THE VALIDITY OF MULTIPLE READING PASSAGES AS DOCUMENTATION OF SPEECH DISFLUENCY

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TABLE OF CONTENTS

LIST OF TABLES

Introduction

Just as computers revolutionized the way we live, health care reform revolutionized the way rehabilitation specialists work (Alston, 1997). Documentation to satisfy health care providers became a way of life for professionals. Consequently, rehabilitation specialists, such as speech-language pathologists, had to be accountable for the services provided and to assure the quality of therapy.

Harris & Lougeay-Mottinger (1987) stated that efficacy of services is determined by evaluating client progress and therapeutic effectiveness. They defined the assessment of client progress as gathering information regarding the amount of progress compared to the client's initial performance and expected outcome. Measuring performance before and after therapy usually assesses progress.

Since speech-language pathology focuses on modifying behaviors, a logical way to measure progress is to count the occurrence or lack of occurrence of targeted behaviors (Siegel, 1975). Such is the procedure used by clinicians who favor a behavioral approach to stuttering therapy. Dr. Ronald Webster at Hollins College in Roanoke, Virginia (1980) developed one behavioral approach in stuttering therapy. Known presently as the Hollins Fluency System, this program teaches clients to modify stuttering through carefully monitoring specific behavioral "targets." The goal of therapy is speech free of stuttering. To assess the degree to which clients have progressed, Webster counts frequency of stuttering in conversation and reading before and after therapy. Hopefully, stuttering frequency will be less after treatment than before.

Another population of clinicians adopted a more global approach to treatment by emphasizing control rather than the elimination of stuttering. This approach teaches the reduction of fear and avoidance of stuttering prior to modifying stuttering behavior (Van

Riper & Emerick, 1990). Emphasis on developing a positive attitude and desensitization to stuttering are key principles used in this approach. Measurement of progress is not as simple as counting behaviors before and after therapy in this approach. Attitude changes and the client's personal accounts of progress count heavily in determining therapy effectiveness.

Within the domain of stuttering therapy, there are different points of view over measurement procedures used to judge therapy progress (Perkins, Rudas, Johnson & Michael, 1974). Two of the main problems in evaluating treatment effectiveness are personal preferences of measurement techniques and the treatment orientation of the clinician. Most literature indicated that percentage of dysfluency was primarily used to document therapy progress (Bloodstein, 1995). However, percentage of stuttering may not be a valid measure of progress for some therapies. Mallard and Westbrook (1988), for example, suggested that percentages could be misleading measures if clients were following a stuttering modification approach. If a client changes the manner of stuttering from uncontrolled tension to relaxed movements, then frequency counts of dysfluency would not account for this type of progress.

In a recent issue of the Journal of Fluency Disorders, Mowrer (1998) and Mallard (1998a) emphasized the need for alternative means of documenting therapy progress. Mowrer stated that clinical knowledge in stuttering could be gained by the use of behavioral and observational designs in conjunction with scientific designs to gather information. Mowrer described how parents provided valuable observational data for therapy.

In the same journal, Mallard (1998b) described the use of problem solving in family management of stuttering. He also discussed (Mallard,1998a) the need for broadening treatment objectives and evaluating therapy effectiveness. Mallard commented that therapy should be individualized for each client and should focus on the objectives the client wishes to achieve. In Mallard's (1998b) family program, the clinician, the parents, and the client often evaluate success as a group. The parents and siblings add integral information regarding the client's carry-over of therapy skills. In the same journal, Lebrun (1998) discussed the contribution observational data has made in the field of stuttering therapy. He stated that the majority of professional knowledge about stuttering derives from observations, which were later substantiated through experimental research. Lebrun warned that not all observations made, especially by parents, should be taken as truths. In conclusion, all of the articles discussed indicate the relevance of qualitative data rather than strictly quantitative data.

It is frequently debated whether quantitative data, such as frequency counts, accurately represent progress in therapy (Siegel, 1975). Regardless, frequency counts are still the most frequently used technique by speech-language pathologists as evidenced in Bloodstein's (1995) Handbook of Stuttering (Appendix, p. 453). If frequency counts are to be used, then speech samples must be long enough to represent the speech patterns of the client. In addition, measurements of speech in both conversation and reading should be obtained (Williams, Darley & Spriestersbach, 1978). When using reading passages for pre-post therapy documentation, factors such as adaptation, grammatical function, word length, word initial phoneme, sentence length, and readability are important variables to consider.

Adaptation

Adaptation is the reduction in the number of dysfluencies produced after successive readings (Wingate, 1966). Frank and Bloodstein (1971) investigated the amount of dysfluency in adult subjects' speech after normal reading and unison reading to determine the degree of adaptation. They found that adaptation was the result of previous practice of the articulatory and phonatory speech pattern. They concluded that adaptation was primarily the effect of reading.

Brenner, Perkins and Soderberg (1972) concurred with Frank and Bloodstein's conclusion. Brenner, et al. investigated the effects of silent rehearsal, silent oral rehearsal, aloud rehearsal and no rehearsal of ten-syllable sentences on the frequency of stuttering in adults. Silent rehearsal did not result in adaptation unless reading was accompanied by silent oral rehearsal. Even though intervention may separate the reading samples used as measures, adaptation may still occur if the same passage is used due to previous exposure and familiarity. The client can predict some of the vocabulary words in the passage and will be familiar with the phrasing because it had been read once. Therefore, the degree of adaptation from one previous exposure to the passage appeared to influence outcome measures. It is obviously necessary to use different passages for measurements because of the partial correlation found between practice, word prediction and adaptation (Frank & Bloodstein, 1971). If the same passage was used to document progress in therapy, then it could not be determined if improvement was due to therapy or due to adaptation.

Grammatical Function

Even when two different passages are used, there are many contextual variables that may cause disfluencies. Individuals typically experience more dysfluency on words that provide the meaning of the sentence, such as nouns, verbs, and adverbs (Brown, 1937; Hahn, 1942; Silverman & Williams, 1967). Brown (1937) researched the influence of word function in relation to the occurrence of dysfluency in contextual material. He measured thirty-two subjects' percentage of stuttering on eight parts of speech (adjectives, nouns, adverbs, pronouns, conjunctions, prepositions, and articles) and found no significant difference in the percentage of stuttering based on grammatical function. When he instructed each subject to rank the eight parts of speech by their perceived level of difficulty, individuals who stuttered consistently ranked adjectives, nouns, adverbs, and verbs as the most difficult to produce. All of these grammatical units are content words that carry the most meaning in a sentence.

