatment, and the client identifies pictures of the production-practice word items.

The cycles approach is a very popular approach, because it can be used with clients who have severe intelligibility problems. The additional feature is the sequencing of treatment cycles in order that multiple targets may first be acquired and then stabilized in succeeding cycles, if necessary. Decisions regarding the completion of treatment goals and the introduction of new treatment goals are based on clinical judgment.

7. Hybrid Approaches
7A. Representation-Based Approach

This treatment was formulated by Rvachew (2005) and has components of auditory perception, phonetic practice and phonemic contrast in the treatment of clients with sound system disorders. Since these features reflect a combination of different program elements, I classify the treatment advocated by Rvachew as a hybrid approach. The first phase of the treatment is one of phonemic perception and stimulability training. The perceptual/phonetic production phase is followed by a phonemic phase of minimal pair contrast using words and short phrases. Finally, the third phase is one that involves phonetic practice of the target (s) in sentences, spontaneous conversation and narratives.

1. Phoneme Perception and Phonetic Training. The author indicates that children with speech sound disorders frequently present with problems of categorical perception of fine grained phonemic contrasts as found with liquid and fricative speech sounds (Rvachew, 2005). Research by Rvachew and her associates suggest that a client’s errors of perception and production are symptomatic of a disparity between the client’s phonological knowledge and the adult organization of underlying phonological contrasts. To assist in the development of phoneme contrasts that are targeted for treatment, perception training is carried out utilizing a computer program, known as Speech Assessment and Interactive Learning System (SAILS; Avaaz Innovations, 1994). The program consists of different sections that target speech sounds frequently misarticulated by young clients. The target sound is embedded in the pre or postvocalic position of a word, and the number of target exemplars range from 10-30 tokens. The stimuli were audio recorded from adults and children to provide the listener with different exemplars of the word. The stimuli include variations along a continuum of correct to incorrect productions and are designed to aid the client in discriminating variants in the appropriate phonemic category from those productions that are not in the phonemic category. The author does not set a specific response accuracy criterion, but recommends that the child be able to identify correct/incorrect tokens at a high accuracy level before terminating perceptual treatment.

The second part of this phase is the introduction of stimulability teaching with the intended target (s) (Miccio, 2005; Miccio & Williams, 2010). If necessary, Rachew (2005) indicates that general sound elicitation techniques such as sound stimulation, phonetic placement, and shaping be used to develop correct production of the target (Secord, 1981a). The author recommends that the initial phase of treatment be terminated when the client achieves 80-90% correct imitative control of the target sound (s) at the syllable or word level in a variety of phonetic contexts.

2. Phonemic Treatment with Minimal Pairs. Phonemic contrasts are introduced during this phase using procedures similar to those described in the Minimal Pairs section. The author indicates that this part of the treatment should not require much time, if the client has successfully completed the initial phase and achieved high accuracy levels in
perceptual identification and imitative practice. Rachew indicates that most children pass through this stage very quickly reaching response accuracy levels of 80% and above for daily treatment sessions; however, there are a few exceptions that she identifies. For example, clients who tend to overgeneralize and use the target sound in place of the nonerror pair “run-one” → “run-run”, and in the case of clients who develop the contrast but the new sound production is distorted. In both cases the author combines both the first and second treatment phases for some of the subsequent treatment sessions. Clients are re-introduced to the perceptual training and stimulability teaching in combination with the minimal pair contrasts.

3. **Phonetic Transfer.** The final phase is a practice phase that incorporates the target (s) in sentence, conversation and different forms of narration. The client is restructuring the underlying representations of those lexical items that contain the target (s) phoneme. The restructuring is achieved by varied practice in the spontaneous contexts discussed. Rachew advocates the use of varied activities, in order that the child has numerous opportunities to use new sounds. Books, art activities, creating written or picture narratives, and the use of computer software are examples of contexts for treatment. The client should be exposed to a variety of activities that require the use of new targets across different lexical items. This phase can also be a time in which the SLP attends to any morphosyntax errors displayed by the client. In addition, phonological awareness activities may also be introduced in the therapy milieu.

Rachew indicates that the monitoring of training trials and generalization testing are also important components of the treatment. The clinician needs these data to make decisions concerning the completion of a phase and introduction of a new phase. The client’s performance data is also used to determine when therapy should be terminated and periodic monitoring instituted. A study conducted by Mckercher, McFarlane, & Schneider (1995) is cited by Rachew as providing guidelines for dismissal from treatment. Their data suggest that clients who achieve a word accuracy level of 75% or better on a generalization measure may be dismissed from treatment and need only to be monitored periodically.

