DAY-TO-DAY VARIABILITY OF STUTTERING

by

Christopher D. Constantino

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This thesis was presented

by

Christopher D. Constantino

It was defended on

June 1, 2012

and approved by

J. Scott Yaruss, Associate Professor, University of Pittsburgh, Communication Science and Disorders

Paula Leslie, Associate Professor, University of Pittsburgh, Communication Science and Disorders

Robert W. Quesal, Professor, Western Illinois University, Communication Sciences & Disorders

Thesis Director: J. Scott Yaruss, Associate Professor, University of Pittsburgh, Communication Science and Disorders

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Christopher D. Constantino, M.S.

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Variability has long been known to be a primary feature of the disorder of stuttering (Bloodstein & Bernstein Ratner, 2008; Costello & Ingham, 1984; Yaruss, 1997a, 1997b). Many factors that affect variability have been investigated (Brown, 1937; Johnson & Brown, 1935; Quarrington, Conway, & Siegel, 1962) yet the typical range of variability experienced by speakers remains unknown. This study will examine the speech of six adult speakers in three spontaneous speaking situations and two reading tasks. The frequency, duration, and types of stuttered events that occur on the tasks will be compared within and between speakers. The focus will be on describing variability in stuttering frequency and duration within speakers and attempting to detect consistent patterns between speakers.

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PREFACE

I would like to acknowledge the work of Dr. J. Scott Yaruss for helping to edit countless drafts of this paper and the assistance of Dr. Paula Leslie and Dr. Robert Quesal for their ideas and suggestions. I would also like to acknowledge the work of Sara McIntyre for being my reliability checker and express gratitude to Caitlin Naples for helping me to standardize and work the kinks out of my data collection sessions. Thank you.

1.0 INTRODUCTION

Stuttering is variable: the frequency of a speaker's disfluencies, as well as their intensity and duration, vary markedly from situation to situation and from day to day (Bloodstein & Bernstein Ratner, 2008; Costello & Ingham, 1984; Yaruss, 1997a, 1997b). This variability frustrates clinicians and clients alike. For people who stutter, it can be discouraging because they do not always know when a moment of stuttering will occur. They can sometimes anticipate when a stuttering event may transpire but this is not always the case. Other times, they stutter on unanticipated words or speak fluently on words that they thought would be disfluent (Bloodstein, 1960). For clinicians variability is of concern because they cannot know if their measurements of a speaker's stuttering behaviors are representative of the speaker's experience with the disorder. When treating a person who stutters they cannot be certain whether a change in stuttering frequency is due to their treatment or to the variability of the speaker's stuttering (Bloodstein & Bernstein Ratner, 2008). Some reassurance can be obtained by conducting a large number of repeated baseline measures for each patient prior to treatment (Costello & Ingham, 1984); however, even then it can be difficult to differentiate improvement from normal variability.

Additional information about variability would help researchers and clinicians better understand the nature of stuttering itself. People who stutter are not always disfluent – researchers have clearly documented situations in which people who stutter tend to speak more fluently than others, as well as those in which people stutter more frequently (see review in

Bloodstein & Bernstein Ratner, 2008). Understanding why some situations allow for greater fluency than others is a key step in determining whether those factors can be generalized to other "less fluent" situations. Likewise, a better understanding of which factors exacerbate stuttering may help researchers and clinicians in the development of more effective treatment techniques.

Knowledge of variability is also important for diagnostic purposes. In order to properly and efficiently diagnose someone with a potential fluency disorder it is vital to have a representative sample of their speech (Conture, 2001; Guitar, 2006; Manning, 2010). A speech sample collected during a diagnostic evaluation may not provide this because the behavior is so variable (Costello & Ingham, 1984). This calls into question the validity of stuttering diagnostics in general. Some researchers have looked into ways to diagnose stuttering in spite of its variability (Sawyer & Yairi, 2006; Yaruss, 1997b). A deeper understanding of this variability would allow clinicians to streamline the diagnostic process. If it is discovered that a particular portion of a speech sample or a particular situation tends to give the most accurate representation of a client's speech then that portion should be used in diagnosis. This would increase both the sensitivity and specificity of the evaluation procedure, as well as save time for both the speaker and clinician. In other words the clinician's impressions of the client's communication disorder would more closely match the actual extent of the impairment.

