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Efficacy of a Cycling Approach for the Treatment of Developmental Verbal Dyspraxic Preschoolers

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Two preschool males who presented with the characteristics of developmental verbal dyspraxia were enrolled in a phonological cycles intervention approach. Initially, each child's deviant phonological processes were analyzed by the CAPD and target patterns and words selected for remediation. A continuous speech sample was obtained and analyzed to measure intelligibility by percentage and rating on a seven-

point scale. A time-space probe was developed based on targeted and non-targeted phonemes and administered prior to the first intervention session. Using the selected targeted patterns and words, an individualized remediation plan was developed, and the phonological process cycling approach used. Each subject participated in 60 minutes of intervention for each targeted pattern to complete the first cycle in approximately 10 weeks. The time-space probes were administered approximately every two weeks.

At the conclusion of the first cycle of treatment, the deviant phonological processes were again analyzed, a second speech intelligibility measure was taken for percentage and rating on the seven-point intelligibility scale, and the time-space probe administered a final time. The pre- and post-test results were compared. Subject A's phonological percentage-of-occurrence scores increased rather than decreased, speech intelligibility improved, and results of the time-space probe indicated slight carryover of targeted phoneme(s) and generalization to non-target phoneme(s) and phoneme sequences. Subject B's phonological percentage-of-occurrence scores decreased, speech intelligibility improved, and moderate carryover of targeted phoneme(s) and generalization of non-targeted phoneme(s) and phoneme sequences was noted. Results of the measurements are discussed and implications for further consideration are presented.

EFFICACY OF A CYCLING APPROACH FOR THE TREATMENT OF DEVELOPMENTAL VERBAL DYSPRAXIC PRESCHOOLERS

by

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TO THE OFFICE OF GRADUATE STUDIES:

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DEDICATION

This work is dedicated to my parents whose love and support were unfailing; and to my sons who always were the willing participants in "another one of Mom's projects."

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CHAPTER I

INTRODUCTION

According to Weiss, Gordon, and Lillywhite (1987), 70% of childhood communication disorders consist of problems dealing with articulation and phonological deficiencies. Discussion of these disorders occurs frequently in the literature, but one disorder, developmental verbal dyspraxia (DVD), continues to generate confusion and controversy. The very existence of DVD as a real speech disorder is questioned by many professionals (Aram, 1984). The word dyspraxia is derived from Latin and indicates an inability to plan and direct cortically a temporal series of coordinated movements toward achieving a result. Crary (1984) suggested that apraxia is a breakdown in the spatial/temporal properties of movements which cannot be explained by direct sensory-motor pathology nor comprehension deficit. The percentage of articulation disorders which present with the characteristics of developmental verbal dyspraxia is unknown, due to the controversy involving the existence of DVD.

This motor planning problem for speech, which was first recognized in 1891, has been researched and observed since that time. It has not been determined whether DVD is a discrete speech and language disorder, an overlap of other disorders, or associated with a syndrome complex (Aram, 1984). Researchers have tried to observe and document systematically the many types of phonological errors

noted in DVD. The common high probability diagnostic indicators are: (a) the presence of vowel and diphthong errors; (b) the increase of errors on longer responses; (c) the indications that oral apraxia may also be present; (d) the presence of groping and trial and error behavior; and (e) imitative utterances possibly characterized by prolongations, repetitions, circumlocutions, and silent posturing of the articulators. Although these symptoms are noted regularly, there have not been enough documented comparison studies to verify the presence of DVD as a distinct speech and language syndrome (Aram, 1984).

Crary (1984) reported that such children present with reduced phonemic repertoires, multiple types of errors, and increased errors as the performance load increases. Children with DVD have been observed to have at least age-level receptive language skills, but sometimes severely reduced speech production and expressive language abilities. Speech-language pathologists have long noted that children who present DVD characteristics are very resistant to remediation. Auditory discrimination tasks and articulation drills seem not to be effective with these children. This resistance to treatment has raised questions regarding the effectiveness of various intervention approaches for children who present with characteristics of DVD. There is a strong need to develop an effective approach for improving the speech of these children.

The cycling approach to treatment as developed by Hodson and Paden (1991) is a consideration for the effective treatment for DVD children. This approach to remediation is based on the concept that even the most disordered speech has its

own structure. The phonological patterns cycling approach takes advantage of this systematic nature of the speech errors. Teaching a sound as an isolated unit, the traditional approach, does not attack the basic system that is in error; the phonological approach helps the child learn sound patterns rather than sounds as isolated units (Hodson & Paden, 1991). The traditional approach of articulation treatment targets individual sounds with each sound being targeted until a predetermined rate of accuracy is reached. Contrarily, the phonological processes cycling approach targets a pattern for approximately 2 to 5 weeks, focusing on a different phoneme or phoneme sequence each week. In this way, several patterns are targeted during a 2- to 4-month cycle of treatment. Because a phonological pattern is targeted rather than individual sounds and because several patterns can be targeted over a 2- to 4-month period, this warrants further investigation as a treatment approach for children who present with DVD.

STATEMENT OF PURPOSE

This study was designed to investigate the effectiveness of the phonological process cycling approach developed by Hodson and Paden (1991) to intervene with preschool children who present with characteristics of DVD. The research question posed was: Is the phonological processes cycling approach an effective method of intervention for preschool children who present with developmental verbal dyspraxia as measured by pre- and post-testing and by time-space probes?

DEFINITION OF TERMS

Phonological Omissions

The phonological processed considered for this study are categorized and defined as follows (Hodson, 1992):

Syllable Reduction: The omission of an entire syllable in the target word, e.g., water → /wa/.

Prevocalic Singletons: Omission of a singleton consonant that initiates a syllable, e.g., basket → /ækət/.

Postvocalic Singleton: Omission of a singleton consonant that ends a syllable, e.g., basket → /bæskə/.

Consonant Sequences: Omission of one or more consonants in a consonant sequence or cluster, e.g., sky → /kaɪ/.

Class Deficiencies

Stridents: Strident sound is totally omitted or is substituted by a nonstrident phoneme, e.g., soap → /top/. Strident phonemes are /s, z, ʃ, ʧ, ʤ, ʒ, f, v/.

Velars: A velar stop is omitted or substituted by a nonvelar sound, e.g., key → /ti/. Velar stop phonemes are /k, g/.

Liquid /l/: An /l/ phoneme is omitted or substituted by another phoneme, e.g., candle → /kændo/.

Liquid /r/: An /r/ phoneme is omitted or substituted by another phoneme, e.g., row → /wo/.

Nasals: A nasal phoneme is omitted or substituted by a non-nasal phoneme, e.g., nose → /doz/. Nasal phonemes are /n, m, ŋ/.

Glides: A glide is omitted or substituted by a nonglide phoneme, e.g., yellow → /lɛlo/. Glide phonemes are /j/ and /w/.

CHAPTER II

REVIEW OF THE LITERATURE

Hadden (1891) first recognized DVD and discussed it as a defect

> of articulation in children of good mental capacity . . . associated neither with mechanical conditions in the mouth, nor with disease of the auditory apparatus, but almost certainly dependent on some fault in the central nervous system (cited in Haynes, 1985, p. 243).

The first detailed description was provided by Morley (1967) as she recognized "the failure or coordinations of the respiratory, laryngeal and oral muscles for articulation when muscle tone is otherwise adequate" (p. vii). The term "apraxia of speech" was first introduced into clinical neurology in 1908 by Leipmann (cited in Love, 1992). Although this term has been used clinically to describe motor speech disorders in adults, there is still disagreement about how to distinguish motor speech disorders in children.