7B. **Collaborative Treatment Approach**

Bowen and Cupples (1999, 2004) and Bowen (2015) present a treatment for sound system disorders that I also classify as a hybrid approach. It is a broad-based approach that consists of components similar to other treatments, but it also includes caregiver roles, phonological awareness, and the block scheduling of treatment sessions. The elements of their treatment include: (1) family education, (2) metalinguistic treatment, (3) phonetic production practice, (4) minimal pair contrast and auditory bombardment, and (5) home practice. It is a comprehensive approach to treatment that is based on the premise that clients with phonological disorders need to be directed on the path of normal development with caregivers directly involved in the process. Moreover, normal phonological acquisition is acquired gradually, and it is individual to each child. The
authors indicate that the treatment differs from other treatments in terms of three key factors. First, it includes an educational module for caregivers, which is presented in an innovative manner. Second, it uses block scheduling, so that clients alternate between treatment and treatment breaks. Third, the employ of the five intervention components in the manner to be described generates a unique treatment approach. Additional information is available in Bowen (2015).

1. **Family Education and Involvement.** Bowen and Cupples (1999) indicate that well-informed caregivers play an important role in the treatment of their children. Initially, caregivers need information concerning their child’s sound system disorder and that information consists of both verbal discussion and written information. What is the problem? How does it impact on the client’s ability to be understood by others? What will be done in treatment? Will I be involved in my child’s therapy? What do I need to do to help my child? Bowen (1998) prepared an informational booklet for parents. The information in the pamphlet includes: (1) a definition of sound system disorders within a developmental perspective of sound acquisition, (2) a discussion of the assessment and treatment process, (3) a list of questions frequently asked by parents, and (4) intervention techniques such as modeling and promoting self-monitoring are discussed along with the role that these facilitation techniques play in parental involvement.

   The authors stress that the initial contact with the client’s caregiver is very important in forming a successful bond between the caregiver and SLP. Parents are generally in an information-seeking role and need to understand the nature of their child’s sound system problem. During the early stages of treatment, they will observe portions of the treatment session in order to understand what is being done with their child. It is also an informal introduction to what they may do with their child in home practice sessions. After each session, some of the intervention activities are sent home with the client, so that the parents can conduct home practice.

2. **Phonological Awareness Tasks.** The authors feel that it is important that the client develop self-monitoring skills and the development of these skills is facilitated through the employ of various phonological awareness tasks. The use of phonological awareness tasks furnishes opportunities for the client, SLP, and caregivers to engage in language introspection. The client can experiment with her/his language in ways that help them to learn about their language with an emphasis of the phonological component. The different activities range from sound recognition and discrimination of target sounds to incorporating targets in various morphophonemic alterations. Please refer to the initial part of this handout for further information regarding phonological and phonemic awareness.

   SLPs should note that phonological awareness develops on a continuum that begins with the child’s awareness of words, then syllables, and finally an awareness of phonemes. Justice and Schuele (2004) indicate that word and syllable awareness are
acquired initially and represent shallow levels of awareness; however, phoneme awareness represents a deep or high level of phonological awareness. Word awareness begins as the young child becomes sensitive to rhyme and alliteration. Words are distinct units that are subject to introspective phonological analysis. Syllable awareness includes an awareness that multisyllable words contain syllable combinations, and that the syllable is composed of phonemic units. In English, syllable structure can be identified in terms of onset-rime patterns. Onset is the consonant or cluster combination that occurs before the vowel in the word, while rime is the vowel nucleus and those consonants after the vowel. For example, the onset of the word “spot” is “sp” and the rime is “ot.”

3. Phonetic Production Skills. Bowen and Cupples acknowledge that some clients need phonetic production training as part of their treatment. From their perspective, clients with severe sound system disorders may need phonetic training early in treatment to assist in expanding their limited inventories. Conversely, they also recommend phonetic training for clients with mild impairments, as it may be sufficient to trigger the formation of expected phonological patterns. Phonetic placement techniques and sound stimulation are typically used to establish production at the isolation or syllable level depending on the target sound or sounds. Additional phonetic practice with word units is employed but limited, because the authors feel that expanded phonetic practice may be detrimental to phonemic development. Most of their clients receive direct treatment to establish phonetic production of target sounds, and approximately 50% engage in limited phonetic production at word or other levels of practice in conjunction with phonological awareness tasks. The remaining 50% participate in phonetic drill activities prior to participating in phonemic treatment activities.

