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Coexistence of Stuttering and Disordered Phonology in Young Children

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The purpose of the present study was to assess differences in stuttering, phonological, and diadochokinetic behaviors in young children who exhibit both stuttering and disordered phonology and children who exhibit only one of the disorders. Subjects were 21 male children (aged 4 to 6 years), representing three groups of seven children each: (a) stuttering and normal phonological abilities (*S+NP*), (b) stuttering and disordered phonology (*S+DP*), and (c) normal fluency and disordered phonology (*NF+DP*). Stuttering behavior was assessed during a 30-minute conversational speech task; phonological behavior was assessed during a 162 item picture-naming task; and diadochokinetic abilities were assessed during bi- and multisyllable productions. Results indicated that the S+DP group produced significantly more sound prolongations and significantly fewer iterations per whole-word repetition than the S+NP group. However, there were no differences between the two groups in other stuttering indices. Moreover, no differences were noted between the S+DP and NF+DP groups in phonological behavior. Diadochokinetic rates did not differ among the three groups. The possibility of two types of stuttering, one occurring with and one without disordered phonology, is discussed.

Approximately one-third of children who stutter at one time or another exhibit articulation difficulties (Cantwell & Baker, 1985; also see review in Wolk, Conture, & Edwards, 1990). Yet, despite frequent reference to the coexistence of articulation difficulties and stuttering in children (Blood & Seider, 1981; Bloodstein, 1987; Cantwell & Baker, 1985; Daly, 1981; Louko, Edwards, & Conture, 1990; McKay & MacDonald, 1984; Riley & Riley, 1979; St. Louis & Hinzman, 1988; Thompson, 1983; Van Riper, 1982; Williams & Silverman, 1968), there have been few empirical investigations of the nature of these articulation difficulties and their relation to stuttering in children. Thus, little is known about the nature of these two disorders when they coexist in young children. Moreover, only recently have investigators begun to consider stutterers' speech sound production difficulties from a linguistic (i.e., phonological) perspective (Louko, Edwards, & Conture, 1990), and no studies have contained detailed phonological investigations.

As Bloodstein (1987) stated, "There is hardly a finding more thoroughly confirmed in the whole range of comparative studies of stutterers and nonstutterers than the tendency of stutterers to have functional difficulties of articulation, 'immature' speech, and the like" (p. 219–220). It seems, then, that the prevalence of articulation difficulties in roughly one-third of young stutterers is greater than what would be expected in a typical population (2 to 6.4%) (Beitchman, Nair, Clegg, & Patel, 1986; Hull, Mielke, Timmons, & Williford, 1971). Thus, articulation disorders appear to be the communication disorder most commonly associated with stuttering.[1]

[1]There are also reports of "language delay" in young children who stutter, although it does not appear to be as well documented nor as prevalent in young stutterers as articulation difficulties (Bloodstein, 1987). For a detailed review of language disorders associated with stuttering, see Nippold (1990).

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In a recent critique of the literature on concomitant speech and language disorders in children who stutter, Nippold (1990) highlighted several methodological problems that tend to limit the overall conclusions that can be drawn from the studies on articulation disorders in young stutterers. These are (a) the use of parental interview or informal observation in place of direct testing of children (Andrews & Harris, 1964; Darley, 1955; Seider, Gladstein, & Kidd, 1982); (b) the absence of data establishing test-retest and interscorer reliability of articulation assessment (Blood & Seider, 1981; McDowell, 1928; Williams & Silverman, 1968); (c) the difficulty in distinguishing true articulation errors from manifestations of stuttering (Schindler, 1955); and (d) the absence of ethnic and linguistic background matching criteria.

An understanding of the relationship between stuttering and articulation difficulties in young children appears to be important at several levels. At a conceptual level, it may be important to discover possible common factors underlying the two disorders. It is speculated that these two disorders may somehow interact with and/or relate to one another. In addition, the absence of both of these disorders is fundamental to accurate, intelligible speech production. Further, both behaviors would appear to be dependent, at least in part, on optimal temporal programming and sequencing. At a descriptive level, clinicians and researchers alike would benefit from knowing whether there are differences in the stuttering behaviors of children who stutter *and* exhibit disordered phonology versus those who only stutter. Similarly, it should be important to discover whether there are differences in the articulatory/phonological behaviors of children who stutter *and* exhibit phonological difficulties versus those who only exhibit disordered phonology.

In general, there have been few speculations about the importance of young stutterers' concomitant speech and language problems, but the following three views appear to be representative. The first view, which takes a psychosocial perspective, is discussed by Bloodstein (1975, cited in Bloodstein, 1987). He suggested that children with communication disorders are more likely to acquire a sense of failure as speakers and thus learn to struggle with their speech attempts. A second view refers to a common predisposition underlying the two problems (stuttering and other speech and/or language problems); that is, they are caused to some extent by the same underlying variable (Bloodstein, 1987, p. 221). For example, West, Kennedy, and Carr (1947, p. 93) suggested that stuttering and speech retardation frequently appear in the same individuals because they have inherited a common predisposition to both conditions. A third view is perhaps a subcategory of the second view, in that both stuttering and associated speech/language problems are speculated to be caused by the same phenomenon—specifically a "central neurological processing deficit" (Byrd & Cooper, 1989). Two empirical studies provide some support for this third view (Byrd & Cooper, 1989; Yoss & Darley, 1974). For example, Byrd and Cooper (1989) compared 16 children with stuttering, 15 children with developmental apraxia of speech (DAS), and 15 normally speaking children (aged 4 to 9 years) on their performance on the Blakely Screening Test for Developmental Apraxia of Speech (STDAS). They found no significant differences between the stuttering and DAS groups on seven out of eight subtasks, suggesting additional support for the hypothesis that a central neurological processing deficit may be one of the etiological factors in stuttering.

It has been further speculated that children who exhibit both stuttering and articulation difficulties are also likely to exhibit delays/disorders in neuromotor behavior (e.g., Daly, 1981; Van Riper, 1982). However, there has been limited empirical investigation of this issue. It is possible that such delays/disorders in neuromotor behavior may relate to disruptions in "temporal programming" for speech, thought by many to be central to the problem of stuttering (e.g., Caruso, Abbs, & Gracco, 1988; Kent, 1983, 1984). Thus, the temporal aspects of speech production appear worthy of investigation in children who exhibit both articulation difficulties and stuttering.

Several studies have shown that stutterers may differ from their matched controls in their oral-motor abilities (Grimes & Healey, 1985; Riley & Riley, 1979, 1985). Perkins, Rudas, Johnson, and Bell (1976) coined the term "oral motor discoordination" (OMD) to refer to motoric difficulties observed in some stutterers. Van Riper (1982), in his description of stuttering as a "disorder of coordination," speculated that speech timing, slow reaction times, and airflow differences during perceptibly fluent speech may differentiate the speech production of some stutterers from that of nonstutterers.