Of even greater importance is the idea that a better understanding of the variability of stuttering might improve treatments for fluency disorders. When determining whether or not a treatment is effective a clinician compares a speaker's frequency and severity of stuttering after treatment to a baseline measure before treatment (Andrews, Guitar, & Howie, 1980; ASHA, 1995, Bothe, Davidow, Bramlett, & Ingham, 2006; J. C. Ingham & Riley, 1998; Riley, 1972). The variability of stuttering makes this difficult. For example, if an individual's stuttering was particularly mild during baseline testing and particularly severe during post-treatment testing it could appear that a perfectly valid treatment technique is ineffective. The opposite could also occur where variability makes an invalid treatment seem successful. Of course, not all treatment outcome measures are, or should be, based on fluency measures as stuttering is a complex disorder and disfluency is only one manifestation of it (Yaruss & Quesal, 2004). That being said, it is the variation in fluency that is of concern in this project. Researchers who are exploring treatment options for fluency need to have baseline and post-treatment measures that provide accurate representations of their participants' speech. The same line of reasoning can be applied to treatment in the clinic. In order to accurately measure clinical progress baseline and post-treatment measures must be valid and trustworthy (Ackoff, Gupta, & Minas, 1984; Cook & Fry, 2006; World Health Organization, 2002; Yaruss, 1998, 2004).

Although prior studies have shown that variability is not completely random, a full understanding of "what words are stuttered" (Taylor, 1966, p. 233) continues to elude researchers. Such variability might be based on factors within the environment and within the speaker themself that are not yet fully understood. For example, factors such as speaking environment and linguistic complexity have been shown to increase and decrease stuttering (Taylor, 1966; Yaruss, 1997a). While previous research, which will be reviewed in detail in this paper, has revealed much about the nature of the patterns underlying the distribution of disfluencies, the results leave many vital questions unanswered. In order for variability to be predicted more accurately a greater knowledge of how these factors interact must be obtained.

This study concerns itself broadly with the validity of treatment outcome measurements of stuttering as they pertain to the variability of stuttering in research and treatment. The variability in the frequency and duration of moments of stuttering that speakers experience from one day to another will be investigated in order to evaluate the range of variability a speaker might exhibit in similar settings over time. The information gained will help clinicians evaluate the efficacy of treatment, for if the difference between the outcome and baseline measures for a given treatment falls within the range of expected variability, then it is reasonable to question the validity or efficacy of the treatment. If, however, the difference between ending and beginning measures is outside this range then clinicians can be more confident that their treatment has had a positive impact on their client's fluency. This knowledge can allow researchers and clinicians to tailor treatment to include only those techniques that consistently produce results outside of the range of normal, day-to-day variability and thereby improve the efficacy of treatment options for people who stutter.

1.1 BACKGROUND

The need to understand the variability of stuttering has become more important as the field of speech language pathology has embraced the use of evidence-based practice (EBP; J. C. Ingham, 2003). EBP is the use of current best evidence to inform decisions made about the care of individual patients (Sackett, Rosenberg, Muir Gray, Haynes, & Richardson, 1996). This is accomplished through a partnership of research evidence, clinical expertise, and individual patient preference (McKibbon, 1998). It is critical to apply EBP to the measurement of stuttered events (Bernstein Ratner, 2005; Bothe, 2004; Yaruss & Quesal, 2004). In order to apply EBP to their measures, clinicians must first understand the current body of research.