A recent study by Au-Yeung, Howell and Pilgrim (1998) substantiated earlier findings that adults were more dysfluent on content words. Content words such as verbs, nouns and adverbs are "...open classed words that carry full lexical meaning..." (p. 1019).

Au-Yeung, et al. (1998) studied the dysfluencies of fifty-one subjects classified as young, middle, and older children, teenagers and adults who stutter. Analyses of conversational samples indicated that teenagers and adults were more dysfluent on content words compared to children.

Researchers have proposed theories on why individuals who stutter believe content words are more likely to be stuttered. Brown (1937) theorized that a stutterers' increased unwillingness to stutter on words important for meaning or content caused the individual to be more dysfluent on those words. Van Riper (1971) also hypothesized that distress of any kind could cause motoric breakdown. A stutterer begins a behavioral pattern, such as stuttering, when he experiences distress on an upcoming word that is important (Bloodstein, 1995). Au-Yeung, et al. (1998) proposed that dysfluencies on content words may result from the additional linguistic planning needed due to the increased complexity in semantic content, in phonetic composition, and in word length. The findings of Brown (1937) and Au-Yeung, et al. (1998) indicated that when a client avoids a word that he or she felt might be difficult, that word would more than likely carry greater informational load.

<u>Word Length</u>

Another variable shown to influence an individual's fluency was word length (Brown & Moren, 1942; Schlesinger, Melkman & Levy, 1966, Wingate, 1967; Silverman & Williams, 1967; Silverman, 1972; Danzger & Halpern, 1973). Brown and Moren (1942) recorded the oral contextual reading of thirty-two subjects. They studied the length, in number of syllables and letters, of each adjective and preposition in a reading passage. Brown and Moren used adjectives and prepositions in their study because adjectives were previously ranked as a more difficult grammatical form and prepositions as an easier form in Brown's (1937) study on loci of stuttering. Brown and Moren found that regardless of whether the word was grammatically more difficult (adjective) or not (preposition), stutterers experienced more dysfluencies on words that had five or more letters. Other researchers (Schlesinger, Melkman & Levy, 1966; Wingate, 1967; Danzger & Halpern, 1973) found the same results. Brown and Moren (1942) hypothesized that the reason why dysfluency occurred on longer words may be due to the increased motor planning demands.

Word Initial Phoneme

An additional variable that may influence words stuttered is the word initial phoneme. Research has shown that in word lists or in contextual material, certain sounds were stuttered more consistently than others (Johnson & Brown, 1935; Hahn, 1942; Silverman & Williams, 1967). Results of Johnson and Brown's (1935) study indicated that the /g/, /d/, /1/, /ø/ (unvoiced), and /tʃ/ sounds were the most difficult for individuals who stutter when these occurred at the beginning of a word in contextual material. Hahn's (1942) study correlated with the results found in Johnson and Brown's (1935) study of thirty-two stuttering subjects. He analyzed each passage for the number of times each consonant occurred in the initial position of words. In addition, Hahn ascertained the number of initial vowels, but made no attempt to classify vowels. He found no physical basis, such as voicing, place or manner of production, for the phonetic difficulties observed.

Sentence Length

Extending previous research, Brown (1938) found that dysfluencies occurred most often on the first, second or third word of a sentence. Silverman and Williams (1967) hypothesized that dysfluencies occurred on these words due to difficulties initiating the motoric sequence necessary to begin each new sentence. Tornick and Bloodstein (1976) used the results of Brown's (1938) study to evaluate sentence length. Tornick and Bloodstein studied the dysfluencies experienced on twenty short sentences compared to twenty long sentences. They looked at the beginning part of each long sentence, which was the same as the short sentence, and concluded that more dysfluency occurred when the words were in the long sentence compared to when the words stood alone in the short sentence. One reason why sentence length may cause more dysfluencies was the increased perception of the demand for motor planning (Tornick and Bloodstein, 1976). It appeared that subjects realized that the sentence was longer and would require more preparation, which contributed to the number of dysfluencies (Tornick and Bloodstein, 1976).

Silverman and Williams (1967) investigated variables such as sentence position of words, grammatical function, word length, and word-initial phoneme in nonstutterers. They found that the position of the word in the sentence did not affect the disfluencies of nonstutterers. Nonstutterers were just as likely to experience disfluency on a word at the beginning of a sentence as on a word at the end of the sentence. However, just as stutterers, nonstutterers experienced more disfluencies depending on the word's grammatical function, length, and initial phoneme.

Readability

Readability level may also affect fluency. Studies conducted with children and adults who do and do not stutter have indicated that individuals display increased disfluencies as a result of increases in reading level (Cecconi, Hood & Tucker, 1977; Schlesinger, Forte, Fried, & Melkman, 1965; Taylor, 1966; Kroll & Hood, 1976). This may be due to increases in linguistic content, word length and vocabulary difficulty, which accompany increases in reading level. For instance, Cecconi, et al. (1977) conducted a study using normally communicating subjects in elementary school grades 3, 4, 5, and 6. Each subject read a passage below grade expectation, at grade expected level and two to three times above the expected grade level. Cecconi, et al. (1977) found that as the reading material increased in difficulty above the child's grade level abilities, the number of dysfluencies significantly increased. They hypothesized that as the readings became more difficult the children had to read longer vocabulary words and linguistic load was more complex. Research by Schlesinger, et al. (1965) found the same results in adults. Adults were more dysfluent on words with higher informational load and infrequently seen English vocabulary words, both of which occur in more difficult reading material

(Schlesinger, et al., 1965). Consequently, passages should be at the same level of reading difficulty when used as pre-post intervention measures.

Equating Reading Passages

With all of these variables affecting individuals' disfluencies during reading, how can equal measures of fluency during reading possibly be taken? Passages used to evaluate treatment outcomes do not have to be equal on each variable, but they should be comparable. Equating passages is not painstaking or impossible. Many researchers compare passages on the basis of Brown's word weights (1945) or Flesch's readability formula (1951) to determine passage equality (Bruce & Adams, 1978; Frank & Bloodstein, 1971; Leutenegger, 1957). For example, Leutenegger (1957) investigated the degree of recovery from adaptation after various amounts of delays between successive readings. He constructed three passages to be used in the study so each would provide approximately an equal probability of dysfluency. He made the passages comparable by using Brown's (1945) system of word weighting and the Flesch formula (1951).