Studies of the relationship between articulation difficulties and general motor skills have yielded inconsistent and inconclusive results (Jenkins & Lohr, 1964). The specific relation between oral-motor skills and articulation/phonological difficulties is as yet uncertain (Bernthal & Bankson, 1988). Some studies have shown that children with one articulation error (e.g., /s/ or /r/ misarticulations) perform more poorly on diadochokinetic tasks than their normally speaking peers (Dworkin, 1978; McNutt, 1977). However, no studies appear to be available regarding the diadochokinetic abilities of children who exhibit many misarticulations and low intelligibility, that is, children with disordered phonology.[2]

In the present study, which concerns children with disordered phonology, speech sound errors are described according to *phonological processes*. These are defined as systematic sound changes that affect classes of sounds (e.g., velars, fricatives) or sound sequences (e.g., /s/ plus sonorant clusters, such as /sw, sl/, etc.) (Edwards & Shriberg, 1983, p. 31). *Diadochokinesis* is defined as "the performance of rapid, alternating, and repetitive bodily movements such as opening and closing the jaws or lips, raising and lowering the eyebrows, or tapping the finger" (Wood, 1971, p. 11). For the purposes of this study, diadochokinesis relates specifically to the rapid, alternating, and repetitive production of speech

[2]Some researchers have questioned the usefulness of rapid syllable repetition tasks (diadochokinesis) in assessing motor control of the articulatory mechanism (McDonald, 1964; Winitz, 1969). For example, it has been suggested that diadochokinesis assesses alternating contraction of opposed muscles rather than the simultaneous contraction of different muscle groups necessary to produce the complex patterns of overlapping movements required for speech production (McDonald, 1964). Thus, it may not be possible to adequately interpret results of these studies until the relationship between diadochokinesis and the ability to articulate sounds in context is further clarified (Bernthal & Bankson, 1988).

sounds. Finally, the term *temporal programming* (or *temporal organization*) is defined as "... essentially a time plan or pattern useful for both perceptual processing of sequential patterns and for the regulation of motor sequences" (Kent, 1984, p. 283).

The purpose of the present study was to investigate stuttering, phonological, and diadochokinetic behaviors in young children who exhibit both stuttering and disordered phonology and to compare these behaviors to those of children who exhibit each disorder in isolation.

Method

Subjects

Twenty-one young male English-speaking Caucasian children (aged 4:2 to 5:11 years) participated in this study. There were three groups of seven children each ($N = 21$):

- stuttering with normal phonological abilities (S+NP)
- stuttering with disordered phonology (S+DP)
- normal fluency with disordered phonology (NF+DP)

All children participated in this study *before* receiving any prescribed speech-language treatment.

Subjects were paid volunteer participants who were naive as to the precise purpose and methods of this study. They were referred by their parents, speech/language pathologists, preschool, and elementary classroom personnel. All children were from the Central New York area. All subjects participated in one data collection session, which lasted 2 to 3 hours.

Subject selection for all groups began with a parent questionnaire administered at the subjects' homes by the first author. The purpose of this questionnaire was to obtain, for each child, personal and demographic information: medical history (including any history of middle-ear infections), visual and hearing acuity, and history of any previous speech, language, or hearing assessment and/or treatment. During the home visit, the first author also engaged in play activities with the child while audiotape recording a spontaneous speech sample. The recording was used to perform an informal screening evaluation of the child's speech fluency, articulation, and language abilities. In addition, each child was given an oral peripheral examination, as well as a formal language test. These data, together with the first author's clinical experience, enabled her to determine whether a given child was a suitable subject for the study.

All subjects met the following criteria for selection:

- no prior articulation, language, or stuttering treatment
- normal hearing as determined from pure tone evaluations (bilateral testing at 25 dB SPL from 250 to 4000 Hz) and tympanometry (impedance audiometry from 800 to 3000 ohms)
- English as a native language with no known or reported influence of a bilingual background or significant exposure to any language other than English in the home
- normal receptive and expressive language functioning, as determined by the Northwestern Syntax Screening Test (NSST) (Lee, 1969)
- no known or reported neurological illnesses or trauma
- no evidence of oral muscular weakness or dysarthria as determined by an oral peripheral examination
- no known or reported difficulties in behavioral and/or intellectual functioning
- adequate general and oral motor functioning as determined by the Selected Neuromotor Task Battery (SNTB), a measure developed for this study (see Wolk, 1990, for a detailed description).

One-way analyses of variance (ANOVAS) failed to yield significant differences among the three groups in terms of age, $F(2, 18) = 2.18$; receptive language, $F(2, 18) = 3.43$; expressive language, $F(2, 18) = 1.71$; and general neuromotor behavior, $F(2, 17) = 1.975$ (all $ps > 0.05$].

Criteria for Group Classification

Stutterer. A child was classified as a "stutterer" (S) if he met both of the following criteria:

- exhibited *three or more* within-word disfluencies (sound/syllable repetitions, sound prolongations, or monosyllabic whole-word repetitions) per 100 words of conversational speech (Bloodstein, 1987). [Note: Although this was used as a cut-off point, all subjects exceeded this cut-off. The minimum for any subject was 8.3% stuttering frequency.]
- had people in his environment who had implicitly or explicitly expressed concern regarding his speech fluency and/or believed that he was a stutterer or highly at risk for becoming one.

Disordered phonology. A child was classified as having "disordered phonology" (DP) if he fulfilled *either* of the following criteria as assessed in a conversational speech task and analyzed using the processes in Edwards and Shriberg (1983):

- exhibited *at least two* age-inappropriate phonological processes, each of which had at least four opportunities to apply and affected at least 25% of all relevant items (McReynolds & Elbert, 1981).
- exhibited *one or more* "unusual" or "atypical" phonological processes, that is, processes not typical of normal development (Edwards & Shriberg, 1983; Stoel-Gammon & Dunn, 1985), each of which had at least four opportunities to apply and affected at least 25% of all possible items.

Normal fluency. A child was classified as "normally fluent" (NF) if he met *both* of the following criteria:

- exhibited *two or fewer* within-word disfluencies per 100 words spoken. This is in keeping with Zebrowski's (1987) finding that 10 normally fluent children, aged 2–5 years, produced a mean of 1.2 (range = 1–2) within-word disfluencies per 100 words spoken and Conture and Kelly's (1991) finding that in a sample of 30 normally fluent children a mean of 0.7 ($SD = 0.6$) within-word disfluencies per 100 words spoken were produced.
- no implicit or explicit concerns expressed by people in the child's environment about his speech fluency or the belief that he was a stutterer or highly at risk for becoming one.