It should be noted that when frequency of stuttering is addressed in the literature, two different measurements are frequently discussed: moments of stuttering and instances of disfluency. These are two distinct behaviors that are not always easy to distinguish. Many researchers have tried to set up criteria to place different behaviors in either category. Behaviors thought to be exemplary of stuttering are often called “stuttering-like disfluencies” (Yairi, 1996; Yairi & Ambrose, 1992a; Yairi, Ambrose, & Niermann, 1993; Yairi, Ambrose, Paden, & Throneburg, 1996; Yaruss, 1997b) and usually include word repetitions (“big-big-big”), sound repetitions (“b-b-big”), syllable repetitions (“be-be-because”), prolongations (“ssssing”), and blocks (“be______cause”). They are also called “within-word disfluencies” (Conture, 1990a, 1990b; Yaruss, 1997b), “stutter-type disfluencies” (Meyers, 1986; Yaruss, 1997b), and “less-typical disfluencies” (Campbell & Hill, 1987; Gregory, 1986, 1993, Yaruss, 1997b). These are the disfluencies associated with stuttering behaviors and are not normally exhibited by typical speakers.

There are also "other disfluencies" (Yairi, 1996; Yairi & Ambrose, 1992a; Yairi, Ambrose, & Niermann, 1993; Yairi, Ambrose, Paden, & Throneburg, 1996; Yaruss, 1997b), also known as "between-word disfluencies" (Conture, 1990a, 1990b; Yaruss, 1997b), "normal-type disfluencies" (Meyers, 1986; Yaruss, 1997b), and "more-typical disfluencies" (Campbell & Hill, 1987; Gregory, 1986, 1993, Yaruss, 1997b). These are disfluencies thought to be exhibited by both people who stutter and typical speakers, such as interjections ("I uh am hungry"), revisions ("I is- I am hungry"), and phrase repetitions (I'm thinking- I'm thinking we should go eat"). Table 1 summarizes the above information.

Table 1. Categories of Disfluency

Stuttering	**Typical Disfluency**
The disfluent behavior unique to stuttering. Also called: within-word disfluencies[1], stuttering-like disfluencies[2], stutter-type disfluencies[3], less-typical disfluencies[4]	The disfluent behavior common to people who stutter *and* typical speakers. Also called: between-word disfluencies[1], other disfluencies[2], normal-type disfluencies[3], more-typical disfluencies[4]

Common Types	**Example**	**Common Types**	**Example**
Word repetitions	big-big-big	Interjections	I uh am hungry.
Sound repetitions	b-b-big	Revisions	I is- I am hungry.
Syllable repetitions	be-be-because	Phrase repetitions	I'm thinking- I'm thinking we should go eat.
Prolongations	ssssing		
Blocks	be____cause		

Note: [1] From Conture, 1990a, 1990b. [2] From Yairi, 1996; Yairi & Ambrose, 1992a; Yairi, Ambrose, & Niermann, 1993; Yairi, Ambrose, Paden, & Throneburg, 1996. [3] From Meyers, 1986. [4] From Campbell & Hill, 1987; Gregory, 1986, 1993.

Distinguishing between disfluency types is not a trivial issue. If stuttering could be easily distinguished from typical disfluent behavior it would make sense to only count instances of stuttering, as it is the behavior of interest. However, this is often not the case. The many classification systems mentioned above speak to the difficulty of defining, as a listener, what behaviors are moments of stuttering, and what behaviors are typical disfluencies. Perkins, Kent, and Curlee (1992) made the case that it may be impossible for a listener to distinguish between normal disfluencies and stuttered disfluencies. Perkins (1990) defined stuttering as a "loss of control" experienced by the speaker. It was this "loss of control" that separated stuttered disfluencies from nonstuttered disfluencies. Due to the ambiguity of this distinction some have argued that it is best to measure all disfluencies (Wingate, 1964; Yaruss, 1997b). To complicate matters further, many people who stutter, in an attempt to avoid stuttering, have an increase in typically disfluent behavior (Manning, 2010).