Brown's Word Weights. Brown's (1945) word weights are based on his four word characteristics that were correlated to dysfluency. These characteristics were word initial phoneme, word length, word position in the sentence and the grammatical function of the word. Each of the passages used in the study were analyzed for the presence or absence of the four word characteristics (Brown, 1945). Each word was given a plus or minus for the presence of the four word characteristics (initial sound, word length, sentence position, and grammatical function). Brown (1945) gave a "plus" sign to words containing an initial sound that had a dysfluency percentage exceeding 9.7, words functioning as adjectives, nouns, adverbs or verbs, words occurring in the first, second or third position of a sentence, and words consisting of five or more letters. Therefore, any given word could possess all four word characteristics and obtain a plus rating of four or it could contain none of the four characteristics and obtain a zero rating. Consequently, each word had the possibility of a "plus-rating" of 0, 1, 2, 3, or 4. Brown (1945) found that individuals were more likely to be disfluent on words that had a higher "plus-rating." The proportion of the number of words with a particular weight can be derived for any passage using Brown's method.

Many researchers use Brown's word weights (1945) to equate assessment stimuli used in research (Leutenegger, 1957; Frank & Bloodstein, 1971; Bruce & Adams, 1978; Howell & Au-Yeung, 1995). For example, Leutenegger (1957) used three 250-word passages while investigating adaptation and recovery in stutterers. He stated that each passage was "...constructed to provide approximately equal probability of stuttering" (p. 277). Leutenegger stated that two criterion were used to achieve equality. The first was Brown's system of word weighting and the second was the Flesch formula, which was used to equate reading ease.

Flesch's Readability Formula. The Flesch formula (1951) can also be used to determine if two passages are comparable. The Flesch readability formula considers average sentence length and average word length to determine a reading ease score, which specifically analyzes the number of words per sentence and the number of syllables per 100 words in the passage. This formula has been incorporated into most word processing programs today. Simply performing an analysis of a passage using a word processing program, such as Microsoft Word (User's Guide: Microsoft Word, 1992), results in a count of words, sentences and paragraphs, average sentence and paragraph lengths, average words per sentence, a Flesch Reading Ease value and a Flesch Grade Level.

In summary, accurate measures of progress in stuttering therapy are often based on representative reading samples (Williams, et al., 1978). In order to measure fluency accurately during a reading sample, variables such as adaptation, grammatical function, word length, initial phonemes, sentence length and readability that affect disfluency must be controlled and balanced among passages. If variables that affect disfluency are not controlled, then frequency of disfluency may be affected by the passages.

Purpose

A year ago the investigator of this study was enrolled in a course on the treatment and evaluation of stuttering. The professor of the course discussed many therapy approaches, including Webster's Precision Fluency Shaping Program (PFSP) (1980). Webster (1980) stated that clinicians should obtain percentage of dysfluency measures in conversation and during a reading task before and after treatment. He stated that "Passage I is to be used in the initial speech evaluation, Passage II is used after therapy is completed." (p. A-1).

The professor had been trained in PFSP and had treated over one hundred clients using this approach. He observed over the years that the reading passages used for documenting progress appeared to be at different levels of reading difficulty. Clients seemed to have more difficulty reading the pre-therapy passage than the post-therapy passage. It was hypothesized that the perceived difference in reading difficulty between the passages may be due to the difference in topic and vocabulary. Passage I, which will be called the Boat passage through the remainder of this manuscript, was about yachting and Passage II, which will be called the Horse passage, was about horseback riding. The topic of yachting and the associated vocabulary may not be as familiar to the average client as the topic of horses and the associated vocabulary.

It was also noted that many clients would hesitate or mispronounce such words as "anchor rode," "manila," and "Dacron" contained in the Boat passage. Often, puzzled looks would appear on the face of clients when they came to these words because the words appeared unfamiliar to them. This lack of word familiarity did not appear to be as prevalent on the Horse passage. If, as suspected, the Boat passage elicited more dysfluency than the Horse passage, then the associated dysfluency counts of clients would be contaminated by the difference between the reading passages and not true reflections of the client's dysfluency.

In order to determine if the reading passages were a factor in dysfluency counts, the reading passages need to be assessed using normal talkers. The purpose of this study, therefore, was to compare the equality of the two reading passages used in the Precision Fluency Shaping Program (Webster, 1980).

Method

Data Collection

Every attempt to replicate Webster's evaluation procedures, as outlined in the Clinician's Program Guide (Webster, 1980), was made during this study. Any procedures not outlined in the guide, such as video-taping, placement of the microphone, etc. were based on procedures used by Webster at Hollins College in 1976 (A. R. Mallard, personal communication, October 20, 1998).

Each subject entered the research laboratory and was asked to take a seat at a table. The investigator asked each subject questions from a case history to get a conversational speech sample for screening purposes (see Appendix A). The individual subjects were screened during the interview for articulation disorders and for dysfluencies by the investigator, a second-year graduate student who was under the supervision of an ASHA certified speech-language pathologist. Any participants that displayed speech or language difficulties, had a history of speech-language therapy, or received remedial reading while in school were excluded from this study. A total of sixty subjects were interviewed and ten were excluded. After the interview, each subject signed a consent form (see Appendix A) that was read by the investigator. The individual subjects then selected a piece of paper from a glass jar which had a letter typed on it indicating which passage was to be read first.

A sound resistant acoustic booth was used to provide a "...quiet, free environment." (p. A-2) Once inside, each subject was positioned in a chair in the corner of the booth. In order to replicate Webster's procedures, a Panasonic PK-751 color video camera was positioned on a Vidipod in the opposite corner of the booth, directly in front of the subject. Subjects were told that they were being recorded; however, no video recordings were made.

A Sony FV33 dynamic microphone was positioned approximately 15 centimeters in front of each subjects' mouth (Decker, 1990) on an adjustable stand and a Radio Shack CTR69 voice actuated cassette recorder was positioned next to the participant's chair to record each subject's speech.