Normal phonological abilities. A child was classified as having normal phonological abilities (NP) if he met *either* of the following two criteria:

- exhibited *no* speech sound production errors.

- had essentially intelligible speech and exhibited only phonological processes that are typical of normal development and appropriate for his age (Edwards & Shriberg, 1983; Grunwell, 1982; Stoel-Gammon & Dunn, 1985).

Testing/Speaking Conditions

Two speaking conditions were employed for the elicitation of speech: (a) a conversational speech task (CST), for the perceptual analysis of speech disfluencies, and (b) a picture naming task (PNT), for the perceptual analysis of phonological errors. The third task was a diadochokinetic task (DDK).

Conversational speech task (CST). The CST involved a loosely structured conversation between mother and child, lasting approximately 30 min. The conversation was centered around a common set of toys, used for all children. A sample of 300 words of conversational speech was collected during the middle 10 min of each 30-min conversation.

Picture naming task (PNT). A picture-naming task was selected for the perceptual (as opposed to acoustic) analysis of phonological errors in order to obtain a large and well-controlled sample. None of the published phonological assessment procedures (e.g., Grunwell, 1985; Hodson, 1985, 1986; Shriberg & Kwiatkowski, 1980) met the specific needs of this study because they tended to use smaller and less diverse speech samples and/or to assess a smaller number of phonological processes. Thus, they do not provide an adequate opportunity to elicit a wide range of consonant cluster sequences or words that vary in syllable structure and length. Therefore, a PNT was designed for the present study. Some 162 simple line drawings were formulated to elicit all English consonant sounds in initial, medial, and final word positions, as well as a wide variety of word-initial clusters. An attempt was made to obtain spontaneous (i.e., nonimitated) productions of all 162 words on the PNT, but it was sometimes necessary to elicit delayed imitations in which a verbal model was provided, followed by a comment about the picture—for example, "That's called a _____. We use these to . . . Do you remember what this is called?" A detailed description of this procedure is provided in Wolk (1990) and is further discussed in relation to other methods of elicitation in Wolk and Meisler (1992).

A diadochokinetic task. A diadochokinetic (DDK) task was administered to assess the subject's ability to rapidly sequence speech sounds with a reasonable degree of precision. Although this has been extensively studied in the past for some speech behaviors (Dworkin, 1978; McNutt, 1977), there is limited information regarding the DDK abilities of children between ages 4 and 6 years. To ensure that the sounds used for the test had (a) a high probability of being correctly produced by children in this age group, and (b) facilitated voiced/voiceless transitions or sequencing, the DDK tasks used in this study included the production of eight sound sequences, each elicited in three trials. Four sequences were selected: /pʌpʌ/, /pʌtʌ/, /tʌkʌ/, and /pʌtʌkʌ/, as well as their voiced counterparts: /bʌbʌ/, /bʌdʌ/, /dʌgʌ/, and /bʌdʌgʌ/. The reduplicated bilabials /pʌpʌ/ and /bʌbʌ/ were deliberately included so as to provide the phonologically disordered children with an opportunity to produce a relatively simple sequence as correctly and intelligibly as possible.

Initially, the child was given an opportunity to practice rapid productions with simple monosyllabic productions and was then instructed to do the same for each of the eight sound sequences (voiceless-voiced pairs were presented in succession) on three separate trials. For each trial, the researcher determined (from videotape recording, to be discussed below) DDK rate, which refers to the number of seconds it took for the child to produce 10 repetitions of a particular sound sequence.

General Procedures

Instrumentation

Each child was audio- and video-recorded in a room specially designed for the experimental testing of young children. This room has been treated to minimize ambient electrical and acoustic noise and to maximize frequency and amplitude responses of all audiovideo and audio recordings. The conversational speech task, the picture naming task, and the diadochokinetic tasks were all audio- and videotaped in this room.

Two high quality Panasonic color video cameras (Models WV-3500 and WV-3250) were used, one directed toward the child and a second toward the mother, positioned to obtain a clear video image of the mother's[3] and the child's head, neck, upper torso, hands, and arms. The output of each camera was channeled to a Panasonic video switcher (Model WJ-3500) where the two signals were multiplexed, or combined, to form a split-screen composite, with the child occupying the left- and the mother the right-half of the screen of a Sony color television monitor (Model Trinitron). The output of an Evertz time code generator/reader (Model 3600D) was fed through the switcher, and the Evertz's visually apparent time code (Minutes:Seconds:Videoframes) was time-locked to the videotape recording of the mother-child interaction and visually displayed on the upper central portion of the split-screen composite image. Provision of a visible time code has been shown to assist significantly in locating selected portions of data during reiterative viewing and/or subsequent analysis of audiovideotaped behavior (Conture, Schwartz, & Brewer, 1985).

The video composite image (together with the time-locked visually apparent time code) was recorded on a Panasonic 1.25 cm videocassette recorder (Model AG 6500), along with the associated acoustic signals from mother and child. The child's audio signal was obtained using either a Sony (Model ECM-50) or Samson (Model CR-2X) lapel microphone placed on the child's clothing at a distance of approximately 15 cm from his mouth. Mothers were fitted with a Unex

[3]Each mother's audio and video signals were recorded together with her child's signals because it has been found that valuable perspective on the child's fluent and disfluent utterances and related behaviors are gained in this way. In addition, the researcher is able to disambiguate some of the child's utterances and behaviors if both the child's and the mothers' face and neck, upper torso, hands and arms (plus associated audio signals) are simultaneously videotaped (e.g., Schwartz & Conture, 1988; Conture & Kelly, 1991).

headset microphone (Model HS-1 A101) placed at a distance of 5 cm from the mother's mouth. Both mother and child's audio signals were simultaneously recorded and were stored on separate audio channels of the VCR, along with the video signals.

Neutral-toned cloth backdrops were placed behind both the child and the mother to provide a consistent background for maximum clarity and contrast of the recorded video images. Two Lowel 1000-watt studio lights were positioned, facing the taping areas from opposite sides, to provide additional illumination for a consistently clear video image. [At the time of analysis, the VCR was controlled by means of a Panasonic video editor (Model AGA750), which also permitted subsequent viewing of recorded data from stop motion through real time.] Transcription and analysis of speech disfluencies and phonological behaviors as well as the DDK rates were accomplished using the video editor unit, VCR, and video monitor.

Data Collection

Each child was tested individually. The entire three-task assessment battery (i.e., CST, PNT, and DDK tasks) took 2 to 3 hours per child, including two 10-min breaks to minimize the child's fatigue, distractions, and/or restlessness. Order and sequence of presentation of these three tasks was randomized across all subjects.