DEFINITION OF TERMS

Just as the characteristics of DVD are multiple, so are the terms suggested for labeling it. Developmental verbal dyspraxia has been referred to by various researchers as developmental articulatory dyspraxia, verbal dyspraxia, childhood verbal apraxia, dilapidated speech, developmental apraxia of speech, and a disorder of speech programming (Aram, 1984). The term *developmental* was included in

labeling this disorder to distinguish it from acquired verbal dyspraxia, an adult disorder usually associated with cerebral vascular accidents. Developmental verbal dyspraxia suggests a congenital condition that relates to a partial breakdown in motor skill for speech.

An apraxia for nonspeech acts of the oral structures has been termed developmental oral apraxia. This term is sometimes used synonymously for DVD, but should be used to describe the distinctly different disorder in children of praxis of the oral facial muscles. Love (1992) defined developmental oral apraxia as the "inability to perform voluntary movements of the muscles of the pharynx, tongue, cheeks and lips, although automatic movements of these muscles may be preserved" (p. 10). It was suggested by Aram and Nation (1982) that developmental oral apraxia and developmental verbal apraxia may either coexist or be independent.

Childhood dysarthria and DVD are both motor speech disabilities, but are marked by different characteristics. Children with dysarthria may present with delayed motor development, a traumatic birth history, cerebral palsy, muscle weakness, paralysis, or feeding difficulties. Children with DVD usually present with unremarkable birth histories, normal development, and no muscle weakness or paralysis.

PHONOLOGICAL CHARACTERISTICS OF DEVELOPMENTAL VERBAL DYSPRAXIA

A major focus of DVD is the severe phonological deficit associated with it. Only a few studies have tried to characterize the phonological errors. Crary (1984)

reviewed these studies and summarized the overlapping findings, including: (a) multiple speech sound errors representing omissions (most prominent), substitutions, additions, and distortions of consonants and vowels; (b) difficulties with sound sequencing; (c) increased error as word length increases; and (d) single words more intelligible than words in conversation. Rosenbek and Wertz (1972) also noted that speech sound errors vary with the complexity of articulatory adjustment and that errors are inconsistent. Yoss and Darley (1974a) added that there are distinctive feature error differences between repetition and conversation. With so many characteristics of DVD that overlap with so many other existing speech and language disorders, Aram (1984) asks if DVD can be separated from other developmental speech and language disorders, or are the disordered characteristics overlapping and continuous with other types of disorders? The evidence appears equivocal.

CONTROVERSIES OF DEVELOPMENTAL VERBAL DYSPRAXIA

Etiology

The etiology of DVD is unknown. It has been logical to look at DVD in terms of a neurological base and to examine brain lesions as a possible etiologic explanation. So called *soft signs* have been observed in suspected DVD cases, but the evidence is inconclusive. Rosenbek and Wertz (1972) were the first investigators to report the results of a major study which suggested a neurologic component in DVD children. Yoss and Darley's (1974a; 1974b) findings showed abnormal

neurologic *soft signs*. Williams, Ingham, and Rosenthal (1981) duplicated the Yoss and Darley study and found only limited evidence of neurologic components.

Some limited data suggest familial tendencies for DVD. Two studies have noted a family history of speech and language disorders in the backgrounds of children with DVD (Aram & Nation, 1982; Lewis, 1990). Love (1992) cautions that, although these studies are compelling, they do not provide absolute evidence of a genetic etiology. Although some indications for a possible genetic influence exist, some findings suggest a neurological base; the evidence is not clear-cut. In fact, Rapin (1988) stated succinctly that, in most cases, the cause is unknown.

Characteristics

DVD has been described as a syndrome or syndrome cluster, but with the lack of exclusive symptoms, can DVD really be described as such? Guyette and Diedrich (1981) recommended that the concept of DVD as a syndrome be eliminated (cited in Love, 1992). Thompson's (1988) review of the literature found significant dispute about the presenting symptoms of DVD and whether they are characteristic or not characteristic of the disorder. Aram (1984) suggested that DVD should be viewed as a syndrome complex that does not depend on a distinguishing characteristic since several characteristics may overlap with other speech and language disorders. She stated that a DVD diagnosis would be based on "the grouping or particular constellation of symptoms that collectively create a distinct syndrome" (p. iii). Love (1992) agreed, even suggesting that the inconsistency among symptoms should be expected.

ASSESSMENT

The controversy surrounding DVD and its myriad of suggested symptoms makes it difficult to develop test procedures that accurately identify it. The only commercial test available for children, the Screening Test for Developmental Apraxia of Speech (Blakeley, 1980), received significant criticism from Guyette and Diedrich (1983) for its construction, administration procedures, scoring procedures, and interpretation. Until a reliable, valid test is developed, clinicians must rely on subjective judgment and appropriate, selected tests.

Love (1992) reviewed the suggested areas of assessment presented by Haynes (1985) and Love and Fitzgerald (1984). The common areas of assessment in both approaches include:

1. Volitional movements of oral muscles in isolation and in sequence at the speech and nonspeech levels.
2. Diadochokinetic rates in speech and nonspeech movements.
3. Articulatory proficiency of isolated phonemes, polysyllabic words, and connected speech and analysis of place, manner, and error type.
4. Speech intelligibility.
5. Language testing.
6. Presence or absence of *soft* neurologic signs.

Areas for additional consideration include assessment of oral awareness and oral sensory perception, items to eliminate the presence of basal ganglia disorder or cerebellar dysfunction, and analysis of vocal characteristics. Love (1992) also

suggested that longitudinal assessments may be beneficial as is diagnostic therapy. Once DVD is suspected or identified, treatment may be warranted.

TREATMENT METHODS

Despite the controversy surrounding DVD as a diagnosis for a subgroup of children who demonstrate articulation disorders, the experience of many speech-language pathologists suggests that these children may not benefit from traditional articulation intervention designed for functional articulation disorders. Several techniques have been suggested in the literature that may include traditional approaches for articulation treatment or that utilize techniques used for adults with acquired apraxia of speech. There is belief among some speech-language pathologists that similar treatment techniques work well for both adult and child dyspraxia (Jaffe, 1986). Contrarily, Diedrich (1982) noted limited similarities between adult and child verbal dyspraxia. He implied that a similar approach to treatment of developmental verbal dyspraxia, dysarthria, and functional misarticulation is probably effective for all. Many professionals, however, are in agreement that a unique approach for treating DVD is needed. Pannbacker (1988) noted that, although there are many management techniques, the effectiveness of most treatment approaches for DVD is unknown. It appears to be left to the speech-language pathologist to research and select an approach best suited to the individual child.

Traditional Approaches

Oral-motor and oral-sensory training. For the child with DVD, Yoss and Darley (1974b) have advocated the use of oral exercises, including mirror work, imitation of movement sequences, and precise placement of the articulators. Drills for tongue and lip movements may be incorporated. The use of a mirror presumably improves the awareness of visual awareness of articulatory postures.

Haynes (1985) incorporated additional sensory awareness techniques. The oral-sensory mechanism may be stimulated by brushing sandpaper, cotton, or other textures across the lips and inside the mouth. Deep pressure and resistance techniques may be used to increase oral-sensory awareness. Love (1992) indicated that it is unclear if this technique is beneficial and suggested additional research is needed.

Manual and/or rhythmic movement. Large motor movements are often paired with attempts to increase vocalizations/verbalizations when working with children with DVD. Foot or finger tapping are helpful in treating children with DVD, according to Haynes (1985).

Development of articulatory postures. The technique of development of articulatory postures utilizes manual placement of the articulators to develop the articulatory postures for vowels and consonants. Several clinicians incorporate this technique in their programs (Blakeley, 1983; Haynes, 1985). Others (Jaffe, 1986) are opposed to this procedure because the child with DVD may find it difficult to imitate the model provided by the clinician.

Sound sequencing. One of the presenting characteristics of DVD is difficulty in producing sounds in sequence. The sound sequencing approach teaches consonant-vowel, vowel-consonant, and consonant-vowel-consonant sequences in syllables, followed by these productions in words and phrases. This has long been incorporated into the intervention process (Rosenbek, Hansen, Baughman, & Lemme, 1974; Yoss & Darley, 1974b).