Next, each subject was given the randomly selected passage to read. The investigator used 14-point Times font with double spacing to reduce the chances of subjects losing their place while reading (see Appendixes B and C). The two reading passages used in the PFSP by Webster (1980) were single-spaced, 12-point font passages on one page. The investigator instructed each subject, as stated in the PFSP Clinician's Program Guide (Webster, 1980), to "...read Passage I at your normal speech rate and intensity level" (p. A-1). Then, the investigator instructed each subject to state a designated subject number before beginning to read, to begin reading from the top of the page including the title, and to knock on the window when finished. The investigator left the sound resistant booth while the subject read the passage.

Although, Jones (1955) found that adaptation effects on one passage were not transferred to another passage within a twenty-four hour period, as long as the second passage was of new material, for this study a week was designated as the time increment between the initial and the second reading. This time period was selected to insure that adaptation effects could not influence subjects' performances. Upon return, individual subjects received the same instructions and read the second passage. After reading the second passage, the subject was asked which passage seemed more difficult to read.

Subjects

Thirty-two female and 18 male college, undergraduate students participated in this study. The investigator spoke to various undergraduate classes and offered free hearing screenings as inducements to obtain subjects. All of the participants in this study were treated in accordance with the ethical standards of the American Psychological Association (1992). As can be seen in Table 1, the participants ranged in age from 18 to 45 years.

Thirty-four of the participants were Caucasian, 12 were Hispanic, one was African-American and one was Asian. The majority of subjects were schooled in Texas; however, some were schooled in Oklahoma (OK), Virginia (VA), Michigan (MI), Illinois (L), California (CA) and one subject was from Ecuador (ECD). The subject from Ecuador had an accent but was a college student proficient in the English language.

Passage Analyses

Four analyses were performed on each passage. The first analysis counted the number of words, sentences and paragraphs in the passages using Microsoft Word Version 5.0 (User's Guide: Microsoft Word, 1992). Each passage was highlighted, including the title, and the grammar check was selected. After the computer performed the grammar check, a single table containing the number of words, sentences and paragraphs and the average of each appeared in a table on the computer screen. In addition, the word processing program computed a Flesch reading ease value and a Flesch grade level, which is also displayed in the table.

The second analysis determined whether grammatical function of words was a significant variable affecting the number of disfluencies produced by subjects. The investigator identified each disfluent word within a passage as either a function word, such as an article or preposition, or as a content word, such as a noun or verb. The number of function and content words disfluent for each subject was obtained. An analysis of variance was performed to determine if grammatical function was a significant variable for subjects' fluency within a passage or a significant variable between the passages.

Third, the words in each passage were determined to be either a short word or long word. A word was considered long if it contained five or more letters (Brown & Moren, 1942). Each subject's disfluency was identified as occurring on a long or short word. Individual subjects' number of disfluencies occurring on long and short words in each passage was determined. An analysis of variance was performed to determine if word

Table 1

Subject Information Regarding Age, Gender, Ethnicity, and State of Primary Schooling

Subject	Age (Years)	Gender	Ethnicity	State of Primary Schooling
1	20	M	Caucasian	TX
2	21	M	Caucasian	TX
3	21	F	Hispanic	TX
4	23	F	Caucasian	TX
5	21	F	Caucasian	TX
6	21	F	Hispanic	TX
7	20	F	Caucasian	TX
8	23	F	Caucasian	TX
9	21	F	Caucasian	TX
10	22	F	Caucasian	TX
11	20	F	Caucasian	TX
12	49	F	Caucasian	TX
13	21	F	Caucasian	TX
14	20	F	Hispanic	TX
15	19	M	Hispanic	TX
16	20	F	Caucasian	OK
17	22	F	Caucasian	TX
18	21	F	Hispanic	TX
19	21	F	Caucasian	TX
20	19	F	Caucasian	TX
21	17	F	Caucasian	TX
22	23	F	Caucasian	TX
23	23	F	Caucasian	TX
24	22	F	Caucasian	TX
25	21	F	Caucasian	TX
26	20	M	Hispanic	ECUADOR
27	23	M	Hispanic	TX
28	24	M	Hispanic	TX
29	23	M	Caucasian	TX
30	23	F	Asian	TX
31	22	F	Caucasian	TX

Table 1 (continued)

32	23	M	Caucasian	TX
33	20	M	Caucasian	TX
34	21	M	Caucasian	VA
35	19	F	Caucasian	MI
36	23	M	Caucasian	TX
37	23	F	Caucasian	TX
38	22	F	Hispanic	TX
39	21	F	Hispanic	TX
40	22	M	Hispanic	TX
41	37	M	Caucasian	NONE
42	23	M	Hispanic	TX
43	21	F	African American	TX
44	21	M	Caucasian	TX
45	19	F	Caucasian	TX
46	43	M	African American	TX
47	45	F	Caucasian	TX
48	41	F	Caucasian	TX
49	23	M	African American	TX
50	29	M	Caucasian	CA

length was a significant variable for subjects' fluency within a passage or a significant variable between the passages.

Finally, each passage was analyzed to determine the loci of disfluencies within each sentence. Each sentence was determined as having a disfluency occurring within the first three words or after the first three words for individual subjects.

Analysis of Disfluency

According to Webster (1980), a word was to be "...scored 'disfluent' if a client displays audible struggle behavior concurrent with speech initiation, silent stops, repetition of sounds, syllables, or words, prolongations, omissions, or substitutions" (p. A-3). In a later publication, Webster (1979) identified his primary response unit as:

> ...the number of words on which at least one disfluent event was observed. Disfluent events include struggle with speech onset, silent stops followed by audible struggle, forced breathing and repetitions of sounds, syllables, or words. Words omitted from reading passages, substitutions within reading passages, and words in repetitions or phrases or whole sentences are also scored disfluent. A reliable measurement procedure can be established by scoring *all* instances of disfluency and avoiding the selection of assumed "stuttering disfluencies" and the rejection of assumed "normal disfluencies." (p. 231)

Recordings of each subject reading the passages were played on a tape recorder. A copy of the passage was used to mark disfluent words, placing a line through a word judged as disfluent. The investigator scored each subject's reading sample for overall number of disfluencies and type of disfluency, based on the dysfluency categories recommended by Webster (1980).

Reliability

Before any subjects participated, the investigator received instruction on how to analyze speech for disfluencies by a licensed speech-language pathologist who has over thirty years of experience in evaluating the speech of children and adults who stutter. Training included listening to recorded samples of normal talkers and instruction on recognizing the various types of dysfluency as defined by Johnson (1961).