Any time "stuttering" is mentioned in this paper it is stuttered disfluencies that are being discussed. Any time "disfluencies" are discussed in this paper it is a combination of stuttered disfluencies and nonstuttered disfluencies that are being discussed.

1.1.1 Explanations of Variability

Although it has long been known that stuttering is variable, the *reasons* that it varies have eluded researchers. Many early researchers sought to explain this variability by looking for a pattern or relationship between past and future stuttered events. Past occurrences of stuttering have been shown to somewhat predict future occurrences of stuttering. The consistency effect, as demonstrated by Johnson and Knott (1937) gave researchers some of the first clues that stuttering does not happen randomly but appears to be somewhat controlled by stimuli.

Johnson and Knott had their participants read a passage ten times in succession and noted which words they were disfluent on. For most of the participants the distribution of stuttered events was noticeably stable from reading to reading. The words on which the participants stuttered on in repeated readings tended to be words which they had stuttered on in the past. Johnson and Inness (1939) confirmed this finding.

The consistency effect was also observed in preschoolers by Needley and Timmons (1967) and Williams, Silverman, and Kools (1969). The consistency effect not only predicts moments of stuttering but also the type of stuttering. Zenner, Webster, and Fitzgerald (1974) demonstrated that not only does the moment of stuttering tend to be consistent from one reading to the next but also the type of disfluency. The consistency effect has been shown to decrease somewhat when large time intervals are interspersed between repeated readings but the majority of it still remains, meaning that many of the same words are still stuttered (Stefankiewicz & Bloodstein, 1974).

Similar to the consistency effect is what is known as the adjacency effect (Bloodstein & Bernstein Ratner, 2008). The adjacency effect demonstrates that a speaker who is reading out loud will be likely to stutter on words adjacent to words that the speaker had stuttered on in a previous reading of a passage if the original stutter inducing words are blotted out (Johnson & Millsapps, 1937; Rappaport & Bloodstein, 1971). For example, Johnson and Millsapps (1937) had their participants read a passage nine times in succession. After completion of a reading the authors blotted out words that the participant stuttered on so that they could not be read. In subsequent readings new words would become stuttered and to a significant degree these new words were adjacent to the previously stuttered words. Rappaport and Bloodstein (1971) were concerned that the blotting might produce stuttering for reasons other than their association with past stuttering events, such as the resulting lack of continuity in the passage. In order to parse out whether it was past stuttering events or the blots themselves that contributing to the moments of stuttering Rappaport and Bloodstein compared an ordinary adjacency condition to a condition in which words were blotted out at random. The authors give the random blot condition first to half of their participants and the normal adjacency condition first to the other half of their participants. All participants ultimately received both conditions. For the participants that received the random blot condition first there was no adjacent stuttering around the random blotting. For the participants that received the random blot condition second there was adjacent stuttering abound the random blotting. The authors concluded that the blots scatted at random did not in of themselves produce adjacent stuttering; however, once the participants had the experience of having past stuttered words blotted out (the normal adjacency condition) the random blotting served as stimuli for adjacent stuttering. Rappaport and Bloodstein confirmed Johnson’s and Millsapps’s findings that a speaker reading out loud will be likely to experience stuttering on the words adjacent to words that were previously stuttered, should these previously stuttered words be blotted out.

Pittenger (1940) also sought a pattern or relationship between past and future stuttered events. She examined the duration of temporal intervals between successive stutters. She sought the answers to four questions: 1) in a given individual, do the time intervals between successive stutters tend to be similar or different; 2) do these intervals follow any sort of a cyclic pattern; 3) do these time intervals vary greatly from one individual to another; and 4) what is the relationship between mean duration of time intervals between stutters and variability in the duration of intervals. She concluded that the temporal intervals varied greatly for a given individual and between individuals, though there did not appear to be any sort of a pattern. Also, "the relationship between mean duration of temporal intervals between successive moments of stuttering and variability in the duration of these intervals is negligible" (Pittenger, 1940, p. 340). Her research suggests that there is no pattern that predicts stuttering events from one moment of stuttering to another, at least in terms of elapsed time.