Other Approaches

PROMPT. The PROMPT (Prompts for Restructuring Oral Muscular Phonetic Targets) system was developed by Chumpelik (1984) to focus on the basic elements of DVD, the decreased ability to sequence and produce volitional speech acts. She stated that the PROMPT system:

> imposes control on the articulators by providing tactile and kinesthetic (closed-loop) feedback, while guiding the structures toward sequential, feed-forward (open-loop) programming (p. 144).

This system uses an external prompt for each English phoneme to reshape individual and connected phonemes and sequences. This approach combines the elements of sensory feedback with motor-learning.

Touch-cue method. The touch-cue approach is not a speech-sound treatment method, but rather a speech-sound sequencing method. This approach was developed by Bashir, Grahamjones, and Bostwick (1984) to teach systematically segmental production skills initially, followed by combinations of these segments into meaningful units. The touch cues, touching designated areas of the face and neck,

are presented at the same time as the visual and verbal cues. The children progress through three stages with specific activities associated with each. The stages begin with simple consonant-vowel and consonant-vowel-consonant productions, move to multisyllabic units, and finally move to multiword utterances in spontaneous speech.

Adaptation of melodic intonation therapy. The melodic intonation therapy approach, first used with adult aphasics in 1973, uses intoned sequences to target propositional language. This approach was adapted by Helfrich-Miller (1984) for children with DVD. After a language foundation is established, the child moves through three levels which include four processes: increased length of the spoken unit, increased phonemic complexity, reduced dependence on the clinician, and reduced dependence on intonation. When progressions through the levels are completed, it is hoped that the children have developed an internal cuing system of their own.

Phonological Processes Cycling Approach

The Phonological Processes Cycling Approach was first presented at the 1977 convention of the American Speech and Hearing Association by Hodson. Hodson and her colleague, Paden, first published their work in 1983. This approach targets the phonological system rather than individual speech sounds. For example, a /t/ may not be produced correctly because the child deletes final consonants or because he/she replaces velar sounds with alvelors (/t/ for /k/), or because he/she does not *mark* past tense endings. Targeting /t/ as an individual phoneme does not necessarily take into account this variety of system production possibilities. The phonological

approach does take these possibilities into consideration by taking advantage of the systematic nature of even the most unintelligible speech.

Hodson and Paden (1991) emphasized that the phonological approach was designed for, and has been successful with, children whose speech intelligibility is severely impaired. She contended that even the most unintelligible child will have structured phonological systems. This approach targets these systems and utilizes whatever stimuli are needed to facilitate progress and ultimately improve intelligibility. Auditory bombardment may be one stimulus used. Here, the child listens, at a low level of amplification, to a list of words containing the target sound or sequence. This increases the awareness of the acoustic characteristics of sounds that the child did not learn by normal listening. Tactile cues may also be used. These are developed according to the child's needs. Tapping the upper lip for /t/ or touching under the chin for /k/ may increase awareness of these phonemes. Visual stimuli may be used to draw attention to the type of sound desired. Mirrors, hand signals, and pictures are often used. Production practice is another technique used to increase the kinesthetic awareness. A few specific target words are selected that provide the child the opportunity to produce the target sound as correctly as possible. The emphasis is on the correctness of the production, not on how many productions can be elicited in a session. Finally, developing semantic awareness is incorporated. Since impaired phonology may impact semantic meaning, contrasts between *old* and *new* productions are provided in later stages of intervention. For example, if a child is working on /sp/ clusters, *pot* and *spot* could be contrasted.

Developing semantic awareness seems particularly important since a phonologic-linguistic link in DVD children is reported in the literature. Data presented by Ekelman and Aram (1984) revealed eight children diagnosed with DVD had disordered sentence structure in terms of an expected mean length of utterance for age. Panagos and Bobkoff (1984) stated that verbal dyspraxia cannot be viewed as only a motor or phonologic problem because phonology is so much a part of language. The cycling approach encompasses both phonology and language.

Description. The cycling approach is designed to improve speech intelligibility as quickly as possible. The focus is on facilitating the emergence of phonological patterns. The time period needed to focus on all deficient phonological patterns is called a cycle. Each pattern may be the focus of treatment for 2 to 6 hours. When each pattern has been targeted, a cycle has been completed. Each session, usually 60 minutes in length, will follow the same basic format (Hodson & Paden, 1991):

1. Review of preceding session's production-practice words.
2. Auditory bombardment.
3. Potential word list for production practice of words selected carefully for facilitative phonetic environments.
4. Production-practice activities.
5. Probing to ascertain next session's target phoneme(s).
6. Repeat of auditory bombardment.
7. Home practice words and listening word list provided to parents.

When a cycle has been completed, the Assessment of Phonological Processes-Revised (Hodson, 1986) is administered to note improvement. Cycle two is initiated, again targeting the previously identified phonological patterns which remain deficient.

Rationale for this investigation. Children with DVD present with highly unintelligible speech, multiple articulation errors, and may have language impairments. The phonological processes cycling approach is designed for children who present with these characteristics, regardless of the presence or absence of DVD. The cycling approach also utilizes stimulus techniques suggested by many other treatment approaches. In addition, it follows a systematic, structured treatment format. These considerations, taken together, suggest that the phonological processes cycling approach provides a viable treatment approach for children who present with DVD.

SUMMARY

Developmental verbal dyspraxia is a motor speech disorder first recognized in 1891. It can be differentiated from oral apraxia, acquired adult apraxia, and dysarthria. There is not a set of distinguishing characteristics agreed upon by all professionals. DVD is surrounded by controversy, including its etiology and nature. There is not an acceptable standardized test to diagnose DVD; therefore, clinicians must rely on their clinical judgment and selected protocols. Several treatment methods for DVD exist. The phonological processes cycling approach was selected for the purpose of this study.

CHAPTER III

METHODS

GENERAL PLAN

This study was conducted at Portland Center for Hearing and Speech in Portland, Oregon. Two preschool male subjects, each presenting with characteristics of DVD, participated in the study. Each subject received 10 weeks of direct intervention utilizing the phonological processes cycling approach. A probe, consisting of imitated words in targeted patterns, was administered every 2 weeks throughout the intervention. The families were instructed to provide daily homework assignments.

Prior to, and at the conclusion of, the 10-week intervention period, a phonological processes analysis and intelligibility measures were completed. The results of the pre- and post-treatment administrations of these measures, as well as the biweekly probes, were compared to note any changes in scores that would indicate the efficacy of the cycling approach with children who present with the characteristics of DVD.

SUBJECTS

Selection

Two preschool male children were selected from this examiner's caseload to participate as subjects. Both children were enrolled in a traditional speech intervention program and met the criteria for inclusion in this study. Subject A (aged 2 years, 11 months) had participated in direct intervention for 3 months, and subject B (aged 4 years, 1 month) had participated in direct intervention for 10 months. The criteria for inclusion in the study were as follows:

1. Displays the characteristics of DVD.
2. Informed consent form signed by the parents/primary caregivers/ acknowledging their child's participation in the study (Appendix A).
3. Hearing within normal limits in one ear.
4. Standard English as the primary language spoken in the home.
5. Receptive language development within a normal range as determined by the Auditory Comprehension portion of the Preschool Language Scale (PLS) (Zimmerman, Steiner, & Pond, 1979).
6. No prior treatment with the cycling approach.

The intervention approach to be used was described to the parents prior to the administration of testing required for this study and prior to their children's participation in the intervention method used for this study. Criteria had been met prior to or during the children's participation in the previous intervention provided by this examiner. This information was documented and described in original

evaluation reports and/or in daily progress notes. Hearing was re-screened prior to initiation of this study.