After training in dysfluency recognition was completed, an initial reliability value was determined between this investigator and the speech-language pathologist. Webster's (1980) passages were used for determining reliability. Scoring was recorded on a 14-point Times double-spaced version of both the Boat and Horse passage. Recordings were made of a normally communicating graduate student, not used in this study, reading each passage.

All reliability measures were determined based on methods recommended by Young (1961). Young's formula evaluates the number of dysfluencies scored by each judge and the number of dysfluencies scored on the same words. Pre-assessment interjudge reliability on the Boat passage was 85 percent and on the Horse passage was 88 percent. Reliability scores above 80% were considered adequate for clinical purposes (Ingham, 1999).

Intrajudge reliability for all measures used in this study was determined for the investigator by randomly choosing a speech sample for reanalysis at the end of the study. The percentage of agreement was 91 (Young, 1961). Interjudge reliability was obtained again between the investigator and the same licensed speech-language pathologist. The percentage of agreement was 100% (Young, 1961).

Results

Table 2 contains three different sections, each pertaining to the computer analysis of the passages. The first section is Counts and displays the number of words, sentences, and paragraphs in each passage. As indicated, the Boat passage contained 500 words, and the Horse passage contained 502 words. The Horse passage had two more words, three more sentences and two extra paragraphs to read compared to the Boat passage.

The second section in Table 2 displays the Averages, including the number of characters per word, the number of words per sentence and the number of sentences per paragraph. Each passage averaged approximately four letters per word. However, the Boat passage averaged more words per sentence and more sentences per paragraph than the Horse passage.

The last section in Table 2 displays Readability. The Flesch Reading Ease value obtained for the Boat passage was 64.2 and the value for the Horse passage was 69.3. Both values are considered a "standard" reading ease value (User's Guide: Microsoft Word, 1992). A "standard" reading ease value coincides with a Flesch Grade Level of 7 to 8 (User's Guide: Microsoft Word, 1992). A Flesch Grade Level value indicates the number of years of schooling required for an average native English speaker to understand the material (User's Guide: Microsoft Word, 1992).

The Flesch Grade Level obtained for the Boat passage was 8.7 and the level obtained for the Horse passage was 7.4. A Flesch Grade Level higher than 8 indicates that some secondary schooling would be required to understand the material (User's Guide: Microsoft Word, 1992). The Flesch Grade Level indicated that the Horse passage is easier to understand than the Boat passage. The Boat passage would require some secondary schooling to understand the material.

Table 2

Analysis of Each Passage Including Counts, Averages, and Readability Using Microsoft Word 5.0

	Reading Passages	
	Boat	Horse
Counts		
Number of words	500	502
Number of sentences	28	31
Number of paragraphs	3	5
Averages		
Characters per word	4	4
Words per sentence	17	16
Sentences per paragraph	9	6
Readability		
Flesch Reading Ease[a]	64.2	69.3
Flesch Grade Level[b]	8.7	7.4

Note. Flesch Reading Ease and Flesch Grade Level are "…indexes based on the average number of words per sentence and the average number of syllables per 100 words. 'Standard' writing averages approximately 17 words per sentence and 147 syllables per 100 words." (p. 275) (User's Guide: Microsoft Word, 1992)

[a] Flesch Reading Ease value ranges from 0 (very difficult) to 100 (very easy). A value of 60-70 is considered standard (User's Guide: Microsoft Word, 1992).

[b] Flesch Grade Level ranges from 4 (very easy) to above 8 (secondary schooling required). A Grade level of 7-8 is considered standard (User's Guide: Microsoft Word, 1992).

Table 3 displays the total number, mean number and standard deviations of disfluencies for each passage. The mean number of disfluencies was 8.1 on the Boat passage and 5.8 on the Horse passage. A t-test revealed that subjects as a group experienced significantly ($\underline{t}_{.05}$ (1, 49) = 4.03, p < .001) more disfluency on the Boat passage compared to the Horse passage. The number of disfluencies each subject produced by passage can be found in Appendix D.

As can be seen in Appendix D, 74% (37 of 50) of the subjects experienced more disfluencies on the Boat passage versus 26% (13 of 50) on the Horse passage. Subjects 4, 16, 17, 19, 21, 23, 28, 29, 32, 36, 38, 42, 44 produced more disfluencies on the Horse passage.

Recall that each subject stated which passage he or she believed was more difficult to read. Appendix D lists each subject's answer, such as “B” for the Boat passage or “H” for the Horse passage. Ninety-two percent (46 of 50) of the participants stated that the "Boat" passage was harder to read compared to the "Horse" passage. The observations of the subjects concurred with the results of the statistical analysis.

Table 4 presents the number of disfluencies occurring in each passage classified by Webster’s (1980) dysfluency types. Word repetitions occurred the most, followed by substitutions, omissions, and part-word repetitions.

Table 5 displays descriptive data regarding the mean number of disfluencies by grammatical function across passages (M for the Rows Across Passages) and the mean number of disfluencies by passage across grammatical function (M for the Columns Across Grammatical Function). In addition, the total number, the mean number, and the standard deviations of disfluencies for each passage by grammatical function are displayed. The row and column means were used to determine the main effect statistics. As can be seen, subjects produced more disfluencies on content words than on function words for the Boat passage (239 versus 164) and for the Horse passage (162 versus 134). Consequently, the subjects produced a greater mean number of disfluencies on content words in both

Table 3

Total Number, Mean Number, and Standard Deviations of Disfluencies by Passage

	Reading Passages	
	Boat	Horse
Number of Disfluencies	403	293
Mean of Disfluencies	8.1	5.8
Standard Deviation	4.8	3.9

Table 4

Number of Disfluencies According to Webster's Type of Disfluency for Each Passage

	Reading Passages	
Type Of Disfluency	Boat	Horse
Word Repetitions	118	100
Substitutions	97	66
Omissions	93	64
Part-word repetitions	77	53
Silent Stops	7	5
Audible Struggle	6	3
Prolonged Sound	5	2
Totals	403	293

Table 5

Subjects' Total Number, Mean Number, and Standard Deviations of Disfluencies for Each Passage by Grammatical Function

	Reading Passages		
	Boat	Horse	M for the Rows Across Passages
Content Words			
Number of Disfluencies	239	162	
Mean of Disfluencies	4.78	3.24	4.01
Standard Deviation	2.9	2.0	
Function Words			
Number of Disfluencies	164	134	
Mean of Disfluencies	3.28	2.68	2.98
Standard Deviation	2.8	2.4	
M for the Columns Across Grammatical Function	4.03	2.96	

Table 6

Results of Analysis of Variance Listing the Degrees of Freedom, F-value and Significance for the Passages, Grammatical Function and the Interaction of Passages and Grammatical Function

	df	$F_{.05}$	Sig.
Passages	1, 49	15.892	.0003
Grammatical Function	1, 49	15.05	.0004
P x **G**	1, 49	3.028	.0882

passages. The number of disfluencies that each subject produced on function and content words within each passage can be found in Appendix D. It should be noted that in the Horse passage one instance of the function word "a" was disfluent by 22 subjects. The majority of those disfluencies were omissions of the word. The means regarding the number of disfluencies for each passage by grammatical function were used to determine the interaction effect statistics. The statistical results based on these means can be found in Table 6.