One early theory of stuttering attempted to account for variability based on a conflict of *approach* and *avoidance* activities. The Sheehan-Quarrington hypothesis assumed that stuttering occurred in "waves or cycles" (Quarrington, 1965, p. 223). The theory suggested that people who stutter build up tension during fluent speech. As this tension increases, the probability of a stuttered event occurring also increases, until the anxiety-producing act (the stutter) occurs. The stutter itself relieves the built up tension and brings about an increase in fluent speech until the tension builds up again (Conway & Quarrington, 1963; Quarrington, 1965; Sheehan, 1958). The threshold for the amount of tension that triggers the moment of stuttering was believed to vary from person to person.

Taylor and Taylor (1967) sought to test this hypothesis by seeking a cyclical pattern in the speech of people who stutter. They found that within a phrase the probability of stuttering tends to decrease with or without the presence of a prior stuttering event. Stuttering is more likely at the start of sentences and phrases. In other words, the absence of a moment of stuttering at the beginning of a sentence or phrase did not increase the likelihood that a stutter would occur at the end of that sentence or phrase. They found that the locations of moments of stuttering had little to do with the locations of previous stutters and more to do with linguistic influences. They concluded that the Sheehan-Quarrington conflict theory does not account for actual stuttering events and that any theory that wishes to predict future stuttering events based on past stuttering events will be incomplete. Thus Taylor and Taylor's conclusion was consistent with Pittenger's results almost 30 years prior. (Note that the present study does not seek to predict future stuttering events based on those of the past, but rather, to describe and explain the extent of variability as it pertains to the measurement of stuttering.) At present, there is no unifying theory for describing how these factors work together in a particular speech sample to determine what syllables or sounds are stuttered. Indeed, instead of trying to explain *why* variability exists many contemporary researchers have turned their attention to identifying the factors that may affect this variability.

1.1.2 Factors that Affect Variability

Although the ability to predict stuttering based on past stuttering events has eluded researchers many characteristics of stuttering variability have been defined. These include factors that reduce or increase the frequency of stuttered events, the effects of speaking situation on variability, the effects of linguistic and paralinguistic factors on variability, and the effects of speech sample length on variability.

1.1.2.1 Fluency Facilitating Conditions

Researchers have identified conditions or effects (termed “stuttering phenomena” by Bloodstein & Bernstein Ratner, 2008) that tend to significantly minimize or reduce the presence of disfluencies in people who stutter. Some of these include the adaptation effect, the white noise effect, delayed auditory feedback (DAF), and the metronome effect (Bloodstein & Bernstein Ratner, 2008).

Adaptation Effect

The adaptation effect is a phenomenon in which the frequency of stuttering events decreases with repeated readings of the same passage (Johnson & Knott, 1937; Frank & Bloodstein, 1971; Golub, 1955). The reduction of stuttering events varies from speaker to speaker; however, a reduction of syllables stuttered by 50% is not uncommon (Bloodstein & Bernstein Ratner, 2008). It is important to note that the adaptation effect is only temporary. A brief time interval, e.g., 30 minutes, between successive readings of the passage will negate the adaption effect (Shulman, 1955).

Novel Speech Patterns

The introduction of white noise or DAF (i.e., playing a speaker's voice back to him or her with a brief delay) to the ear of a person who stutters significantly reduces the speaker's frequency of stuttering (Bloodstein & Bernstein Ratner, 2008; Kalinowski, Armson, Roland-Mieszkowski, Stuart, & Grecco, 1993; Lee, 1951; Stuart, Kalinowski, & Rastatter, 1997). Bloodstein and Bernstein Ratner (2008) observed that introduction of white noise and DAF cause speakers who stutter to spontaneously use fluency enhancing techniques, they "tend to slow their rate of speech, run their words together, concentrate on proprioceptive and tactile monitoring, or over articulate" (pp. 299-300). The metronome effect has similar results to DAF.