DVD Characteristics

Both subjects presented with characteristics associated with DVD, including vowel errors, reduced intelligibility further reduced with performance load, omission and substitution errors, difficulties with sound sequencing, inconsistent errors, and decreased expressive language abilities. The diagnosis for DVD was verified via direct observation, subjective assessment, parent interview, and by a second speech-language pathologist experienced with this disorder and holding the Certificate of Clinical Competence awarded by the American Speech-Language-Hearing Association.

PROCEDURES

Screening Procedure

Normal hearing was defined as passing an audiometric screening at 20 dB for the frequencies of 500, 1000, 2000, and 4000 Hz in at least one ear. Hearing screening was performed in a soundproof booth with a portable Beltone audiometer, ANSI, 1969.

Pre- and Post-Test Measures

Phonological processes analysis. Fifty objects representing the stimulus words from the Assessment of Phonological Processes-Revised (APP-R) (Hodson, 1986)

were utilized in the testing. The target words and processes are listed in Appendix B. Presentations of these objects elicited words which provide opportunity for use of the ten basic phonological processes analyzed by this test instrument.

The test was administered according to APP-R procedures described in the test manual at the onset of each subjects' phonological cycles remediation. The 50 objects were presented in random order to each subject. If the subject failed to respond or gave an incorrect response, the investigator provided a prompt about the object. If the subject still did not say the target word, the investigator provided a delayed model of the word by saying the target word and instructing, "Now you say it." If the child still did not imitate the word, a direct model was given. All imitated responses were noted. All utterances were transcribed phonetically at the time of testing by this examiner. The administration of the APP-R was tape-recorded for later verification of the examiner's on-line transcription. The audiotape was replayed to verify or alter the *live* transcriptions. A second speech-language pathologist listened to the audiotape and transcribed the results. This investigator and the speech-language pathologist compared the transcriptions. When discrepancies occurred, the audiotape was reviewed until both transcribers were satisfied with the composite result.

The child's transcribed responses were entered into the Computer Analysis of Phonological Deviations (CAPD) (Hodson, 1992). This analysis resulted in a percentage-of-occurrence score for each of the ten basic processes, average phonological processes frequency-of-occurrence score, a composite deviancy score,

and a severity interval. An example of a CAPD printout appears in Appendix C. Targeted phonological patterns were selected from this information.

Speech intelligibility. Speech intelligibility was determined for each child by assessment of a 100-word speech sample using a *dot-slash* technique, with a *dot* indicating an intelligible word and a *slash* indicating an unintelligible word. Unintelligible words were counted and the number subtracted from the total 100 words, thus giving the number of intelligible words. This information was translated into an intelligibility percentage. A second intelligibility measure was obtained using a seven-point rating scale, with one representing *completely unintelligible* and seven representing *completely intelligible*. A speech-language pathologist, unfamiliar with the children, listened to the 100-word speech sample and rated each child's intelligibility on the seven-point rating scale. This rating scale is found in Appendix D.

Intervention Procedures

After the computer analysis of the APP-R was completed, five phonological patterns were chosen as targets for Subject A and three were chosen for Subject B. The target patterns, target sounds and sound sequences, and sample target words can be found in Tables I and II.

Each subject participated in at least 60 minutes of direct intervention per week for 10 weeks (Cycle One). Subject A participated in twice weekly sessions of 30 minutes each and Subject B participated in a once weekly session of 60 minutes.

TABLE I

TARGET PATTERNS, PHONEMES, AND WORDS:
SUBJECT A

Target Pattern	Target Phonemes and Phoneme Sequences	Sample Target Words
Syllableness	2 syllables 3 syllables	cowboy, ice cream cowboy hat, ice cream cone
Nasals	final m initial n	home, boom knock, knee
Velars	final k initial k	book, make cow, cone
Stridence/consonant sequences	ts ps sw sn	eats, boats hops, peeps swing, sweep snow, sneak
Liquid	l	lick, lock, lamp

TABLE II

TARGET PATTERNS, PHONEMES, AND WORDS:
SUBJECT B

Target Pattern	Target Phonemes and Phoneme Sequences	Sample Target Words
Stridency/consonant sequences	sn sp sm st sk sw	snake, sneak spoon, spider smoke, smell star, stop sky, skip swim, sweep
Liquids	l r br	look, light race, rat broom, break

The sessions per week were dictated by parent scheduling needs. Each phonological pattern was the focus for 2 to 5 weeks during this Cycle One phase of remediation. The sessions followed the guidelines detailed by Hodson and Paden (1991). At the beginning of each 60 minutes of intervention, the preceding session(s) production-practice words were reviewed. A portable amplification device was utilized to provide a short period of auditory stimulation with sight amplification for the new target phoneme/pattern for the current session. The subjects drew pictures of the three to five carefully selected new target words for that session on 5" by 8" index cards. These word-picture cards were used in five to seven experiential-play, production-practice activities. Near the end of the 60 minutes of intervention, probing was conducted to select the optimal phoneme(s) within a pattern that would be used as the target for the next session. Auditory bombardment with slight amplification was repeated, using the same words read at the beginning of the session.

Daily home practice was required. Each session, the parents were given the word list used during the auditory bombardment portion of the session. They were instructed to read this list aloud to their children each day. A sample word list is found in Appendix E. The picture cards for production-practice used during the treatment sessions were sent home for the children to name once daily. Each daily home practice session was estimated to last 2 to 3 minutes.

During the first session, and every 2 weeks, a time-space probe was administered. The probe for the targeted phonological pattern consisted of non-

practice words that contained the targeted phoneme or phoneme sequences, and of non-practice words that contained non-targeted phonemes or phoneme sequences. These words were imitated after a model was provided by this investigator. The probe was used to measure carryover. The time-space probes for Subject A and Subject B are listed in Appendix F.

DATA MEASUREMENT AND ANALYSIS

At the completion of Cycle One of intervention, post-testing was conducted. The APP-R was re-administered and scored, and a second 100-word speech sample was elicited for post-intervention intelligibility measures. The results of the pre-testing and post-testing were compared. A brief parent interview was also conducted to note any progress and/or carryover in the home environment.

Time-space probes were administered at the beginning of, and every two weeks during, the 10-week treatment process. Each response was evaluated for accuracy of production. The non-practice words containing targeted phonemes or phoneme sequences were evaluated for the accuracy of the target sound and the accuracy of the use of the correct phonological pattern. The non-practice words containing non-target phonemes or phoneme sequences were evaluated for the accuracy of the correct phonological pattern and to note any generalization from the target sounds to the non-targeted sounds within the phonological pattern. These probes measured progress and any generalization during Cycle One of the intervention.

CHAPTER IV

RESULTS AND DISCUSSION

RESULTS

The research question posed was: Is the phonological processes cycling approach an effective method of intervention for preschool children who present with developmental verbal dyspraxia as measured by pre- and post-testing and by time-space probes?

Pre- and Post-Test Measures

Two subjects completed cycle one of the phonological processes treatment approach. Subject A, 3 years of age, received 9 hours of direct intervention; and Subject B, 4 years of age, received 8.5 hours.

Phonological process analysis. The APP-R was administered at the beginning of cycle one to obtain baseline data for phonological deviancies and to select target processes for remediation. The APP-R was re-administered at the conclusion of cycle one to compare results to the baseline data and to note any changes in percentage-of-occurrence score, average phonological processes frequency-of-occurrence score, the composite deviancy score, and the severity interval. Table III displays the phonological analysis summary for Subject A, and Appendix G shows the

TABLE III

COMPUTER ANALYSIS OF PHONOLOGICAL DEVIATIONS FOR SUBJECT A

Phonological Deviations	Percentage of Occurrence—Pre (2:11)	Percentage of Occurrence—Post (3:2)
OMISSIONS		
Syllables	32	32
Prevocalic Singletons	25	32
Postvocalic Singletons	19	26
Consonant Sequences	98	100
CLASS DEFICIENCIES		
Stridents	88	100
Velars	100	95
Liquid (l)	100	100
Liquid (r)	95	86
Nasals	53	53
Glides	70	90
Average of Phonological Deviations	68	71
Phonological Deviancy Score	68	71
Severity Interval	Profound	Profound

pre- and post-test phonemic transcriptions of the subjects' productions of the words on the APP-R.