4. Multiple Exemplar Training. This step in the intervention regimen combines minimal pair contrast and auditory perceptual stimulation as the phonemic portion of the treatment. The authors suggest that the auditory perceptual stimulation is similar to the auditory bombardment advocated by Hodson and Paden (1983) but no amplification is employed. Minimal contrasts are introduced in the context of drill play activities and initially modeled for the client, until they can respond spontaneously to the picture stimuli. Pictures with the printed word are typically used as stimulus items and approximately 3 to 9 training pairs are used. The drill activities vary and some examples include:

A. The client is instructed to point to the picture produced by the SLP. The minimal pairs are presented individually in random order. For instance, “Point to big, point to cub, point to cup, point to pig.”

B. The clinician instructs the client to produce a target word, and the SLP responds by giving the client the picture of the target item. If the child produces an incorrect target, she/he is given that item to create a communication mismatch or what Weiner (1981) refers to as homonymy confrontation.

C. The clinician and client exchange roles in this therapy activity. The clinician
produces a target item while pointing to the picture, and the client must judge the correctness of the item. The clinician may correctly produce the target or the other minimal pair, so that the client must monitor carefully the SLP’s productions.

The auditory stimulation activities are employed to provide experience with a particular target in an explicit word position, specific phonetic feature, or minimal contrast word pairs. For example, a list of 10 to 15 words that feature /f/ in the initial word position or minimal pairs that contrast the omission of final consonants can be assembled. The list may be composed of familiar or unfamiliar words and is presented from one to three times per session. The client is instructed to listen carefully, while the SLP produces the words.

The components of the treatment are not employed for a specific amount of time and can vary in terms of order, but a typical intervention session may consist of the following activities:

A. Auditory stimulation of the minimal pair contrasts.
B. Minimal pair contrast activities.
   a. Client produces different minimal treatment pairs.
   b. Client judges the accuracy of the clinician’s productions in a homonymy confrontation task.
C. Introduce phonetic treatment for a target the will be introduced at a later treatment session.
D. A phonological awareness activity is introduced. The client and clinician view minimal pair pictures that will be the focus of the next therapy session. The clinician produces each item for the child and prints the word on each picture.
E. Auditory stimulation is carried out again.
F. The parent is given a short summary of the session.
G. Home treatment activities are discussed prior to the parent using them.

5. **Home Treatment.** Home treatment provided by caregivers is the final and an equally important element of the overall home program. Although most treatments discuss the utilization of caregivers, Bowen and Cupples (1999, 2004) have included caregiver participation as a major element in the treatment process. They feel that active participation in the treatment process has many advantages such as facilitating generalization, demonstrating positive outcomes of treatment, and promoting client/parent interactions in the absence of the clinician. Moreover, the National Outcome Measurement System (NOMS) has identified the advantage of home treatment conducted by caregivers with their children.

The authors recommend that home practice be carried out approximately five to six days per week. Parent-child practice sessions should be carried out one to three times per day for about five to seven minutes. Home practice activities consist of perceptual
training, production practice, and phonological awareness tasks with an emphasis on perceptual training and awareness tasks. Although caregivers may want to emphasize production tasks, the authors feel that auditory perceptual training and awareness tasks should be given priority. The SLP prepares a homework book for the client that contains an outline of home activities for each week. These are reviewed by the SLP and caregiver prior to enactment at home in order that the caregiver understands the nature of the tasks and their requirements. This is also done to train the caregiver in the technical aspects of the home treatment such as presentation of stimuli, evaluation of stimuli, providing appropriate feedback, and collecting data. The components of the parent program are as follows:

A. Parent education. Parents are introduced to teaching techniques such as modeling, recasting, and feedback strategies that they will use with their child.

B. Metalinguistic training. The SLP, client, and parent participate in games and activities that present different variations of phonemic introspection that the parent can employ in home practice.

C. Phonetic production training. The client is taught the phonetic components of the phoneme by the SLP. The parent conducts home practice in both the perception and production of the therapy target(s).

D. Multiple exemplar training. The parent carries out contrastive production training and conceptual training in a variety of play activities.

E. Homework. The parent carries out treatment activities in the home as directed by the SLP. The homework supplements the treatment activities that were completed during the client’s previous treatment session.

The schedule of home intervention activities is similar to that conducted by the SLP, but the activities will be of shorter duration due to time allocation constraints. Furthermore, treatment is provided in 10-week training and vacation blocks. Clients receive direct treatment for approximately 10 weeks and are then dismissed for about 10 weeks. When starting a new training block, a review of the client’s phonological status is conducted to plan the current 10-week treatment segment.