When a person who stutters speaks in time with a metronome their frequency of stuttered events is significantly reduced. This reduction in frequency of stuttering has been attributed to two factors: rhythmicity and syllabification (Azrin, Jones, & Flye, 1968; Brady, 1969). Rhythmicity refers to the rhythm and timing of an individual's speech. Talking in time with a metronome requires that the speaker keep pace with the timing of the metronome. Syllabification refers to the tendency of speakers to coordinate their speech with the timing of the metronome by saying one syllable per beat. The white noise effect, DAF, and metronome effect may work because they produce a novel mode of speaking for the person who stutters (Bloodstein & Bernstein Ratner, 2008). Although the reasons for the effectiveness of novel speech patterns in suppressing stuttering is not yet understood, it has long been documented that novel speech patterns, in particular rhythmic speech, reduces stuttering (Packman, Onslow, & Menzies, 2000).

1.1.2.2 Situational Factors

Other researchers have studied how situation can affect the fluency of people who stutter (J. C. Ingham & Riley, 1998; Martin, Kuhl, & Haroldson, 1972; E. M. Silverman, 1971; Wexler, 1982; Yaruss, 1997a). Both nonstuttering children (E. M. Silverman, 1971; Wexler, 1982) and children who stutter (J. C. Ingham & Riley, 1998; Martin, Kuhl, & Haroldson, 1972) have been shown to vary in their measures of fluency in different speaking situations.

Costello and Ingham (1984) suggest that, in order to obtain an adequate picture of a speaker's stutter, clinicians should measure the speaker both "within and beyond" (Costello & Ingham, 1984, p. 305) the clinic setting. They recommend taking at least four measurements "beyond clinic" that vary with the age of the speaker. When the client is a child they should be measured speaking with the clinician outside of the clinic room, speaking with their caretaker at home, speaking with a playmate at home, and speaking in a school setting. Adults should be measured in a conversion with the clinician outside of the clinic room, in a conversion with someone close to the speaker, in a telephone conversation with a friend, and in a conversion with someone at their place of work.

Yaruss (1997a) investigated the effect that speaking situation has on the frequency of stuttered events as exhibited by preschool children who stutter. Five situations were observed: 1) parent/child interaction 2) play 3) play with pressure 4) story retell 5) picture description. The speaker's stuttering varied between all the speaking tasks. There was variability in the mean frequency of more typical (or normal / non-stuttered) disfluencies and less typical (or stuttered / stutter-like disfluencies (e.g. Campbell & Hill, 1987; Meyers, 1986; Yairi, 1996, Yaruss, 1997b) in each situation as well as in which situation the speakers were "most disfluent" and "least disfluent" (Yaruss, 1997a, p. 194). Interestingly, this study showed significantly greater variability in the frequency of disfluencies *between* different speaking situations than within a single speaking situation.

This could have some important implications for the current study. Perhaps documenting the range of variability a person who stutters exhibits across various speaking situations will give researchers and clinicians a picture of the range of variability they normally exhibit in day to day life. The results of this investigation will be compared to the results of Yaruss's 1997a study, with caution taken to account for the age differences between the participants in the two studies. If there are strong similarities, clinicians and researchers may be able to measure a speaker's frequency and severity of stuttering in different situations in order to figure out their normal day-to-day variability (Costello & Ingham, 1984). Achievement of improvements in fluency that exceed of this range could then be shown to be a clinically significant treatment outcome.

1.1.2.3 Linguistic Factors

Other researchers have looked into linguistic factors that can affect the amount of disfluencies in speech. For example, Taylor (1966) summarized much of the research into the *loci* of stuttering in regards to linguistic variables that had been conducted by prior researchers (e.g., Brown, 1937; Johnson & Brown, 1935; Quarrington, Conway, & Siegel, 1962). Four factors have been assumed to affect likelihood of stuttering: initial sound, length, position, and grammatical class. Considering these and other factors, Taylor (1966) concluded that:

> Words starting with consonants rather than with vowels, words at earlier rather than later positions in sentences, and longer rather than shorter words are those more likely to be stuttered. All these conditions describe words of more, rather than less, certainty. (p. 241)

The linguistic variables that have been explored can be separated into phonological, grammatical, and syntactic factors.