The results of the CAPD show that, with the exception of the score for velars and liquid /r/, all of Subject A's percentage-of-occurrence scores for the phonological deviations remained the same or increased. His severity interval remained at the profound level, but his average of phonological deviations increased as did his phonological deviancy score.

Table IV displays the phonological analysis summary for Subject B. The results of the CAPD for Subject B show increases in the percentage-of-occurrence scores for liquid /l/, liquid /r/, and glides. The syllable omission score remained the same and all other percentage-of-occurrence scores for phonological deviations decreased. The severity interval remained severe, but the average of phonological deviations score and the phonological deviancy score decreased.

TABLE IV

COMPUTER ANALYSIS OF PHONOLOGICAL DEVIATIONS FOR SUBJECT B

Phonological Deviations	Percentage of Occurrence—Pre (4:1)	Percentage of Occurrence—Post (4:4)
OMISSIONS		
Syllables	11	11
Prevocalic Singletons	9	5
Postvocalic Singletons	10	3
Consonant Sequences	85	60
CLASS DEFICIENCIES		
Stridents	70	60
Velars	27	0
Liquid (l)	73	82
Liquid (r)	57	90
Nasals	16	5
Glides	40	50
Average of Phonological Deviations	40	37
Phonological Deviancy Score	45	42
Severity Interval	Severe	Severe

Speech intelligibility measure. A 100-word speech sample was not obtainable from Subject A due to his reluctance to participate in this activity. The intelligibility percentage was calculated from the limited speech sample obtained. The baseline measurement of the speech intelligibility percentage, based on a 50-word sample was 20%. Based on a 62-word sample, the speech intelligibility percentage at the conclusion of this investigation was 32%. On the second intelligibility measure, the seven-point rating scale, Subject A was initially rated as 1, i.e., *completely unintelligible*. At the conclusion of this study, he was rated a 2, which indicated an increase in intelligibility of 1 point on the seven-point scale. Subject A's post-test continuous speech sample was characterized by strings of unintelligible syllables with intelligible single words embedded.

Subject B's baseline percentage of speech intelligibility measure was 30% and he was given a rating of 2 on the seven-point rating scale. The speech intelligibility percentage at the conclusion of this investigation increased to 62%. For comparison purposes, a second 100-word sample was taken when the context was known. The percentage of intelligibility increased to 72%. His post-test rating on the seven-point scale was 4, indicating a 2 point increase in intelligibility on the scale. Subject B's post-test speech sample was characterized by unintelligible syllables mixed with strings of intelligible words.

Time-Space Probes

Time-space probes were administered at the initiation of cycle one, then approximately every 2 weeks during cycle one, and finally, at the conclusion of cycle

one. These responses were imitated after this investigator provided the model. The non-practice words containing targeted sound(s) were evaluated for accuracy of the target sound and accuracy of the correct phonological pattern. The non-practice words containing non-target sound(s) were evaluated to ascertain any generalization from the target sound(s) to the non-targeted sound(s) within the phonological pattern. Table V displays the results of the time-space probes of Subject A to document changes over time of target patterns with non-practice words containing targeted and non-targeted sounds.

By the final administration of the time-space probe, Subject A produced his target patterns of syllableness and nasals (with final /m/ targeted) with 100% accuracy. Use of other non-targeted nasal sound sequences (medial /n/ and /m/) were emerging. With two exceptions, he did not produce targeted and non-targeted sound sequences for the patterns of velars, stridents, and liquid /l/.

Table VI displays the results of the time-space probes for Subject B. An increase in accuracy over time was noted for the targeted pattern of stridency/consonant sequences when testing targeted phoneme sequences. Subject B produced /sm/ and /st/ correctly 50% of the time and /sn/ correctly 75% of the time in non-practice words. There was no carryover to non-target phoneme sequences. For the target pattern of liquid /r/, carryover was noted for the non-target vocalic /r/ of 75% accuracy, but not for non-practice words containing targeted /r/ and /br/. He essentially showed no generalization for liquid /l/.

TABLE V

RESULTS OF TIME-SPACE ADMINISTRATIONS IN TERMS OF CORRECT AND INCORRECT SOUND SEQUENCE PRODUCTIONS: SUBJECT A

Target Patterns		Times of Administrations of Probes						Percent of Correct Over Time
		Baseline	Second	Third	Fourth	Fifth	Final	
Syllableness								
Target:	3 syllables	-	+	+	+	+	+	100
Nasals								
Target:	final /m/	-	+	+	+	+	+	100
	initial /n/	-	-	-	-	-	-	0
Non-target:	medial /n/	-	+	-	-	+	-	40
	medial /m/	-	+	-	-	+	-	40
Velars		-						
Target:	final /k/	-	-	-	-	-	-	0
	initial /k/	-	-	-	-	-	-	0
Non-target:	initial /g/	-	-	-	-	+	-	20
	medial /g/		-	-	-	-	-	0
Strident/Consonant Sequences								
Target:	/ts/	-	-	-	-	-	-	0
	/ps/	-	-	-	-	-	-	0
	/sn/	-	-	-	-	-	-	0
	/sw/	-	-	-	-	-	-	0
Non-target:	/sm/	-	-	-	-	-	-	0
	/ks/	-	-	-	-	-	-	0
Liquid /l/								
Target:	initial /l/	-	-	-	-	-	+	20
Non-target:	medial /l/	-	-	-	-	-	-	0

TABLE VI

RESULTS OF TIME-SPACE ADMINISTRATION IN TERMS OF CORRECT AND INCORRECT SOUND SEQUENCE PRODUCTIONS: SUBJECT B

Target Patterns		Times of Administrations of Probes					Percent of Correct Over Time
		Baseline	Second	Third	Fourth	Final	
Stridency/Consonant Sequences							
Targeted:	/sn/	-	+	-	+	+	75
	/sw/	-	-	-	-	-	0
	/sp/	-	-	-	+	-	25
	/sm/	-	-	-	+	+	50
	/st/	-	-	+	+	-	50
	/sk/	-	-	-	+	-	25
Non-targeted:	/sh/	-	-	-	-	-	0
	/squ/	-	-	-	-	-	0
	/str/	-	-	-	-	-	0
Liquid /l/							
Targeted:	initial /l/	-	-	-	-	-	0
Non-targeted:	medial /l/	-	-	-	-	-	0
	/sl/	-	-	-	+	-	25
	/pl/	-	-	-	-	-	0
Liquid /r/							
Targeted:	initial /r/	-	-	-	-	-	0
	/br/	-	-	-	-	-	0
Non-targeted:	vocalic /r/	-	-	+	+	+	75
	/tr/	-	-	-	-	+	25

DISCUSSION

Subject A

For Subject A, the results of the CAPD showed general increases in the percentage-of-occurrence scores, average of phonological deviations, and phonological deviancy scores. The reasons for these increases are unclear; however, one might speculate why improvements were not noted on the APP-R. It is possible that not enough time was spent on each pattern. In fact, Hodson (1991) recommends that for some children as young as Subject A, several sessions of focused auditory input for each pattern should precede actual verbal practice. She also indicated that often improvements do not occur until after cycle two (Hodson, 1992). The selected words for each pattern may have been too difficult for this subject to produce. For example, *lick* and *lock* were used with targeting liquid /l/. Both of these words contain a final /k/. This subject did not produce final /k/ when it was targeted earlier in the cycle. The sequence of phonological development may not have been followed closely enough. Even physical immaturity may have been a factor. One can speculate that the cycling approach encouraged more attempts at verbalization and a new variety of sounds; therefore, the higher percentage of phonological processes scores may reflect these new attempts.