Ancillary Activities

Emerging Literacy and Literacy Development

This is just a short summary on reading and overall literacy that is based primarily on the work of Justice (2006) and others (Catts et al, 2001). Justice describes in detail the general process for teaching reading, remediating reading problems, and the potential roles of the SLP in this process. This coexisting problem has been discussed in the Assessment section, but it is important to remember that children with speech and/or language impairment frequently exhibit problems in the acquisition of reading and other forms of literacy. Moreover, it is often the case that the SLP sees these children for assessment/treatment before the advent of formal reading instruction.
One methodology that is employed for evaluating instruction in the public schools is Response to Intervention. RTI is a multi-tiered approach for the provision of assessment and treatment services to normal learners and at risk learners at increasing levels of intensity. The components of RTI include: universal screening, high-quality instruction and interventions matched to student need, frequent progress monitoring, and the use of child response data to make educational decisions. RTI is used for making decisions about general, compensatory, and special education, and creating a well-integrated and comprehensive system of intervention using child outcome data (Ehren, 2009).

In applying RTI to reading, it is usual that most children receive their reading instruction in the context of the classroom and the SLP can play an important role in both consulting and collaborating with the classroom teacher. Classroom instruction will emphasize different components as a function of the child’s grade. Prekindergarten and kindergarten children receive instruction in: alphabet knowledge, print knowledge, phonological awareness, language comprehension and vocabulary. It is also assumed that the instruction will be in a stimulating environment that exposes the child to a variety of literacy activities such as print displays, books, alphabet displays, different learning centers and a variety of instructional modes such as group and individual reading and writing instruction. First and second grade children engage in phonemic awareness, phonics, reading comprehension, vocabulary development and reading fluency also within a literacy rich environment.

Children who experience difficulties in the acquisition of reading skills during the emergent literacy stage are generally targeted for additional reading and literacy instruction. This group of children will more than likely contain a number of clients with speech and language impairment. Without additional instruction, these children will continue to have problems in the area of reading. Preschoolers in the emergent literacy stage requiring additional assistance typically receive supplemental instruction in alphabet knowledge, print knowledge, vocabulary, and phonological awareness. Please see Figure 3 for a summary as presented in Justice (2006).

Alphabet knowledge is also referred to as letter knowledge and is the child’s knowledge of the individual letters of the alphabet. Alphabet knowledge is an important early skill that helps the child later to decode words. A child’s knowledge of the orthography of written language is known as print knowledge. As children are exposed to different print entities such as letters, words, punctuation, etc., they begin to decode words and higher level language units that may vary from individual words to sentences. Vocabulary is a reflection of the child’s word knowledge, which is important for the child’s reading comprehension. A child needs to build a reading vocabulary to be a successful reader. Finally, phonological awareness is the child’s ability to reflect on various language units that are part of spoken language. Phonological awareness skills develop on a continuum beginning with words and progressing to the analysis of individual phonemic units. Currently, there are not strong data to support what level a child must achieve to be successful in reading or what tasks should be carried out with
the child. However, Justice (2006) indicates that phonological awareness skills are important in the acquisition of reading competency. In addition, keep in mind that there is no significant correlation between severity of the speech sound disorder and phonological awareness skills. Please see Figure 4 for a summary of phonological awareness skills.

Children who are beginning readers and experience problems typically receive enhanced instruction that emphasizes phonemic awareness, phonics, fluency, vocabulary, and reading comprehension. Phonemic awareness is a component of phonological awareness and pertains to the child’s internal analysis of various units within syllables and words. Phonics is the child’s knowledge of the correspondence between letters and sounds. That is, it is the ability of the child to associate a letter with a sound. Successful readers read materials in an automatic and competent manner, which is known as fluency. This is a skill that is targeted in enhanced instruction. Word vocabulary items are introduced, so that the child can map those words into their oral vocabularies. Finally, children receive instruction in expanding their reading comprehension abilities; they are taught strategies to comprehend different textual materials.

**Figure 3.** A summary of reading activities by grade for children needing additional reading instruction.

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>PreK</td>
<td>1. Name writing  2. Alphabet knowledge  3. Storybook reading</td>
</tr>
<tr>
<td></td>
<td>4. Phonological awareness  5. Journal writing</td>
</tr>
<tr>
<td>Kindergarten</td>
<td>1. Print concepts and awareness  2. Alphabet knowledge</td>
</tr>
<tr>
<td></td>
<td>3. Phonological awareness  4. Letter to sound mapping</td>
</tr>
<tr>
<td></td>
<td>5. Sight word activity  6. Guided reading</td>
</tr>
<tr>
<td>First Grade</td>
<td>1. Letter-sound recognition  2. Decoding activity  3. Sight word activity</td>
</tr>
<tr>
<td></td>
<td>4. Short story reading  5. Partner activity</td>
</tr>
<tr>
<td>Second Grade</td>
<td>1. Reading fluency activity  2. Phonemic awareness  3. Reading comprehension</td>
</tr>
<tr>
<td></td>
<td>4. Phonics activity  5. Writing</td>
</tr>
</tbody>
</table>