Table 6 presents the results of a two-by-two repeated-measures analysis of variance (ANOVA) investigating the main differences in the number of disfluencies across the passages and across the disfluencies based on grammatical function. Likewise, the interaction differences in the number of disfluencies for each passage by grammatical function were investigated. As can be seen, the differences in the number of disfluencies across the passages and the number of disfluencies across grammatical function were significant. Subjects produced significantly more disfluencies on the Boat passage compared to the Horse passage ($F_{05.}$ (1, 49)= 15.89, $p < .001$) and significantly more disfluencies on content words than on function words passage ($F_{05.}$ (1, 49)= 15.05, $p < .001$). There were no significant interaction effects ($F_{05.}$ (1, 49)= 3.03, $p > .05$) found between the passages with regard to disfluencies by grammatical function. Consequently, no statements can be made regarding whether there were significantly more disfluencies on content words in the Boat passage than in the Horse passage. Therefore, the increased number of disfluencies subjects produced on the Boat passage compared to the Horse passage can not be explained by difference in the grammatical function of the words.

Table 7 contains descriptive data regarding the total number of disfluencies, the mean number of disfluencies and the standard deviations of disfluencies for each passage by word length. As can be seen, subjects produced more disfluencies on long words than on short words for the Boat passage (236 versus 167) and for the Horse passage (162 versus 131). Consequently, the subjects produced a greater mean number of disfluencies

Table 7

Subjects' Total Number, Mean Number and Standard Deviations of Disfluencies for Each Passage by Word Length

	Reading Passages		
	Boat	Horse	M for the Rows Across Passages
Long Words			
Number of Disfluencies	236	162	
Mean of Disfluencies	4.72	3.24	3.98
Standard Deviation	2.6	2.0	
Short Words			
Number of Disfluencies	167	131	
Mean of Disfluencies	3.34	2.62	2.98
Standard Deviation	2.8	2.3	
M for the Columns Across Word Length	4.03	2.93	

Table 8

Results of Analysis of Variance Listing the Degrees of Freedom, F-value and Significance for the Passages, Word Length and the Interaction of Passages and Word Length

	df	$F_{.05}$	Sig.
Passages	1, 49	16.199	.0003
Word Length	1, 49	15.457	.0004
P x WL	1, 49	3.674	.0612

on long words in both passages. The number of disfluencies that each subject produced on short and long words within each passage can be found in Appendix E.

Table 8 presents the results of a two-by-two, repeated-measures ANOVA investigating the main differences in the number of disfluencies across passages and in the number of disfluencies across word length. The interaction differences in the number of disfluencies for each passage based on word length are also displayed. As can be seen, the differences in the disfluencies across the passages and the number of disfluencies across word length were significant. Subjects produced significantly more disfluencies on the Boat passage compared to the Horse passage ($F_{05.}$ (1,49)= 16.19, $p < .001$) and significantly more disfluencies on long words than on short words ($F_{05.}$ (1,49)= 15.46, $p < .001$). No significant interaction effects ($F_{05.}$ (1,49)= 3.67, $p > .05$) were found between the passages with regard to disfluencies by word length. Consequently, no statements can be made regarding whether significantly more disfluencies occurred on long words in the Boat passage than in the Horse passage. Therefore, the increased number of disfluencies subjects produced on the Boat passage compared to the Horse passage can not be explained by a difference in the length of words.

Table 9 displays data regarding the position of disfluencies in a sentence. Subjects produced more disfluencies after the first three words within a sentence than within the first three words. Most of the disfluencies after the first three words were spread out throughout the sentences, with no specific pattern being observed.

Table 9

Subjects' Total Number, Mean Number, and Standard Deviations of Disfluencies Occurring in the First 3 Words and After the First 3 Words

	Boat		Horse	
	1ST 3 Words	After 1ST 3 Words	1ST 3 Words	After 1ST 3 Words
Number of Disfluencies	57	345	52	237
Mean of Disfluencies	1.14	6.9	1.04	4.74
Standard Deviation	1.21	4.41	1.11	3.22

Discussion

The results of this study indicated that the pre-therapy Boat passage was harder reading material compared to the post-therapy Horse passage based on the differences found in readability levels of the passages. In addition, subjects produced significantly more disfluencies on the Boat passage than on the Horse passage, with a greater number of disfluencies by type on the Boat versus the Horse passage. Forty-six of the fifty subjects (92%) indicated that in their opinions the Boat passage was harder to read than the Horse passage. In addition, subjects produced significantly more disfluencies on content words and long words across the passages.

Given the higher readability score and increased frequency of disfluencies on the Boat passage, the reading level may have contributed to the increased number of disfluencies. Cecconi, et al. (1977) found that as reading material increased in difficulty, the number of disfluencies significantly increased in children. Schlesinger, et al. (1965) found similar results with adult subjects. Thus, varying reading levels between two reading samples may cause subjects to have more disfluencies on the more difficult material.

A second explanation for the differences between the passages may be the unfamiliarity of boating and associated terms compared to horses and associated terms. The vocabulary associated with boating such as "boom," "yacht tenders," "mooring cleats," "Dacron," etc. occur infrequently compared to the vocabulary associated with horses. Subjects were asked which passage was harder to read in their opinion following their reading of the second passage. Many subjects made statements such as, "The Boat passage had harder words." and "That passage was hard for me to read." One subject stated that the Boat passage was easier for him to read because boating was his hobby. It appears, therefore, that passage topic and vocabulary influenced subjects' opinions of reading difficulty.