The inconsistency of errors that is associated with DVD is evident in the time-space probes. This was especially true when reviewing the probes for the younger Subject A. From the administration of one probe to the next, his errors varied, not only according to the word on which they occurred, but varied with the phonemes

used as well. There were some improvements noted, especially for the syllableness and nasal patterns. These are early developing patterns and thus would be anticipated.

Speech intelligibility improved for Subject A over time, although scores on the phonological analysis summary do not reflect this. When comparing the pre- and post-test APP-R, different sound omissions were noted from test to test, and a wider variety of sound attempts was observed. In addition, on the post-test his sound substitution patterns were more like what one would expect in typically developing phonology. Therefore, in conversation his intelligibility minimally improved. These findings suggest that speech intelligibility was improved at a functional use level despite the increased percentage-of-occurrence scores.

The results of the testing measures were variable and do not provide enough information to state that the cycling approach did or did not work for this child. Speech intelligibility increased on a functional level and increased attempts at verbalization were noted. These improvements may, in part, be a result of the cycling approach used with this child.

Subject B

The results of the CAPD showed that generally percentage-of-occurrence scores of phonological processes decreased. The changes are not dramatic, which is consistent with Hodson's (1992) contention that improvements in a child's phonological system often do not occur after only one cycle of intervention. There were clinically significant decreases for consonant clusters and stridency, both

patterns targeted during cycle one. One of the phoneme sequences targeted for stridency was part of this subject's first name which was used as a practice word. He responded correctly and intelligibility to "What's your name?" for the first time. There were also significant score decreases for velars and nasals which were not targeted for treatment. The decreases in these scores may be related to the coincidental use of velar and nasal phonemes used in practice words when targeting other patterns. The severity interval remained severe, but the average of phonological deviations score and the phonological deviancy score decreased.

On the time-space probes, Subject B's phoneme errors remained relatively stable over time, but he sometimes produced a sound correctly one time and incorrectly the next time, which is characteristic of DVD. Beginning of carryover to non-practice words in targeted patterns was noted.

Speech intelligibility gains were noted in spontaneous conversation. On the post-test of the APP-R, this subject produced fewer omissions and his sound substitution errors reflected more typically developing phonology. This probably impacted his intelligibility at the conversational level.

Subject B's percentage-of-occurrence scores decreased, his speech intelligibility increased, and beginning carryover of targeted patterns was noted on the time-space probes. As noted in functional use and on the testing instrument, the speech of this subject seemed to improve, presumably as a result of the phonological processes cycling approach.

Parent Report

Both mothers of the subjects expressed their support of this treatment approach. Both noted significant changes in speech intelligibility at home and both made statements regarding how much more others were understanding the speech of their children. In addition, both liked the daily homework and appreciated the limited time it took to complete. It was reported that the children also enjoyed saying their words and were proud of the picture cards they made each week.

Other Considerations

The age of the children may have had some influence on the outcome of this study. Subject B was one year older than Subject A. The added emotional, physical, and mental maturity may have increased the probability for intelligibility gains. Subject B also had previous preschool experience. Both subjects did not separate easily from their mothers, although Subject A was much more reluctant to have his mother out of the clinic room. Attention to task also was a consideration for the two different ages. Subject A stayed on task for 3 to 5 minutes, which Subject B was on task for up to 10 minutes.

Time spent in previous intervention may also be a factor. Subject B had participated in 10 months of intervention prior to the onset of this study. He knew the *routine* and had progressed beyond initial behavioral concerns. Subject A had participated in only 3 months of prior intervention and was still manifesting some behaviors that seemingly hindered the intervention process.

The different schedule patterns for each subject also may have influenced results. Subject B may have benefitted from the concentrated emphasis of 60 minutes per session. Subject A also had 60 minutes of intervention per week, but the sessions were divided into two sessions of 30 minutes each. The focus of a continuous 60 minutes on each sound or sound sequence may be more effective when using the cycling treatment approach.

CHAPTER V

SUMMARY AND IMPLICATIONS

SUMMARY

Two preschool males who presented with the characteristics of developmental verbal dyspraxia were enrolled in a phonological cycles intervention approach. Initially, each child's deviant phonological processes were analyzed by the CAPD and target patterns and words selected for remediation. A continuous speech sample was obtained and analyzed to measure intelligibility by percentage and rating on a seven-point scale. A time-space probe was developed based on targeted and non-targeted phonemes and administered prior to the first intervention session. Using the selected targeted patterns and words, an individualized remediation plan was developed, and the phonological process cycling approach used. Each subject participated in 60 minutes of intervention for each targeted pattern to complete the first cycle in approximately 10 weeks. The time-space probes were administered approximately every 2 weeks.

At the conclusion of the first cycle of treatment, the deviant phonological processes were again analyzed, a second speech intelligibility measure was taken for percentage and rating on the seven-point intelligibility scale, and the time-space probe administered a final time. The pre- and post-test results were compared.

Subject A's phonological percentage-of-occurrence scores increased rather than decreased, speech intelligibility improved, and results of the time-space probe indicated slight carryover of targeted phoneme(s) and generalization to non-target phoneme(s) and phoneme sequences. Subject B's phonological percentage-of-occurrence scores decreased, speech intelligibility improved, and moderate carryover of targeted phoneme(s) and generalization of non-targeted phoneme(s) and phoneme sequences was noted. Results of the measurements are discussed and implications for further consideration are presented.

IMPLICATIONS

Based on the results of this investigation and observations of speech and language disorders treated in this investigator's clinical practice, several issues can be considered. First, the results of this study would suggest that the phonological cycles approach is a viable treatment approach for DVD children. However, one cycle through the targeted patterns is not enough for these highly unintelligible children. The first cycle seems only to lay the foundation for the following cycles.

Based on parent report and increased intelligibility measures, it would appear that the cycling approach may encourage increased attempts at verbalizing. According to the parents, the children seemed to feel successful, even asking to practice their words.

The use of time-space probes may or may not provide a measure of carryover of targeted phonemes and of generalization to non-targeted phonemes and phoneme

sequences. This warrants further investigation, particularly in light of perceived inconsistencies of speech errors in DVD children. The number of words in the probe may need to be increased to measure carryover more effectively.

Additional research questions may be considered. Since language and phonology are so closely related, it would appear beneficial to investigate how the phonological cycling approach could incorporate grammatical morphemes into the treatment program. For example, when targeting stridency in consonant clusters, the use of plural endings could be included, e.g., *boats, hats, cats.*

Children with cleft palate may also be highly unintelligible. Given the possibility of velopharyngeal incompetency, would use of the cycling approach benefit their treatment? How could the cycling approach be utilized to focus on the air pressure consonants that may be affected in speech production of children with cleft palate?

Slight amplification with word repetition is used in the cycling approach. Would this be beneficial when using more traditional articulation treatment approaches?

The speech development history of the subjects in this study included little or no babbling. This point was also noted when reviewing the literature. Is there a relationship between a history of little babbling and DVD? How could this information provide additional input for DVD diagnosis?

Finally, since the computer analysis of deviant phonological processes is so advantageous, it would seem equally useful to develop a computer-assisted treatment program for cycling phonological processes.

The focus of this research was to investigate the efficacy of the phonological process cycling approach for the treatment of DVD preschool children. It appears to be a treatment option, although many questions still need to be answered regarding its use over time for treating DVD. This study will be continued as part of this researcher's clinical practice. Both subjects will be resuming treatment after a 1-month break. Both subjects' targeted pattern will be cycled through at least two additional times. The methods described previously will be followed to assure the reliability of the continuation of this study.

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APPENDIX A

INFORMED CONSENT

INFORMED CONSENT

I, _____, the parent of _____,

hereby agree to allow my child to serve as a subject for the investigation of: Efficacy of a Cycling Approach with Developmental Verbal Dyspraxic Preschoolers. This study is conducted under the supervision of Janet R. Lambert.