It should also be noted that there are some environmental and familial risk factors that may be associated with children who may have coexisting communication and literacy problems. For example, the presence of attention-deficit disorder, behavior, and/or conduct problems may be associated with poorer performance on literacy tasks. In addition, familial factors such as limited English proficiency, low-income, lack of education and a family history of reading problems are additional risk factors that the SLP needs to consider.
Figure 4. *A summary of phonological awareness skills by chronological age.*

<table>
<thead>
<tr>
<th>Phonological Awareness Skill</th>
<th>Estimated Age of Development</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Awareness of Words.</strong></td>
<td></td>
</tr>
<tr>
<td>A. Awareness of Rhyme.</td>
<td>Emerges between 2 and 3 years of age. Begins to emerge at 3 and continues refinement up to age 5.</td>
</tr>
<tr>
<td>Can recite different rhymes. (Rain, rain go away)</td>
<td></td>
</tr>
<tr>
<td>Can rhyme by sound pattern (Rat, hat, mat)</td>
<td></td>
</tr>
<tr>
<td>B. Awareness of Alliteration</td>
<td>Emerges at 3 years of age and continues refinement up to age 5.</td>
</tr>
<tr>
<td>Can identify words starting with same sound. (Two, tea, time)</td>
<td></td>
</tr>
<tr>
<td><strong>2. Awareness of Syllables</strong></td>
<td>Acquired between 4 and 5 years of age.</td>
</tr>
<tr>
<td>Can segment syllables. (base ball)</td>
<td></td>
</tr>
<tr>
<td>By 5 can count syllables in words</td>
<td></td>
</tr>
<tr>
<td><strong>3. Awareness of Phonemes.</strong></td>
<td>Emerges between 6 to 7 years of age.</td>
</tr>
<tr>
<td>Match initial consonants in words</td>
<td></td>
</tr>
<tr>
<td>(Soup and say both begin with /s/)</td>
<td></td>
</tr>
<tr>
<td>Identify the number of speech sounds in a word. (Bat has 3 sounds.)</td>
<td></td>
</tr>
<tr>
<td><strong>4. Phonemic Analysis and Synthesis.</strong></td>
<td>Begins to emerge at 6 and continues refinement up to age 10.</td>
</tr>
<tr>
<td>Blend 2 to 3 speech sounds to form words. (h a t makes the word hat)</td>
<td></td>
</tr>
<tr>
<td>Segment words by onset and rime Pattern (Treat into tr eat)</td>
<td></td>
</tr>
<tr>
<td>Segment 3 to 4 speech sounds in a word (soap segments to s oa p)</td>
<td></td>
</tr>
<tr>
<td>Delete speech sounds in words (Take h from hat and it is at)</td>
<td></td>
</tr>
<tr>
<td>Develop phonetic spelling</td>
<td></td>
</tr>
</tbody>
</table>
What is the role of the SLP for children with speech/language impairments and coexisting literacy issues? In terms of treatment consideration, if a client is identified with a coexisting literacy problem, the SLP should provide intervention that includes language-based literacy treatment including phonological awareness (Justice & Schuele, 2004). Literacy activities such as vocabulary development, syntax, pragmatics and other area of treatment should be carried out by the SLP and coordinated with the classroom teacher. Some summary information will be provided regarding treatment for the SLP and the types of activities that may be implemented. For more in depth information, the reader is referred to the following websites: http://www.asha.org/policy/GL2001-00062.htm#sec1.8.1 and http://www.asha.org/policy/GL2001-00062.htm#sec1.8.2

Phonological Awareness

Some examples of phonological awareness activities, which were developed by Bowen and Cupples (1999), which can be incorporated into treatment include the following:

A. **Metaphonetic activities.** These are introductory activities that are designed to introduce the client to treatment targets. For example, the SLP might describe the phonetic production characteristics of the sound and make the sound while instructing the client to watch and listen. Another task might have the client listen to words produced by the SLP, and then the client identifies those words that contain the target sound. Another task would be to have the child engage in the identification task and include the written word, so that she/he points to the word with the orthographic representation. Finally, the client is presented with correct and incorrect tokens produced by the SLP, and she/he must discriminate correct versus incorrect productions.

B. **Phoneme-grapheme relationships.** Clients are taught the similarities and differences between phonemes and their graphic counterparts. The phoneme /p/ corresponds to the grapheme “p”, while /s/ corresponds to written “s” and written “s” may also be produced as /z/ in phonologically conditioned morphemes such as “pigs.” The SLP may use an alphabet chart to illustrate the target sound, and its incorporation in practice words. Other activities may include labeling pictures of practice materials and having the client underline the target sound, or assist children in creating stories that contain words with the target sound. Another task might involve the presentation of pictures and the selection and sorting of pictures by initial consonant without any verbalizations. It is done without verbal cues to allow the client to sort items by tapping internal representations.