Analysis Procedures

Stuttering. The video recording of each child's spontaneous speech sample, between the 10th and 20th min, was subsequently viewed from stop motion through real time, and a 300-word sample was taken from this middle portion. The following measures of speech disfluencies were made for all children:

- mean frequency and range of all speech disfluencies per 100 words spoken, based on the 300-word sample
- mean frequency of each different type of within-word disfluency (for example, sound prolongations) per 100 words spoken based on the 300-word sample, as well as each disfluency type's relative proportion of the total number of speech disfluencies
- the mean duration (from onset to offset) in msec of 10 randomly selected within-word speech disfluencies produced by each child during his 300-word conversational speech sample. Measures of duration were determined by using the video editor to stop the videotape and record the visually apparent time code associated with the perceived onset and offset of the selected within-word disfluency.
- the mean number of iterations (repeated units) per sound/syllable repetition (SSR) and monosyllabic whole-word repetition (WWR) for 10 randomly selected disfluencies (SSRs and WWRs) from the total sample of 300 words. For example, in the sound/syllable repetition "b-b-baby" there are two repeated sounds.
- score on the Stuttering Severity Index (SSI) (Riley & Riley, 1980)
- the mean rate of speech in words per min. Rate of speech was calculated *excluding* the time accounted for by within- or between-word disfluencies (i.e., articulation rate) (Costello, 1983; Pindzola, Jenkins, & Lokken, 1989). The mean rate of speech calculated was on the basis of 10 randomly selected phrases from the middle 10 min of each child's total conversational speech sample.

Phonological behavior. The following determinations were made for each child:

- The "phonetic inventory" refers to the phones that each child produced (even if used only as substitutes) in each position in the word, classified by place and manner of articulation. This determination was made in order to observe the breadth of sound distributions as well as any phonotactic constraints (i.e., the production of sounds only in restricted positions and/or phonetic environments) (Edwards & Shriberg, 1983).
- Each subject's Percentage of Consonants Correct (PCC) was calculated based on procedures described by Shriberg and Kwiatkowski (1982). However, in this study PCC was based on the PNT rather than on conversational speech. Thus, PCC refers to the percentage of consonants correctly produced in the sample out of the total number of consonants attempted. In this study, each child's PCC was calculated based on the 566 consonants sampled in the 162 stimulus items of the PNT (e.g., 300 correctly produced consonant/566 total consonants = PCC of 53%).
- Twenty-seven common phonological processes were investigated in this study. (Pilot work had shown that these 27 were the most frequently occurring in children in the age group in this study.) The phonological processes or "systematic sound changes" evident in each child were determined on the basis of the sample derived from the PNT. For each of the 27 processes, the possible number of occurrences for that process was calculated for the entire 162-item PNT and this number was then used to calculate a percentage of occurrence for each process for each subject. For example, if a child exhibited 15 instances of liquid-cluster reduction out of 30 possible occurrences, his percent occurrence for this process was 50%. This calculation was carried out for all 27 phonological processes for each child. The percent occurrence of each process for each group was then calculated, and the rank order of the 15 most frequently occurring processes was determined for each group. The percent occurrence of selected "typical" versus "atypical" phonological processes was also determined and compared for the two DP groups. A "typical" process refers to one that is well documented in normal phonological development—for example, velar fronting (cow → [tao]), whereas an "atypical" or unusual process is one that occurs rarely, if at all, in normal phonological development—for example, velarization (tie → [kaɪ]) (Edwards & Shriberg, 1983).
- Process Density Index (PDI) refers to the average number of process applications per word. To calculate PDI for each child, the number of process applications was calculated for each word. For example, if *ski* is produced as [gi], two process applications (/s/–Cluster Reduction and Initial Voicing) were counted for that word. Process applications were then totalled, and the total was divided by the number of

test words, in this case 162. An overall group PDI was also calculated for each subject group.

Diadochokinetic rates. All DDK rates were measured *excluding* any overt instances of stutterings (i.e., eliminating any apparent instances of stuttering-like repetitions or prolongations of sounds). In addition, phonological errors were ignored in scoring diadochokinetic rates, because reliably determining phonetic accuracy during these diadochokinetic rate tasks proved to be very difficult. For example, if a child produced /k/ → [t] because of velar fronting, the child's DDK rate was still assessed for whichever English sounds he could produce (in this example [t]). DDK rates for voiced and voiceless pairs (e.g., /bʌbʌ/ and /pʌpʌ/ were averaged because preliminary analysis of the data indicated only minimal between-group differences in DDK between the voiced/voiceless DDK pairs across all three groups.

Interjudge and Intrajudge Measurement Reliability

To establish interjudge measurement reliability, all of the data for one child in each group (i.e., 1/7 of the data) were transcribed and reanalyzed by another clinical phonologist or speech-language pathologist who had had experience with the assessment of stuttering and phonological disorders. To establish intrajudge measurement reliability, all of the data for one child in each group were retranscribed and analyzed by the first author 6 to 12 months after she had done the initial transcription and analysis. Sander's (1961) Agreement Index [AI] was used to assess intra- and interjudge measurement reliability for all measures, that is, AI = Agreements/[Agreements + Disagreements] (Sander, 1961).

Reliability of investigator's judgment of disfluency. For fluency measures, intrajudge and interjudge measurement reliabilities, respectively, were as follows: frequency of stuttering, 0.94 and 0.88; speech disfluency types, 0.97 and 0.93; duration of stuttering, 0.91 and 0.84; number of iterations per sound/syllable repetition, 0.98 and 0.98; number of iterations per whole-word repetition, 1.0 and 1.0; stuttering severity, 0.98 and 0.93; and rate of speech, 0.94 and 0.89.

Reliability of investigator's judgment of phonological abilities. For phonological measures, intrajudge and interjudge measurement reliabilities, respectively, were as follows: phonetic transcriptions, 0.99 and 0.90; percentage consonants correct (PCC), 0.99 and 0.99; the phonological process analysis, 0.98 and 0.92; and process density index (PDI), 0.98 and 0.95.

Reliability of investigator's judgment of diadochokinetic rates. Intrajudge and interjudge measurement reliability for diadochokinetic rates were 0.97 and 0.96, respectively.

Data Analyses

The relatively small number of subjects per group ($n = 7$), as well as the total number of subjects ($N = 21$), suggested that it was most prudent to employ descriptive as well as nonparametric inferential statistical procedures to assess certain aspects of the results. Thus, Mann-Whitney U tests and Kruskal-Wallis analyses of variance were employed for the purposes of investigating between-group differences with regard to stuttering, phonological behaviors, and DDK rates because of such factors as sample size and because these data appeared to violate the normality assumptions needed for parametric statistics.