I understand that this study involves my child's participation in an intervention technique designed to improve his/her speech intelligibility.

I understand that there is no risk involved in this study. The only inconvenience involves my time of 60 to 90 minutes of intervention per week, and 2 to 3 minutes of daily home practice with my child.

It has been explained to me that the purpose of this study is to learn if the cycling approach will improve the speech intelligibility of preschool children who present with developmental verbal dyspraxia.

I may not receive any direct benefit from participation in this study but my participation may help to increase knowledge which may benefit others in the future.

Janet R. Lambert has offered to answer any questions I may have about the study and what is expected of me and my child in the study. I have been assured that all information I give will be kept confidential and that the identity of my child will remain anonymous.

I have read and understand the foregoing information and agree to my child's participation in this study.

_____ _____

Signature Date

If you experience problems that are the result of your participation in this study, please contact the Chair of the Human Subjects Research Review Committee, Office of Graduate Studies, 303 Cramer Hall, Portland State University, (503) 725-5262.

APPENDIX B

ASSESSMENT OF PHONOLOGICAL PROCESSES — REVISED

THE ASSESSMENT OF PHONOLOGICAL PROCESSES—Revised

Barbara Williams Hodson

Name _____ Birthdate _____ Date _____ Examiner _____

1. basket 'bæskɪt	11. feather 'fɛðɚ	21. jump rope 'ʤʌmp,roʊp	31. Santa Claus 'sæntə,klɔz	41. string stɹɪŋ
2. boats boʊts	12. fish fɪʃ	22. leaf lif	32. screwdriver 'skru,draɪvɚ	42. sweater 'swɛtɚ
3. candle 'kænd!	13. flower 'flaʊwɚ	23. mask mæsk	33. shoe ʃu	43. television 'tɛlə,vɪʒən
4. chair ʧɛɚ	14. fork fɔɚk	24. mouth maʊθ	34. slide slaɪd	44. thumb θʌm
5. cowboy hat 'kaʊbɔɪ,hæt	15. glasses 'glæsɪz	25. music box 'mjuzɪk,baks	35. smoke smoʊk	45. toothbrush 'tuθ,brʌʃ
6. crayons 7. three 8. black 9. green 10. yellow 'kreɪənz θri blæk grin 'jɛloʊ	16. glove glʌv	26. nose noʊz	36. snake sneɪk	46. truck tɹʌk
	17. gum gʌm	27. page peɪʤ	37. soap soʊp	47. vase veɪs
	18. hanger 'hæŋɚ	28. (air)plane pleɪn	38. spoon spun	48. watch waʧ
	19. horse hɔɚs	29. queen kwin	39. square skwɛɚ	49. yoyo 'joʊ joʊ
	20. ice cubes 'aɪs,kjubz	30. rock rak	40. star staɚ	50. zipper 'zɪpɚ

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APPENDIX C

COMPUTER ANALYSIS OF PHONOLOGICAL DEVIATIONS

COMPUTER ANALYSIS OF PHONOLOGICAL DEVIATIONS

Name of Client:
Date of Birth:
Date of Phonological: 10/2/92
Age in Years: 3
Examiner's Name: Lambert
Diagnostic Information: dyspraxia

Phonological Analysis Summary

Phonological Deviations	Percentage of Occurrence
Omissions	
Syllables	32
Prevocalic Singletons	32
Postvocalic Singletons	26
Consonant Sequences	100
Class Deficiencies	
Stridents	100
Velars	95
Liquid (l)	100
Liquid (r)	86
Nasals	53
Glides	90

Average of Phonological Deviations: 71
Phonological Deviancy Score: 71

Severity Interval: Profound

GOAL: To increase intelligibility by facilitating emergence of the following phonological patterns:

Consonant Sequences
Stridents
Velars
Liquid (l)
Liquid (r)
Nasals
Glides

COMPUTER ANALYSIS OF PHONOLOGICAL DEVIATIONS
Barbara Williams Hodson

APPENDIX D

RATING SCALE FOR INTELLIGIBILITY

RATING SCALE FOR INTELLIGIBILITY

Completely Unintelligible						Completely Intelligible
1	2	3	4	5	6	7

APPENDIX E

WORD LIST

WORD LIST

Words to read:	Words to practice:
sneakers	snake
sniff	snow
snap	sneak
snooze	snack
snoopy	
sneeze	
snooty	
snicker	
snore	
snagged	
snipping	
snide	
snorkel	
snowball	

APPENDIX F

TIME-SPACE PROBES

TIME-SPACE PROBES

SUBJECT A

Target Phoneme	Non-target Phoneme
doom	bunny
neat	empty
luck	gap
could	eager
lights	smear
hopes	makes
shout	melon
swipe	
leap	

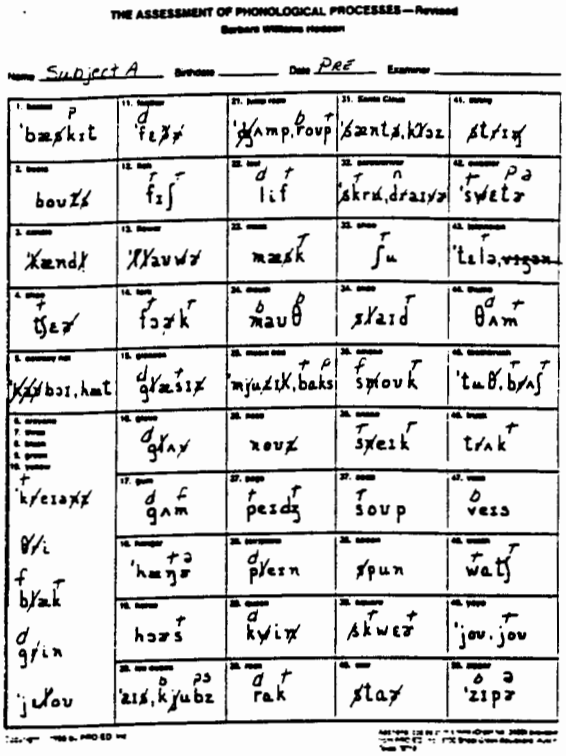
SUBJECT B

Target Phoneme	Non-target Phoneme
snub	shadow
sweater	squat
spin	strike
smack	melon
steep	slope
scout	plow
lake	earth
ripe	troop
brick	