Phonological factors

Taylor's 1966 study was a continuation of research conducted by Johnson and Brown in 1935. Johnson and Brown's study investigated whether people who stutter experience more stuttering on certain speech sounds than others. They assessed 70 speakers on five reading passages of 1,000 words each and looked at the frequency of stuttered events occurring on initial sounds of words. Like Taylor some thirty years later, they concluded that stuttering occurs more often on initial consonant sounds than on initial vowel sounds. Specifically they found that 92% of stuttered events occurred on the initial sounds of words. They noted that individual speakers present exceptions to this general rule to varying degrees. They also discovered that almost all speakers associated significantly more stuttering with some sounds than with others. An interesting caveat to this discovery was that some speakers shifted their tendency to stutter from one group of sounds to another. For example, some speakers would initially have a great deal of stuttering with velar stops and little stuttering with alveolar fricatives. This could then shift to the same speakers having little stuttering with velar stops and much stuttering with alveolar fricatives. In some individuals this transfer of sound groups was "rather rapid and pronounced" (Johnson & Brown, 1935, p. 486) while in other individuals there was very little or no shifting of the tendency to stutter to other groups of sounds. The authors noted that the speakers who were more severe were more likely to be consistent in the comparative amount of disfluencies exhibited in relation to the different speech sounds. The reasons for this shift in tendency to stutter on certain sounds is not fully understood.

Logan and Conture (1997) investigated whether or not syllable structure predicted severity of stuttering. They looked at the speech of 14 white male children who stuttered and 14 white male children who did not stutter. The syllable shape of utterances were analyzed in terms of the number of filled onsets or codas per utterance and the number of consonant or consonant cluster in syllable onsets and codas per utterance. The study did not support the idea that stuttered utterances differ from perceptibly fluent utterances in any of the above categories. The authors concluded that there is no evidence to support that the frequency or duration of stuttered events are significantly associated with the complexity of syllable shapes.

Grammatical factors

Researchers have studied other linguistic factors in addition to speech sounds when investigating variability in the frequency of stuttered events. Brown (1937) looked at how grammar, specifically the part of speech a word belongs to, affects the frequency of stuttering. He grouped words into eight conventional parts of speech and concluded that for individual speakers who stutter there exists an order of difficulty for the parts of speech, which from most difficult to least difficult were adjectives, nouns, adverbs, verbs, pronouns, conjunctions, prepositions, and articles. This order was not statistically significant but there was great consistency among the different participants in the study. Further research is needed to more convincingly determine the effect of grammatical category on stuttering frequency. Brown noted that the grammatical factor of difficulty *does* relate to the phonetic difficulty of speech sounds as investigated in Johnson and Brown (1935). Parts of speech that were easier for speakers to say had a tendency to begin with speech sounds that had previously been ranked as less likely to be stuttered and vice versa. There was also evidence that difficulty in differences between parts of speech and initial speech sounds existed independently. Specific parts of speech were not less likely to be stuttered simply because they tended to begin with speech sounds that were less likely to be stuttered. This is evidenced by comparing the frequency of stuttered events in proper nouns and articles. Even when these two parts of speech began with the same speech sound, proper nouns were more likely to be stuttered than articles. Finally, Brown also concluded that words that were less likely to convey meaning were stuttered less often.