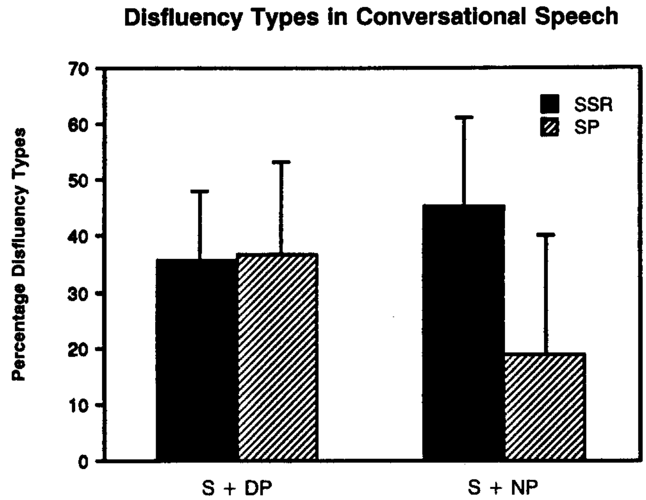

FIGURE 1. Mean percent Sound Prolongations (SP) and Sound/Syllable Repetitions (SSR) per total disfluencies during 300-word conversational speech sample for S+DP (*n* = 7) and S+NP (*n* = 7) children. (T) = one standard deviation above mean.

Results

Stuttering Behaviors

Results pertinent to stuttering behaviors will be discussed and illustrated for both groups of stutterers, those with and without phonological concerns (S+DP and S+NP).

Frequency: Conversational Speech Task. The group mean percent stuttering frequency during the 300-word CST for each of the two groups of stutterers (S+DP and S+NP) showed that there were no significant differences in stuttering frequency between the S+DP ($M = 15.19$) and S+NP ($M = 22.33$) groups [$U = 11.5$, $p > 0.096$].

Frequency: Picture Naming Task. Group mean stuttering frequency on the Picture Naming Task (PNT) was similar for both S+NP and S+DP children (M = 7.76%, Range 0.62–37.03%; and M = 7.14%, Range 0.62–26.34%, respectively). Although the overall stuttering frequency was much lower on the PNT than on the CST, for both groups, there was a very strong correlation between stuttering frequency on the 162-item PNT and the 300-word CST ($r = 0.89$, $p < .0001$).

Disfluency Type: Conversational Speech Task. As shown in Figure 1, during the CST there was a significant difference in percent sound prolongations (SP) between the S+DP (M = 36.68%) and S+NP (M = 18.94%) talker groups [$U = 42.0$ $p < 0.025$]. There was, however, a nonsignificant difference [$U = 18.0$; $p > 0.41$] in percentage of sound/syllable repetitions (SSR) between S+DP (M = 35.58%) and S+NP (M = 45.37%) groups.

Disfluency Type: Picture Naming Task. During the PNT the difference in sound prolongations between the S+DP (*M*

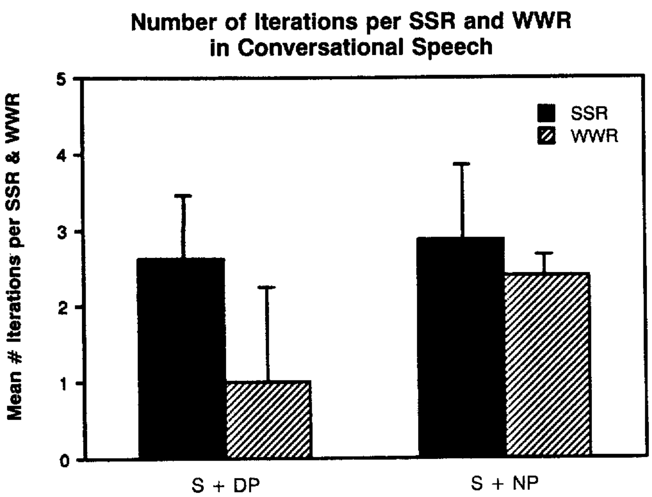

FIGURE 2. Group mean number of iterations per Sound/Syllable Repetition (SSR) and Whole Word-Repetition (WWR) for S+NP (n = 7) and S+DP (n = 7) children. (T) = one standard deviation above mean.

= 45.21) and S+NP (M = 36.68%) groups was nonsignificant [U = 32.0 p > .319]. Similarly, during the PNT the difference in sound/syllable repetitions between the two groups was nonsignificant [U = 17 p > .319] based on the PNT. There was a moderately strong correlation between SSRs on the PNT and on the CST (r = .46, p < .10) for both groups and a very strong, significant correlation for SPs on these two tasks (r = .83, p < .001).

Duration of within-word disfluencies. There was no statistically significant difference [U = 15, p > 0.225] in mean stuttering duration (msec) between S+DP (M = 0.99) and S+NP (M = 1.71) children.

Number of iterations (repeated units) per Sound/Syllable Repetition (SSR) and Whole-Word Repetition (WWR). Figure 2 illustrates the mean number of iterations (repeated units) per sound/syllable repetition (SSR) and whole-word repetition (WWR) for S+NP and S+DP groups. The difference in the number of iterations (repeated units) per SSR between S+DP (M = 2.63) and S+NP (M = 2.87) children was nonsignificant [U = 15.0, p > .22]. However, S+NP (M = 2.4) children produced significantly more iterations per WWR than did the S+DP (M = 1.0) children [U = 8.5, p < 0.037].

Stuttering Severity Index (SSI). There was no statistically significant difference in the total SSI score between the S+DP (M = 18.86) and S+NP (M = 20.29) talker groups [U = 16.5, p > 0.302].

Rate of speech. There was no statistically significant difference in speaking rate[4] in words per minute (w.p.m.) between S+DP (M = 188.73 w.p.m.) and S+NP (M = 187.42 w.p.m.) children [U = 17.0, p > .338].

Phonological Behaviors

The phonological results are discussed and illustrated for both groups of phonologically disordered children, those with and without stuttering (S+DP and NF+DP).

Phonetic Inventories. Due to the qualitative nature of the phonetic inventories of S+DP and NF+DP children, they will be discussed descriptively. In essence, there was little appreciable difference in the phonetic inventories between the two groups of children with disordered phonology. For both DP groups, stops, nasals, glides, and the liquid [l] were most often present in the phonetic inventories, whereas fricatives and, to a lesser extent, affricates were more commonly absent for these children. As might be expected given the age of these subjects, the liquid [r] was the sound most commonly absent for both groups of children.