APPENDIX G

PRE- AND POST-TEST PHONEMIC TRANSCRIPTIONS OF ASSESSMENT OF PHONOLOGICAL PROCESSES—REVISED

PRE- AND POST-TEST PHONEMIC TRANSCRIPTIONS OF ASSESSMENT OF PHONOLOGICAL PROCESSES—REVISED

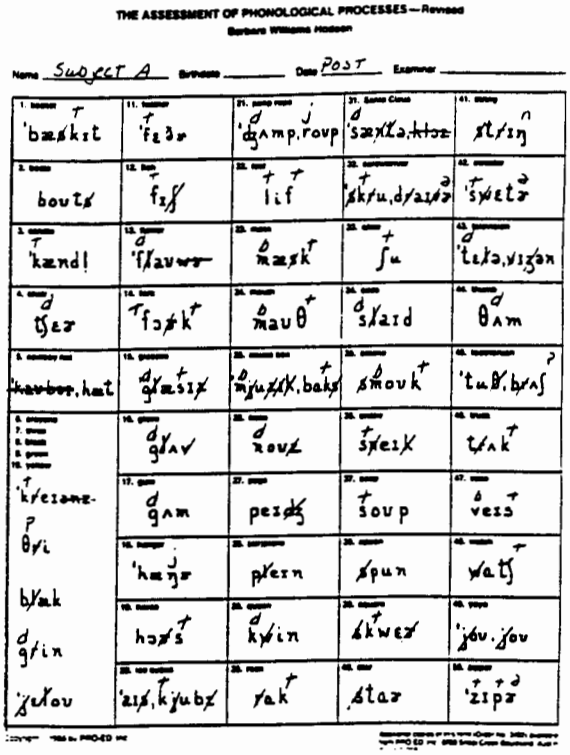


THE ASSESSMENT OF PHONOLOGICAL PROCESSES—Revised

Barbara Williams Hodson

Name Subject A Birthdate _____ Date PRE Examiner _____

'bæɹkɪt	'fɛɜ˞	'ɡʌmp,rovp	'ɹæntɹ,kʏɔz	'stɹɪŋ
bouts	fɪʃ	'lif	'skɹu,dɹaɪɹə	'swɛtə
'kændl	'flaʊə	'mæsk	'ʃu	'tɛlə,vɪʒən
'tʃɛɹ	'fɔɹk	'maʊθ	'sɹaɪd	'θʌm
'kaʊbɔɪ,hæt	'gɹæsɪɹ	'mjuzɪk,baks	'smouk	'tuθ,bɹʌʃ
'kɹeɪənz	gɹʌv	nouz	'sneɪk	'tɹak
θɹi	gʌm	'pɛɹdʒ	'soup	'vɛɪz
bɹak	'hæŋə	'pɹɛɪn	'ɹpun	'watʃ
gɹɪn	hɔɹs	'kwɪn	'skwɛɹ	'jou.jou
'jɛlou	'ɛɪs,kjubz	'ɹak	'ɹtaɹ	'zɪpə

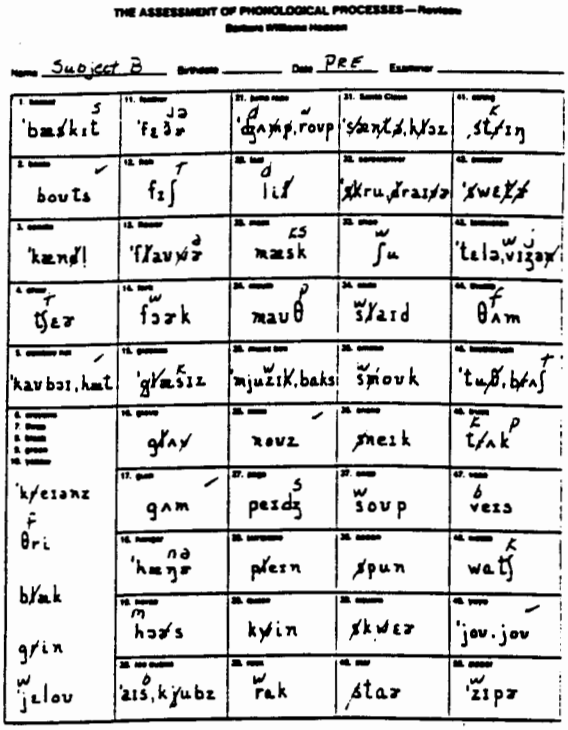


THE ASSESSMENT OF PHONOLOGICAL PROCESSES—Revised

Barbara Williams Hodson

Name Subject A Birthdate _____ Date POST Examiner _____

'bæɹkɪt	'fɛɜ˞	'ʤʌmp,rovp	'sæɹtɹ,kʏɔz	'stɹɪŋ
bouts	fɪʃ	'lif	'skɹu,dɹaɪɹə	'swɛtə
'kændl	'flaʊə	'mæsk	'ʃu	'tɛlə,vɪʒən
'tʃɛɹ	'fɔɹk	'maʊθ	'slaɪd	'θʌm
'kaʊbɔɪ,hæt	'gɹæsɪɹ	'mjuzɪk,baks	'smouk	'tuθ,bɹʌʃ
gɹʌv	nouz	'sneɪk	tɹak	
'kɹeɪənz	gʌm	'pɛɹdʒ	'soup	'vɛɪz
θɹi	'hæŋə	'pɹɛɪn	spun	'watʃ
bɹak	hɔɹs	'kwɪn	'skwɛɹ	'jou.jou
gɹɪn	'ɛɪs,kjubz	'ɹak	staɹ	'zɪpə
'jɛlou				

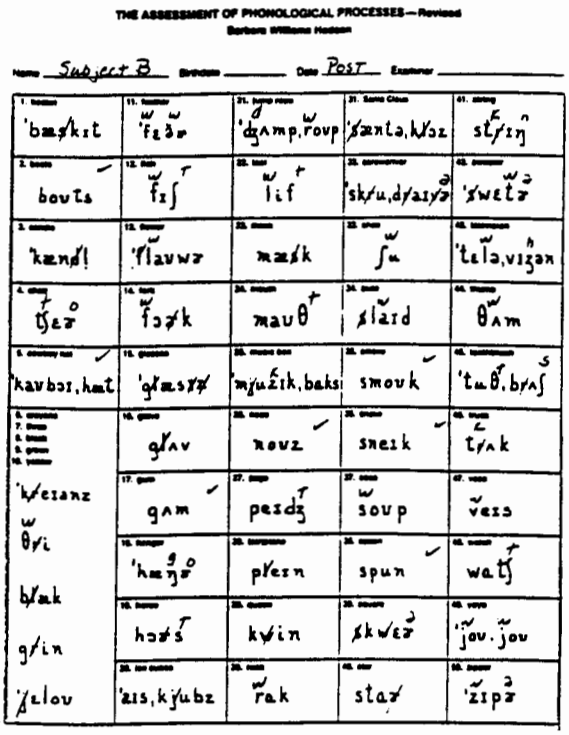


THE ASSESSMENT OF PHONOLOGICAL PROCESSES—Revised

Barbara Williams Hodson

Name Subject B Birthdate _____ Date PRE Examiner _____

'bæskɪt	'fɛɜ˞	'ʤʌmp,rovp	'sæntɹ,kʏɔz	'stɹɪŋ
bouts	fɪʃ	'lif	'skɹu,dɹaɪɹə	'swɛtə
'kændl	'flaʊə	'mæsk	'ʃu	'tɛlə,vɪʒən
'tʃɛɹ	'fɔɹk	'maʊθ	'slaɪd	'θʌm
'kaʊbɔɪ,hæt	'gɹæsɪz	'mjuzɪk,baks	'smouk	'tuθ,bɹʌʃ
'kɹeɪənz	gɹʌv	nouz	'sneɪk	'tɹak
θɹi	gʌm	'pɛɹdʒ	'soup	'vɛɪz
bɹak	'hæŋə	'pɹɛɪn	'ɹpun	'watʃ
gɹɪn	hɔɹs	'kwɪn	'skwɛɹ	'jou.jou
'jɛlou	'ɛɪs,kjubz	'ɹak	'ɹtaɹ	'zɪpə



THE ASSESSMENT OF PHONOLOGICAL PROCESSES—Revised

Barbara Williams Hodson

Name Subject B Birthdate _____ Date POST Examiner _____

'bæskɪt	'fɛɜ˞	'ʤʌmp,rovp	'sæntɹ,kʏɔz	'stɹɪŋ
bouts	fɪʃ	'lif	'skɹu,dɹaɪɹə	'swɛtə
'kændl	'flaʊə	'mæsk	'ʃu	'tɛlə,vɪʒən
'tʃɛɹ	'fɔɹk	'maʊθ	'slaɪd	'θʌm
'kaʊbɔɪ,hæt	'gɹæsɪɹ	'mjuzɪk,baks	smouk	'tuθ,bɹʌʃ
gɹʌv	nouz	sneɪk	tɹak	
'kɹeɪənz	gʌm	'pɛɹdʒ	'soup	'vɛɪz
θɹi	'hæŋə	'pɹɛɪn	spun	'watʃ
bɹak	hɔɹs	'kwɪn	'skwɛɹ	'jou.jou
gɹɪn	'ɛɪs,kjubz	'ɹak	staɹ	'zɪpə
'jɛlou				