C. **Onset phoneme segmentation matching.** Clients are engaged in activities that require the identification and selection of a phoneme that is in the initial position of words. For example, they may be introduced to the target phoneme /r/ and would need to select those words that contain /r/ in the initial word
position. Choices would include the target words and foils. Following identification, the client produces the word containing the target sound. Another task might involve the presentation of pictures with and without the target sound and the selection and sorting of pictures by initial consonant.

D. Rhyme and alliteration awareness. The clinician exposes the child to rhyme awareness through the use of different word rhymes and different alliteration patterns. Alliteration is the awareness of phoneme commonalities across two words. A word pair such as “pat-peach” share a common sound in the initial word position. Books and various clinician-generated materials may serve as a source for presenting rhyming activities such as Jack and Jill.

E. Improving the awareness of words in context. Phrase and sentence level practice materials may also be used for awareness purposes. The SLP can have the clients point to individual written words in practice materials to build an awareness of spoken words and their written form, and that there are boundaries between written and spoken words.

F. Phonemic analysis and synthesis. The development of analysis and synthesis skills enable the child to segment (analysis) words into their phonemic components and syllables and construct syllables and words from a given phoneme sequence (synthesis). During therapy production activities, SLPs can engage in analysis and synthesis tasks with clients. For instance, the SLP might segment a practice word and discuss the position of the target within the word, or she/he may blend the phonemic segments and emphasize the target sound.

Summary Facts

This summary information is from Hesketh (2010) regarding phonological awareness and indicates the following:

Phonological awareness and especially phonemic awareness are important skills in the development of emergent literacy.

Clients who present with speech sound disorders are more likely to have poorer phonological awareness skills than matched normals.

Clients with speech sound disorders are at higher risk for literacy problems, particularly if they have coexisting language impairment.

Some clients with speech sound disorders develop appropriate phonological awareness skills and these clients have a good prognosis for literacy development.

Information regarding the role of phonological awareness in speech acquisition and development is lacking at this time.
Teaching clients phonological awareness skills frequently leads to improved awareness skills and improved literacy.

Introductory phonemic awareness skills such as awareness and identification of individual speech sounds may be taught to preschool clients.

Integrating phonological awareness activities into treatment can lead to improved literacy skills and does not interfere with production-based components of treatment.

**General Emerging Literacy Activities**

Some suggestions for ancillary activities related to literacy for early elementary students are summarized below. The use of, frequency of and role of the SLP in these types of activities will depend on the policies of the specific educational entity:

**Work in collaboration with other educators to develop curriculum-relevant individualized intervention programs** for targeting specific components of reading and writing that individual clients are deficient.

**Work in collaboration with other educators to provide curriculum-relevant individualized plans.** The content and contexts of treatment are based on curricular content of the child's preschool or grade school. Activities such as individualized work in the classroom or adapting curricular goals into speech and language goals in therapy are examples.

Work in collaboration with other educators to modify the child’s educational curriculum and instruction for the purpose of improving student access to and success in the general education curriculum by implementing different collaborative strategies.

The SLP should keep in mind the following for early elementary school students:

Phonological awareness treatment has the strongest influence on reading when paired with formal instruction on alphabetic principles and their role in decoding and spelling words.

Decoding activities should not be used alone but in combination with fluency-building activities (e.g., assisted repeated readings, increasing time spent in reading).

Spelling difficulties may be found in many children, despite improvement in other areas of literacy, such as reading comprehension. Consequently, spelling should be an early treatment goal that continues and is integrated in reading and writing intervention at the discourse level.
Knowledge of text structure is an important skill in listening, reading, writing, and formulation of literate spoken discourse. Some students need to be taught to identify text structures and linguistic cohesion devices. Improvement in these skills may aid students in improving their reading comprehension and written discourse structures, and vice versa. Beginning with activities that build awareness of rhyme and other syllable-level sound structures first, and then add more complex treatment tasks.

Some suggestions for incorporating various activities in treatment include the following:

Introducing activities, which require comparison of phonemes in groups of words, such as identifying whether two words begin or end with the identical sound.

Progress to activities that require more specific levels of phonological awareness, such as teaching children to identify the number of sounds in a particular word. Additional activities directed at teaching segmentation of words into phonemes and blending phonemes into words to aid in improving word decoding and spelling of words with various grapho-phonemic patterns.

Providing opportunities for the children to engage in emergent writing in addition to emergent reading.