Similar to the results of Au-Yeung et al. (1998), this study found that adult subjects were significantly more disfluent on content words than on function words. No significant difference between the frequency of disfluencies on content words in the Horse compared to the Boat passage was found. Perhaps if a larger subject pool had been utilized, a significant interaction may have been found. Further research is needed to investigate this area using the PFSP passages (Webster, 1980).

Brown and Moren (1942) found that stutterers were more dysfluent on words with five or more letters. Word length affected significantly the number of disfluencies produced by subjects in this study, with subjects producing more disfluencies on long words than short words. Subjects did not produce significantly more disfluencies on long words in the Boat passage compared to long words in the Horse passage. Once again, the results may have been different if more subjects had been used.

Silverman and Williams (1967) found that the number of sentences with disfluencies on the first-three words and the number of sentences with disfluencies occurring after the first three words were approximately equal. In this study, subjects produced more mean disfluencies after the first three words of a sentence for both passages. Subjects in this study were not as disfluent on the first part of a sentence as on the last part, as found by Silverman and Williams (1967). Sentence position was not an important variable for the significant increase in frequency of disfluencies on the Boat passage.

In summary, this study showed that even with normal speakers disfluencies increase when the passage increases in reading-difficulty and occur more frequently on content and long words. Although subjects produced more disfluencies on the Boat passage than on the Horse passage, no conclusive statement can be made about the reason for this increase.

Different reading passages can be used to counteract adaptation. Research has found that using the same passage, even if a time interval exists between samplings, may result in decreased numbers of dysfluencies due to previous exposure and familiarity with the passage (Wingate, 1966; Frank & Bloodstein,1971; Brenner, et al.,1972). The solution to speech sampling with different reading material is to use reading material that is at the same readability level, because the number of disfluencies produced by subjects may be affected. Often, more difficult reading material will contain more difficult vocabulary and sentence structure (Schlesinger, et al., 1965), which research has shown to affect frequency of dysfluency as well (Bernstein Ratner & Sih, 1987, Haynes & Hood, 1978).

This study points out the necessity of using multiple evaluation procedures to evaluate progress in stuttering therapy. The Boat passage was more difficult for subjects to read and a significantly higher number of disfluencies was produced by the normal subjects. Clinicians using these passages for assessment purposes may overestimate the number of disfluencies prior to treatment or overestimate the effects of therapy resulting in questionable determinations of progress and impact of intervention procedures. Likewise, Mallard and Kelley (1982) found that subjects can manipulate their level of speech control depending on the situation, thus producing fluency measures that were not representative of normal, everyday communication. Stuttering is a complex disorder and if clinicians are to obtain an accurate assessment of treatment, quantitative (Webster, 1980) and qualitative (Mowrer, 1998; Mallard, 1998a,b) data are needed.

The findings of this study should not cast a negative view on the Precision Fluency Shaping Program. Disfluencies during reading is just one of several pre- and post-treatment measures used by Webster to document therapy effectiveness. Follow-up studies at Southwest Texas State University indicated that many clients who were treated using Precision Fluency Shaping were still experiencing high levels of speech control more than twenty years post treatment.

Appendix A

Case History and Consent Form Used With Subjects

______Subj.No.

Name:____________________ Date:_______________

Address:____

__________________________ Phone:_____________________________

Ethnicity:_________________ Sex:_________ Age:_________

Region of Development:______________________________ Major:_______

Speech or Language Difficulties:_____yes ______no

Have you or any of your family members ever needed additional help due to reading difficulties, such as a learning disability, dyslexia, etc.:

______no ______yes If yes explain below:

____

____

I, ____________________________, agree to participate in the following study and agree to the tape recording of my participation. I understand that whether or not I participate, it will not prejudice my future relations with Southwest Texas State University.

____ (Subject's Signature)

I, Heidi Layman, the conductor of the following experiment agree to keep the identity of each subject confidential. If for some reason I must use identifying information, you will be contacted and permission to use this information will be acquired.

____ (Experimenter's Signature)

Appendix B

Boat Passage

The line, chain or cable used with an anchor is referred to by sailors as a rode. Small boats, that is boats under about thirty-five feet in length rarely use the heavy chains or wire cables seen on larger yachts. These boats rely on a fiber rope to hold them at anchor. Anchor rodes for small boats are usually constructed of vegetable or synthetic plastic fibers. Fiber ropes stretch when the boat surges as waves strike it. Stretchy fiber lines absorb shocks and relieve strain on anchors and mooring cleats. The traditional line used for years as anchor ropes on small boats was constructed of manila fiber. Manila rope has been replaced on most pleasure boats by nylon line. There are several good reasons why nylon line is preferred for anchor rodes. One of the big advantages of nylon over manila is the fact that a nylon rope can be stowed away while it is wet. If a manila line is stowed while wet, it is possible that rot or mildew will set in and destroy the fibers. Nylon is stronger than manila line of the same size and has much more elasticity to it. Modern nylon lines can stretch up to one-third of their length without snapping. nylon is also likely to be from two to three times as strong as manila line of the same size. Nylon is lighter than manila, is easier to handle on deck while pulling the anchor, and better resists chafing. One of the potential difficulties with nylon is that prolonged exposure to sunlight, for example when lines remain coiled on boat decks, causes ultraviolet rays to weaken its fibers by producing chemical changes in the plastic.

Although nylon has many advantages for use in situations where elasticity is required, there are lines which have different special applications. Dacron filaments are used in the construction of ropes which serve other functions. For example, on sailboats, lines which are used to control movement of the boom should be made of dacron. When the sailor adjusts the position of sails on his boats, he does not care for changes in wind pressure to produce changes in the position of sails because his ropes stretch as wind pressure increases. Dacron lines are resistant to stretch, are easy to handle, and are relatively resistant to chafing as they pass through blocks and over pulleys. The lack of give in dacron fibers makes this type of rope particularly unsuitable for use as an anchor rode. Special processing of plastic substances gives dacron its potential for resisting stretch. Another kind of marine line is made from a plastic that floats. These lines are very useful when used as painters on small yacht tenders. The main problem with manila, nylon and dacron lines is that they do not float. In the event it becomes necessary to cause a yacht to go astern, nylon line may sink and tangle in the propeller. Floating plastic lines will remain on the surface.