Percentage Consonants Correct (PCC). There was no significant difference in PCC between S+DP (M = 58.07%) and NF+DP children (M = 51.81%) [U = 33.0 p > .48]. In fact, PCC was strikingly similar for both groups of phonologically disordered children. The mean for both groups fell within the "moderate-severe" range (50–65%) according to Shriberg and Kwiatkowski (1982). (Note, however, that Shriberg and Kwiatkowski's severity ratings are based on conversational speech.)

Process Density Index (PDI). Differences in PDI approached but did not reach statistical significance between the S+DP (M = 1.57) and NF+DP (M = 2.11) groups [U = 12.0; p > .10].

Phonological processes. Twenty-seven phonological processes were investigated based on the PNT. Table 1 contains a list of the 15 most frequently occurring phonological processes (which account for 55.5% of all processes exhibited) in descending rank order for the S+DP and NF+DP groups. Note that the rank ordering for the five most frequently occurring processes is identical for the two groups of phonologically disordered children (S+DP and NF+DP). These are Vocalization, /s/–Cluster Reduction, Gliding of Liquids, Liquid-Cluster Reduction, and Velar Fronting in descending order. The rank order is different, however, for the next 10 processes. Cluster Reduction (CR) (including both /s/–CR and liquid-CR) was the most prevalent age-inappropriate process for both DP groups, with /s/–CR being somewhat more frequent than Liquid-CR. Velar Fronting, Depalatalization (Palatal Fronting), and Labialization occurred frequently for both groups of DP children, with Velar Fronting being the most common change in place of production for both groups (rank = 5). Table 1 shows the results of 15 separate Mann-Whitney U tests that were used to compare percent occurrence of these processes between the two groups. There were no significant differences in percentage occurrence for any of the 15 processes between the two groups of DP children.

As mentioned above, the most frequent syllable structure change was Cluster Reduction, which evidenced a high percent occurrence for both groups of DP children. Both groups of children also exhibited Weak Syllable Deletion (9.05% for S+DP children and 7.14% for NF+DP children) and Syllable Coalescence (7.14% for both groups). Both of these processes involve reduction in the number of syllables

[4]As previously mentioned, rate of speech was calculated *excluding* all within- and between-word disfluencies (Costello, 1983; Pindzola et al., 1989).

TABLE 1. Rank order of the 15 most frequently occurring phonological processes for S+DP and NF+DP groups, as well as the statistical tests conducted on each process.

	S+DP[a] (n = 7)				NF+DP[b] (n = 7)		
Process	Mann-Whitney U Test Statistic	p-value[c]	# Applications/ # Opportunities	% Occurrence	Process	# Applications/ # Opportunities	% Occurrence
VOC	29.00	$p > .561$	222/273	81.32	VOC	199/273	72.90
/s/-CR	17.50	$p > .370$	111/245	45.31	/s/-CR	167/245	68.16
GL	23.50	$p > .898$	273/630	43.33	GL	265/630	42.06
Liq-CR	25.00	$p > .949$	149/455	32.75	Liq-CR	186/455	40.88
VF	15.50	$p > .248$	93/525	17.71	VF	185/525	35.24
INT	26.50	$p > .790$	136/868	15.78	PF	91/287	31.71
FCD	34.00	$p > .223$	106/763	13.89	LAB	39/126	30.95
PF	16.50	$p > .300$	39/287	13.59	ST	181/889	20.35
IV	20.00	$p > .562$	91/679	13.40	INT	135/868	15.55
LAB	12.50	$p > .110$	13/126	10.32	IV	97/679	14.29
ST	15.50	$p > .250$	86/889	9.67	Seg-CO	78/595	13.11
WSD	23.00	$p > .846$	19/210	9.05	FD	28/238	11.76
Seg-CO	16.00	$p > .272$	44/595	7.40	WSD	15/210	7.14
Syll-CO	23.00	$p > .844$	15/210	7.14	Syll-CO	15/210	7.14
FD	17.00	$p > .307$	7/238	2.94	FCD	31/763	4.06

Notes. VOC = Vocalization; /s/–CR = /s/-Cluster Reduction; GL = Gliding of Liquids; Liq-CR = Liquid Cluster Reduction; VF = Velar Fronting; INT = Interdentalization; FCD = Final Consonant Deletion; PF = Depalatalization (Palatal Fronting); IV = Initial Voicing; LAB = Labialization; ST = Stopping; WSD = Weak Syllable Deletion; Seg-CO = Segment Coalescence; Syll-CO = Syllable Coalescence; FD = Final Devoicing. The rank order for S+DP and NF+DP groups is identical for the first 5 processes, but is different for the next 10 processes.
[a]S+DP = Stuttering and Disordered Phonology
[b]NF+DP = Normal Fluency and Disordered Phonology
[c]The p-value refers to the group comparison for the process to the left.

of multisyllabic words. The percentage of occurrence of Segment Coalescence, which has the same effect as CR, was 7.40% for S+DP and 13.11% for NF+DP children.

Differences in the application of selected "typical" versus "atypical" phonological processes between S+DP and NF+DP groups are presented in Table 2. Due to the lack of normal distribution of scores, inferential statistical procedures were not used on these data. Descriptively, as shown in Table 2, the two atypical processes observed (Velarization and Glottal Replacement) were more common for S+DP children than for NF+DP children, mainly because of the data for one child. Conversely, all of the typical processes were less common for S+DP children than for NF+DP children.

TABLE 2. Mean percent application of selected "typical" versus "atypical" phonological processes exhibited by S+DP and NF+DP children.

	Talker groups	
	S+DP	NF+DP
Typical processes		
Depalatalization (PF)	13.59%	31.71%
Velar Fronting (VF)	17.71%	35.24%
Alveolarization (ALV)	2.66%	5.08%
Labialization (LAB)	10.32%	30.95%
Atypical processes		
Velarization (V)	6.82%*	0.19%
Glottal Replacement (GR)	5.87%	3.41%

Note. A "typical" process refers to a process that is well-documented in normal phonological development, whereas an "atypical" or unusual process is one that occurs rarely, if at all, in normal phonological development.
*Note that this mean reflects the data primarily for one child, because five out of seven children in the S+DP group exhibited 0% Velarization and 1 child exhibited 47-10%.

Diadochokinetic Rates

The diadochokinetic (alternating motion) rate results are presented for all three talker groups in Table 3. Results using a Kruskal-Wallis analysis indicated that there were no significant group differences for any of the DDK measures, that is, for bisyllabic and trisyllabic DDK productions (all $ps > .40$).

Statistical comparisons were made, averaging across the syllables with only voiceless consonants (e.g., /pʌpʌ/) and the syllables with voiced consonants (e.g., /bʌbʌ/) for each of the three groups of children. Results indicated that there were no statistically significant differences between the groups across all of the DDK measures. Regardless of the phonetic context of the syllable, all three groups of children exhibited similar DDK scores.