The SLP should keep in mind the following for older elementary and secondary school students:

Treatment needs to be balanced, so that deficient skills in phonemic awareness and sound-symbol associations are addressed, as are potential deficiencies in skills involving higher-level language uses. Developmentally, the skill set for older students includes production and comprehension of spoken and written language used in middle school and high school lectures and print materials. Other needs such as the comprehension of figurative language forms that are used in peer group interactions such as humor, sarcasm and slang and the implementation of metacognitive strategies requisite for comprehending the abstract meanings of literate language may be goals that are pursued.

The literate lexicon of the older school-age client includes acquiring the vocabulary of the school curriculum across the different content areas of mathematics, social studies, and science.

Written and spoken language used by older students consists of increasing complexity at phrase, clause, and sentence levels. For example, written language information is elaborated into noun phrases with increased modification before and after the noun. Verb phrase segments expand to include modal auxiliaries and aspect markers. Clauses become more complex with optional adverbial elements, and sentences more
frequently contain two or more clauses serving in coordinate and/or subordinate function.

**References**


NOMS http://professional.asha.org/resources/NOMS/treatment_outcomes.cfm


LESSON PLAN EXAMPLES

Sample Lesson Plans

**Hypothetical Case:** T. M. is a 5-year-old male with a severe speech sound disorder and a significant problem with intelligibility. His PCC-r was computed to be 42%. He is currently receiving treatment for the first time. The youngster has a preference for using the bilabial and lingua-alveolar stops in place of a number of other speech sounds that include the affricates and some of the fricatives. The /r, l/ are replaced by /w/. He is not stimulable for the affricates or missing fricatives. The youngster passed a hearing screening and has no past history of hearing loss. Oral structure and function were judged to be WNL. Phonological processing testing indicated below average performance of awareness tasks in the areas of rhyme, alliteration, and syllable awareness. Intellectual skills were found to be in the normal range. Academic performance in kindergarten was in the range of below average to date.

**Phonetic Inventory**

Nasals: /m, n, η /
Glides and Liquids: /j, w/
Affricates: /ʊə/ Affricates: /ɸ/ Fricatives: /f, v, h/ Stops: /p, b, t, d/

**Phonemic Inventory**

Nasals: /m, n, η /
Glides and Liquids: /j, w/
Affricates: /ɸ/ Fricatives: /f, v, h/ Stops: /p, b, t, d/

**Treatment**

The SLP will implement the Stimulability Intervention program prior to initiating a phonemic treatment program.

**Beginning Therapy**

**Instructional Objective:** Client will produce the speech sounds /s, z, ʃ, tʃ/ in isolation.* Objective achievement is set at an accuracy rate of 80% for a block of 20 stimulus trials for each of the targeted sounds.
*/tʃ/ can only be produced in a vowel context.

1. Administer stimulability probe for the target sounds. The child is instructed to watch and listen while the SLP produces /s, z, ʃ, tʃ/ in isolation and paired with the /i/ vowel in the pre, inter and postvocalic word positions. (5 minutes).

2. The character cards for the targeted sounds are presented for the child as a review. The pictures are labeled with the graphic representation. Each picture along with an auditory model and hand movement is presented. The child is encouraged but is not required to imitate the different target sounds. After the presentation of the stimuli, each picture is presented again with three other pictures and the SLP points to the printed word and spells it for the child. The child is then asked to identify another word among three items that has the same beginning sound (i.e. Stimulus word sheep- dog, soup, shoe) (15 minutes).

3. Following the auditory/visual model, the child is encouraged to imitate the different sounds that are produced. As the child attends to the task, she/he is asked to watch and listen, then produce the target. Placement cues are also given when thought to be appropriate for the therapy context. After the treatment is completed, the stimulus pictures that contain the target sounds along with 5 randomly selected additional stimulus items are presented individually for the child via auditory/visual model. The SLP then produces a word with one of the target sounds in the prevocalic position and the child is to point to the stimulus card that contains the target sound. (25 minutes).

4. Following the treatment portion, a sound probe is administered. It consists of the following items that are administered to the child in imitative fashion (5-8 minutes):

Pop, Bob, tot, dad, Coke, gag, fife, Viv, sis, zazz, shush, Cheech, judge, mom, none, Lil, roar.

Intermediate Therapy Sessions

Instructional Objective: Client will produce the speech sounds /s, z, ʃ, tʃ/ in pre and postvocalic positions of syllables with the vowels /e, o/. Objective achievement is set at an accuracy rate of 80% for a block of 20 stimulus trials for each of the targeted sounds in the vowel contexts.

1. Administer stimulability probe for the target sounds. The child is instructed to watch and listen while the SLP produces /s, z, ʃ, tʃ/ in isolation and paired with the /u/ vowel in the pre, inter and postvocalic word positions. (5 minutes).