Appendix C

Horse Passage

Horseback riding can be a very enjoyable activity. In order to become a knowledgeable rider, you should learn a great deal about your mount. For example, if you are planning to own a horse you must understand just what needs to be done to care for it. Perhaps you will never buy a horse. Nevertheless, most riding instructors like to teach their students about the care and feeding requirements of horses. Some of the relevant points are discussed below.

Horses are quite large. Because of this fact, many people think they are very expensive to keep. Actually, a horse can be maintained on a small budget. For example, the average horse can be fed for approximately five dollars a month during the summer and for about twenty dollars a month during the winter. Of course, this assumes that you have some place where the horse can be sheltered. Boarding stable near medium sized towns will charge about one hundred dollars a month to keep your horse. Of course, if you are fortunate and own suitable land, your costs for keeping a horse would be reduced over those already mentioned.

The recommended space for keeping a horse is about one acre. The acre of land should be pretty well covered with good grass. As source of running water, either naturally or artificially supplied, is necessary. The land should have a suitable fence around it. If the fence is wooden or stone, it should be high enough to keep the animal from jumping over. Many people prefer either barbed wire fences or electric fences in order to discourage the horse from trying to get to the fabled greener grass which is on the other side. One warning which should be heeded is to avoid placing a horse in any area which was previously an apple orchard. Horses get sick when they eat too many apples. When eaten in large quantities the apples will ferment in the horse's stomach and cause colic.

In order to care for the horse certain kinds of equipment are needed. The standard tolls include various brushes which are used primarily to groom the horse. These are in order of their use, a curry comb, a hard brush, a dandy brush, a soft brush and a tail comb. While it is not necessary to groom the horse at regular intervals, those people who are proud of their horses are likely to groom them frequently. Regular grooming, for example at weekly intervals, will insure that the horse stays in good condition. Very often horses are a little bit like people; they act better when they are treated well.

Of course, if you plan to own a horse you must purchase the gear necessary for riding the animal. The items which are needed include a halter and rope, which are used to lead the horse around in the stable and pasture area. The lead rope should be soft rope about ten feet in length and should be tied and untied easily.

Appendix D

Number of Disfluencies for Each Subject on Function and Content Words by Passage

	Reading Passages			
	Boat		Horse	
Subject	Function Words	Content Words	Function Words	Content Words
1	7	4	2	3
2	6	3	2	5
3	0	5	2	2
4	0	3	3	2
5	4	5	2	4
6	10	8	1	5
7	2	0	0	0
8	0	2	0	1
9	6	5	1	3
10	0	2	1	1
11	6	4	2	2
12	1	2	2	1
13	1	7	2	2
14	4	5	2	2
15	1	2	0	0
16	1	3	1	4
17	0	4	3	2
18	1	5	0	1
19	3	1	2	4
20	4	7	0	2

Appendix D (continued)

21	3	3	4	3
22	4	13	1	7
23	1	1	2	1
24	0	9	4	4
25	7	2	4	3
26	4	6	5	2
27	8	13	11	8
28	1	5	8	4
29	1	5	3	4
30	4	5	2	2
31	4	4	2	6
32	5	7	7	6
33	2	2	1	5
34	3	7	3	3
35	2	3	1	4
36	1	2	6	3
37	3	2	1	2
38	2	5	3	5
39	5	9	3	6
40	3	10	4	4
41	4	4	1	2
42	2	1	1	3
43	1	4	2	3
44	0	4	1	6

Appendix D (continued)

45	3	8	4	1
46	3	3	1	0
47	11	6	4	3
48	8	9	9	7
49	9	7	7	7
50	3	3	1	2
Total Disfluencies	164	239	131	162

Appendix E

Number of Disfluencies by Each Subject on Short and Long Words by Passage

	Reading Passages			
	Boat		Horse	
Subject	Short Words	Long Words	Short Words	Long Words
1	6	5	3	2
2	5	4	4	3
3	0	5	1	3
4	0	3	3	2
5	2	7	2	4
6	11	7	3	3
7	2	0	0	0
8	0	2	0	1
9	5	6	2	2
10	0	2	1	1
11	6	4	2	2
12	0	3	0	3
13	1	7	2	2
14	3	6	0	1
15	1	2	0	0
16	1	3	0	5
17	0	4	2	3
18	1	5	0	1
19	3	1	2	4
20	4	7	0	2
21	2	4	4	3

Appendix E (continued)

22	6	11	2	6
23	1	1	1	2
24	2	7	5	3
25	6	3	5	2
26	4	6	4	3
27	9	12	11	8
28	2	4	4	8
29	1	5	4	3
304	5	0	4	
31	4	4	4	4
32	7	5	7	6
33	2	2	1	5
34	3	7	3	3
35	2	3	1	4
36	2	1	5	4
37	3	2	0	3
38	2	5	4	4
39	6	8	2	7
40	4	9	4	4
41	4	4	1	2
42	1	2	1	3
43	1	4	2	3
44	0	4	3	4

Appendix E (continued)

45	5	6	2	3
46	3	3	1	0
47	10	7	5	2
48	8	9	7	9
49	9	7	8	6
50	3	3	3	0
Total Disfluencies	167	236	131	162

Appendix F

Number of Disfluencies During Reading and Passage Subject Stated was Harder

	Reading Passages		
Subject	Boat	Horse	Harder Passage
1	11	5	B
2	9	7	B
3	5	4	B
4*	3	5	B
5	9	6	B
6	18	6	B
7	2	0	B
8	2	1	B
9	11	4	B
10	2	2	B
11	10	4	B
12	3	3	B
13	8	4	B
14	9	1	B
15	3	0	B
16*	4	5	B
17*	4	5	B
18	6	1	B
19*	4	6	H
20	11	2	B
21*	6	7	B

Appendix F (continued)

22	17	8	B
23*	2	3	B
24	9	8	B
25	9	7	B
26	10	7	B
27	21	19	B
28*	6	12	H
29*	6	7	B
30	9	4	B
31	8	8	B
32*	12	13	B
33	4	6	B
34	10	6	B
35	5	5	B
36*	3	9	H
37	5	3	B
38*	7	8	B
39	14	9	B
40	13	8	B
41	8	3	B
42*	3	4	B
43	5	5	B
44*	4	7	H

Appendix F (continued)

45	11	5	B
46	6	1	B
47	17	7	B
48	17	16	B
49	16	14	B
50	6	3	B
Total Disfluencies	403	298	
Mean	8.1	5.8	
Standard Deviation	4.8	3.9	

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