Discussion

Stuttering

One of the main findings in the present study was the significant difference in sound prolongations (SP) on the CST between young stutterers with and without phonological disorders. That is, S+DP children were more apt to produce "cessation" disfluency types (e.g., SPs) than S+NP children. From the present results, it is hypothesized that sound prolongations may be especially important in the differential diagnosis of young stutterers (see Schwartz & Conture, 1988) and/or may reflect the fact that S+DP children are

TABLE 3. Group mean data for diadochokinetic rates in number of seconds per 10 repetitions of each syllable.

	/pʌpʌ/	/bʌbʌ/	/pʌtʌ/	/bʌdʌ/	/tʌkʌ/	/dʌgʌ/	/pʌtʌkʌ/	/bʌdʌgʌ/
S+DP	5.80	5.15	5.96	5.46	5.82	5.92	10.30	9.64
S+NP	5.51	5.46	6.48	6.00	5.87	6.13	9.76	9.28
NF+DP	6.09	5.51	7.05	6.84	7.17	6.67	12.06	11.31

Note. All *ps* > .40 for between-group differences on all bisyllabic and multisyllabic DDK productions.

beginning to react behaviorally to their speaking difficulties (see Conture, 1990, pp. 23–29 for discussion of sound prolongations as a behavioral index of advances in childhood stuttering). The lack of significant differences in sound prolongations between the two groups of stutterers on the PNT may be due to the fact that during the PNT there were very few disfluencies, with some subjects producing no disfluencies at all. Nevertheless, the *proportions* of SSR to SP disfluency types were similar for the PNT and CST for both groups.

Another seemingly important finding was that children who only stuttered (S+NP) exhibited a significantly higher number of iterations per whole-word repetition (WWR) than did children with both disorders (S+DP). That is, the length of a WWR (in terms of number of repeated units) was greater by about twice as many iterations for S+NP as opposed to S+DP children. This finding is consistent with the nonsignificant trend that S+NP children tended to produce more sound/syllable repetitions, whereas S+DP children tended to produce more sound prolongations and fewer repetitions.

With regard to articulatory rate of speech, there were no significant differences between the two groups of stutterers; in fact, the mean rate of speech in words per minute was strikingly similar for both groups (188.73 w.p.m. and 187.42 w.p.m. for S+DP and S+NP groups, respectively). It should be pointed out, however, that these articulatory rates are in the upper range of "normal" (90th decile and beyond) for adults' overall speaking rate (see Johnson, 1961, Table 3) and appear to be appreciably higher than the speech rate for normally fluent children. For example, Ryan (1984, cited in Pindzola, Jenkins, & Lokken, 1989) found an average overall rate of 160.6 *words*/min in a sample of 2- to 5-year-old children, and Pindzola et al. (1989) reported an articulatory rate of 148 *syllables*/min in 30 3- to 5-year-old children.[5] Thus, the data from the present study suggest that the speech rates of both S+NP and S+DP children (187–188 *words*/min) may indeed be faster than the speech rates of normally fluent children. Importantly, Costello (1983) has proposed that articulatory rates above 180 to 200 *syllables*/min may be too fast to allow a child to produce fluent speech. However, Kelly and Conture (1991) report no significant difference in articulatory speaking rate between normally fluent (N = 13) and stuttering (N = 13) children, but their sample per child (i.e., approximately 100 utterances) was much larger than that of the present study (i.e., 10 utterances). Therefore, although more normative data are needed regarding childrens' speaking rate employing larger, standardized samples, present findings seem to support the clinical practice of attempting to slow down the speech rate of young stutterers (e.g., Conture, 1990, Figure 3-2).

Phonology

There were no statistically significant differences in Percentage Consonants Correct (PCC) or in Process Density Index (PDI) between the two groups of phonologically disordered children. In addition, phonetic inventories were, for the most part, not appreciably different between the two groups of phonologically disordered children. The same *classes* of sounds tended to be absent/present for both DP groups. Certain sound classes, such as fricatives, were clearly more difficult for all the DP children than were other sound classes, such as stops and nasals. These data are in accordance with previous data reported for normally developing and phonologically disordered children (Edwards & Shriberg, 1983; Stoel-Gammon & Dunn, 1985; Weiner, 1979).

There were more similarities than differences in the phonological processes exhibited by the two groups of phonologically disordered children. Although the frequency of occurrence differed somewhat between the two groups for several processes, they were all nonsignificant differences. This could be due, at least in part, to the large within-group variance for each of the two groups. For example, out of seven children in the S+DP group, one child exhibited a relatively high percentage of occurrence of Velarization (47.10%), one child exhibited a low percent occurrence (0.7%), and the other five children exhibited no Velarization. Clearly, for the phonological process analysis, group means do not reflect the essence of the phonological findings for individual subjects. Future case study research may be the most appropriate means for investigating the parameters of individual variation in these children who both stutterer and exhibit disordered phonology. Use of a phonological approach may serve to highlight patterns of disruption not revealed in a traditional sound-by-sound articulation analysis.

For both groups of DP children, Cluster Reduction, particularly /s/–CR, was the most frequently occurring age-inappropriate process. These findings are in agreement with previous studies of phonological disorders (Grunwell, 1982; Hodson & Paden, 1981; Stoel-Gammon & Dunn, 1985).

To our knowledge, this is the first empirical investigation of the phonological behaviors of children who exhibit both stuttering and disordered phonology. Thus, there are few studies with which these results can be compared. One recent investigation into the prevalence of phonological problems of young stutterers (Louko et al., 1990) compared the phonological processes exhibited by 30 4-year-old children

[5]It should be noted that some studies report speech rate in terms of *syllables* per minute, whereas others report speech rate in terms of *words* per minute; Andrews and Ingham (1971) report that the number of syllables per minute can be approximated by multiplying the number of words spoken per minute by 1.5.

who stutter to those exhibited by their normally fluent peers. Louko et al. found that 40% of their young stutterers (versus 7% of their normally fluent peers) exhibited age-inappropriate processes. Further, the stutterers exhibited more atypical processes than their normally fluent peers. Findings were interpreted to suggest that children who exhibit both stuttering and disordered phonology may represent one subgroup of stutterers. Louko et al.'s study corroborates the specific finding of the present study with regard to the general prevalence of cluster reduction (CR) in young stutterers. They found that stutterers exhibited significantly more CR than did age- and sex-matched normally fluent children.

Another study (St. Louis & Hinzman, 1988) explored "articulation deviations" in young stutterers using the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1969), a sound-by-sound approach, rather than a phonological process analysis, thus making it difficult to directly compare findings to those of the present study. Nevertheless, St. Louis and Hinzman found, as with the present study, that ". . . the profiles [of articulation errors] of the two groups of stutterers were similar" (St. Louis & Hinzman, 1988, p. 341).