2. The character cards for the targeted sounds are presented for the child as a review. The pictures are labeled with the graphic representation. Each picture along with an
auditory model and hand movement is presented. The child is encouraged but is not required to imitate the different target sounds. (5 minutes).

3. Following the auditory/visual model, the child is encouraged to imitate the different sounds that are targeted in the two vowel contexts. As the child attends to the task, she/he is asked to watch and listen, then produce the target. Placement cues are also given when thought to be appropriate for the therapy context. After the treatment is completed, the stimulus pictures that contain the target sounds along with 5 randomly selected additional stimulus items are presented individually for the child via auditory/visual model. The SLP then engages in a rhyming game with the child. For example, our funny word is so, what rhymes with so? Yes, toe rhymes with so. Each stimulus item is presented twice for a total of 18 presentations (30 minutes).

4. Following the treatment portion, a sound probe is administered. It consists of the following items that are administered to the child in imitative fashion (5-8 minutes):

Pop, Bob, tot, dad, Coke, gag, fife, Viv, sis, zazz, shush, Cheech, judge, mom, none, Lil, roar.

**Sample Lesson Plans**

**Hypothetical Case:** T. M. is a 6-year-old female with a severe speech sound disorder and a significant problem with intelligibility. Her PCC-r was computed to be 53%. She is currently receiving treatment in her local school system. The youngster has a preference for final consonant deletion in place of a number of other speech sounds that include the affricates most of the fricative class. The youngster passed a hearing screening and has not past history of hearing loss. Oral structure and function were judged to be WNL. Phonological processing testing indicated below average performance of awareness tasks in the areas of syllable and phonemic awareness. Intellectual skills were found to be in the normal range. Academic performance in first grade was reported to be average.

**Phonetic Inventory**

Nasals: /m, n, ɳ /
Glides and Liquids: /l, r, j, w/
Affricates:/tʃ, dz/
Fricatives: /f, v, s, z, ʃ, Z, h/
Stops: /p, b, t, d, k, g/

**Phonemic Inventory**

Nasals: /m, n, ɳ /
Glides and Liquids: /l, r, j, w/
Affricates:/φ/
Fricatives: /f, v, h/
Stops: /p, b,/
Treatment
The SLP will implement the Multiple Opposition Intervention, since there is multiple phoneme collapse that involves deletion of the final consonant for fricatives /s, z, ʃ, ζ/, stops /t, d, k, ɡ/, and affricates /tʃ, dz/.

The targeted sounds are /t, s, tʃ/ and the target word item sets are: pea, Pete, piece, peach, and Lee, lease, leet, leech.

Beginning Therapy

*Instructional Objective:* Client will produce the speech sounds /t, s, tʃ/ in the practice words with imitative cueing. Objective achievement is set at an accuracy rate of 70% for two consecutive blocks of 20 stimulus trials for the targeted sounds.

1. The early sessions are directed to acquiring the phonological rule, presenting the treatment vocabulary and initial production of the sound contrasts. The initial or introductory part of the treatment contains three components. The first component is designed to present the rule that is being taught, the second is to introduce the vocabulary to be used, and the third is production of the sound contrasts.

   A. The first step is presentation of the phonological rule by contrasting what the child does with what they need to do. In this case, the final consonant deletion is presented as “whole words” versus part words. Each word is pictured with blocks below the picture. This visual anchor of small blocks is used to represent each sound and contrasted with a missing block to identify that a sound is missing. There is no completion criteria for this step (20 minutes).

   B. The second step is introduction of the vocabulary, so that the client is familiar with the pictures that represent the desired treatment contrasts. Each picture is presented and produced by the SLP. During the item presentation a short vocabulary description is presented and the child is asked to clap for each sound in each vocabulary item. There is no completion criteria for this step (20 minutes).

   C. The third and final step is actual production of the stimuli imitatively. The SLP provides an imitative model of the contrastive pairs “pea-peach”, while also providing the pictorial references. The client is required to produce the word pairs. Feedback is provided to the child concerning the accuracy of the productions (20 minutes).

Intermediate Therapy

*Instructional Objective:* Client will produce the speech sounds /t, s, tʃ/ in the practice words. Objective achievement is set at an accuracy rate of 80% for a practice period of 30 minutes.
The client has now reached a stage where she/he is using the target sounds in spontaneous discourse contexts. In this particular treatment session, the client “instructs” the SLP to point to different pictures that she/he identifies. Feedback is an important component that is continually provided, so that the client is made aware of correct and incorrect productions. In addition to the practice task described, short stories are read by the client and words with the target sounds identified and the meaning of each is discussed (30 minutes).