Diadochokinesis

There were no statistically significant differences in diadochokinetic rates across all four pairs of DDK syllables among the three groups of children. To the extent that DDK scores reflect upon temporal programming and organization for speech, finding no differences in DDK among the three groups suggests that these three groups have no appreciable differences in temporal processing for speech. However, when comparing the findings with normative data, interesting observations can be made. Both groups of stutterers (S+NP and S+DP) obtained mean scores for all voiceless bi- and multisyllables (/pʌpʌ/, /pʌtʌ/, /tʌkʌ/, /pʌtʌkʌ/) that fell exactly at the mean of the "norms" for this age group. By contrast, normally fluent children with disordered phonology (NF+DP) did *not* perform at the expected age level; rather, they obtained mean scores that fell one standard deviation below the age mean for all of the bi- and multisyllables (Fletcher, 1972; Riley & Riley, 1985).

These results are consistent with those of earlier studies of children with mild articulation disorders (Bernthal & Bankson, 1988). For example, McNutt (1977) found that the rate of alternating syllable productions (e.g., /dʌgʌ/) in normally articulating children was faster than that of both children with /s/ or /r/ misarticulations. Similarly, Dworkin (1978) found that children (aged 7 to 12 years) who had lisps were significantly slower than their normal peers for DDK rates on /tʌ/, /dʌ/, /kʌ/, and /gʌ/. These studies, however, examined children who exhibited one articulation error rather than several patterns of sound errors. Thus, very little information is available concerning DDK rates in children who exhibit moderate-severe phonological disorders. Similarly, limited information is available at present regarding DDK rates in young stutterers. Further clarification of the relationships between DDK and phonological abilities, DDK and articulatory speaking rates, and DDK and fluent speech is still needed.

Implications and Conclusions

Findings of this study suggest that children for whom stuttering and disordered phonology co-occur may exhibit some unique patterns of stuttering behavior. These findings support the possibility of behavioral subgroups among children who stutter. That is, for S+DP children there may be an interaction of two speech disorders such that phonological disorders may influence stuttering behavior. On the other hand, phonological findings of the present study suggest that disordered phonology may be "stable" across groups of phonologically disordered children, that is, those who do and do not stutter. In this study, there were few differences in patterns of phonological disruption across the two groups of DP children, despite the co-occurrence of another speech disorder (i.e., stuttering). However, much individual variation in phonology was observed within and between the two DP groups.

One explanation for these findings may be considered within the framework of an "index/dominant disease" versus "co-morbid disease" proposed in the psychiatric literature (e.g., Boyd et al., 1984). According to Boyd et al., in order to demonstrate that a dominant disorder (Disorder A) can influence Disorder B, there are two central principles that must be demonstrated. First, the disorders must wax and wane together. This means that for certain patients, Disorder B occurs only during episodes of Disorder A, and also that successful treatment of Disorder A leads to remission of Disorder B. Second, Disorder B can be divided into two types: one that occurs during episodes of Disorder A and one that is independent of Disorder A.

Although support for this model in the present study is indirect, phonological behavior was similar across the two groups, whereas differences in stuttering were observed. This lends partial support to the notion of two forms of stuttering—one that co-occurs with (and perhaps is dependent on) disordered phonology and one that is independent of disordered phonology. This would suggest a phonological disorder as the index/dominant disorder and stuttering as the co-morbid disorder. Clearly, future research with more sophisticated methodologies, including treatment studies and longitudinal designs, are needed to support or refute this explanation as a model of co-morbidity of stuttering and disordered phonology.

Relatedly, the present data permit speculation regarding differences in stuttering behavior between S+DP and S+NP children. Specifically, S+DP children evidenced more sound prolongations, whereas S+NP children evidenced a trend toward more sound/syllable repetitions. One possible interpretation of this finding is an extension of Stromsta's (1986) theory of "intraphonemic disruptions," proposing sudden intraphonemic interruptions at the level of the syllable. Thus, for the subjects of this study it is proposed that the S+NP children may have greater difficulty at the level of the vowel, or, in the transition from vowel to the initial consonant of the following syllable, giving rise to sound/syllable repetitions. By contrast, the S+DP children may have greater difficulty at the level of the consonant, or transition from consonant to vowel within the same syllable, or consonant to vowel of the following syllable, giving rise to sound prolongations. Because a sound prolongation refers to a fixed articulatory posture, it is suggested that these children reflect a struggle in the selection and/or sequencing and accurate production of specific consonants and consonant sequences.

Future Research and Caveats

Interpretation of the present findings are only speculative because of the small sample size used in this study. Although there were no significant differences among the groups in terms of background variables (e.g., age, language), one cannot rule out the possibility that differences may have existed but remain undetected because of limited statistical power. Future research should include these variables as covariates in order to better determine possible behavioral differences among these groups.

With regard to the inferential statistical procedures employed, the simultaneous error rate is high because of the large number of tests performed. Thus, with the number of between-group comparisons, one cannot rule out the possibility of spurious findings of differences. Therefore, in future research with larger sample sizes, it is possible that one of the two significant findings relative to differences in stuttering between the two groups may not replicate. This, of course, is an empirical issue that must await future investigation.

Future research should explore apparent differences in stuttering behavior between young stutterers with and without phonological concerns. In particular, the proportional differences of stuttering types (sound/syllable repetitions versus sound prolongations) could have important diagnostic, treatment, and prognostic implications. It may be particularly valuable to investigate the simultaneous occurrence of stutterings and phonological disruption (e.g., the co-occurrence of cluster reduction and sound prolongation on a single sound/syllable/word) rather than studying the occurrence of the two disorders at different moments in time. Such research on the actual instances of co-occurrence may provide data relevant to the issue of "timing" in *both* of these speech disorders. Further investigations of the relationship between conversational speech rates and diadochokinetic rates in larger groups of stuttering and nonstuttering children should help us better understand the temporal aspects of both stuttering and disordered phonology, and could have important clinical implications for the treatment of both disorder types. Furthermore, in addition to diadochokinesis, assessing other forms of neuromotor behavior may provide additional information about these groups of children.

In conclusion, it is hoped that this study will stimulate further research into the issue of co-occurring speech-language disorders (see Ruscello, St. Louis, & Mason, 1991), particularly the interrelations between stuttering and disordered phonology in young children. Results of this study suggest that clinicians should give specialized consideration to the diagnostic, treatment, and prognostic implications for children who exhibit both disorders, as opposed to those who exhibit each disorder in isolation. Such consideration should advance our understanding of the co-occurrence of stuttering and disordered phonology and should eventually lead to improved clinical regimes for children exhibiting these disorders.

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