Quarrington, Conway, and Siegel (1962) also looked at how the grammatical form of a word affected frequency of stuttering. They were not able to confirm Brown’s findings. Quarrington et al. did find differences of statistical significance between the word classes but they were in the reverse order of what would have been anticipated from Brown’s 1935 study. Further research is required to determine the true effect of grammatical category on stuttering frequency. Quarrington et al. did, however, validate Brown’s observation of stuttering frequency as associated with position within a word. Quarrington et al. found a higher level of stuttering associated with the initial position, as compared to the terminal position, of words. In 1965 Quarrington looked at the relationship between word position and word predictability (a measure of likeliness of conveying meaning as defined by Brown) and stuttering incidence. Quarrington’s study supported Brown’s conclusion: correlations with stuttering incidence indicated that the frequency of stuttering increased with words of more informational value (less predictability). Quarrington also found that the earlier a word appeared in a sentence, the more likely it was to contain an instance of stuttering.

Howell, Au-Yeung, and Sackin (1999) further explored how part of speech affects fluency. Their study consisted of 51 people who stutter and 68 fluent speakers that were separated into five age groups: 2-6 year olds, 7-9 year olds, 10-12 year olds, teenagers, and adults. The participants were asked to speak continuously on specific topics and the relationship between stuttered events occurring on function and content words was analyzed. Function words were further subdivided into function words that occurred after a content word and function words that preceded content words. For example, in the sentence, "Give the book to me," when looking at the content word "book," "the" is the function word that precedes the content word and "to" is the function word that occurs after the content word. For all speakers results revealed very few disfluencies on function words that followed content words. Also for both groups disfluencies occurred predominantly on either the content word or the function word preceding a content word. For the fluent group more disfluencies occurred on the initial function word. This pattern was also observed in the 2-6 year old stuttering group but as the stuttering groups increased in age disfluency decreased on initial function words and increased on content words. One possible explanation for this occurrence is that the disfluencies of fluent speakers are often the result of uncertainty (Clark & Clark, 1977). Stalling on the function word prior to a content word allows the speaker to compose the exact content word they want to use, perhaps 2-6 year old children who stutter take longer to formulate their sentences and therefore are more likely to pause or be disfluent on function words prior to content words than older individuals who stutter; further evidence will be needed to verify this assumption.

Syntactic factors

Bernstein (1981) developed "a view of early stuttering as a sentence planning and integration disorder" (p. 341). She examined the speech of eight children who stuttered and eight fluent children. The constituent structures of subject noun phase, auxiliary, verb phrase, object noun phase, conjunction, and complement were isolated for comparison. Children were significantly more likely to be disfluent prior to or on the first word of a constituent rather than scattered throughout constituent components. Furthermore, the stuttering group was significantly more likely to fragment utterances along constituent boundaries than the fluent group, perhaps implying that children who stutter require even more time than fluent children to “integrate the components of the various sentence constituents” (Bernstein, 1981, p. 349). The favored locus of disfluency for both groups was the first noun phrase of an utterance. The results of this study suggest that the loci of stuttered events for young speakers are syntactically governed rather than randomly distributed throughout an utterance.

Bernstein Ratner (1995) synthesized the available research and clinical evidence correlating the likelihood of moments of stuttering with syntactic complexity. A large portion of the prior research established a positive correlation between the two. Bernstein Ratner and Sih (1987) demonstrated a highly significant positive association between grammatical complexity of imitated sentences and the occurrence of stuttering. Their data also suggested that sentence complexity was more likely to be predictive of stuttering than sentence length alone. Brundage and Bernstein Ratner (1989) added to this when they found that utterance length measured in morphemes was more likely to predict moments of stuttering than was utterance length measured in syllables. Gaines, Runyan, and Meyers (1991) used Developmental Sentence Scores (DSS; Lee, 1974) to measure the structural complexity of sentences and then compared them to moments of stuttering. DSS rates children’s spontaneous sentences based on a developmental scale of syntax acquisition (Lee & Canter, 1971). They concluded that children who stutter are significantly more likely to stutter on more structurally complex sentences, as measured by DSS, as well as on longer sentences; these results were replicated by Weiss and Zebrowski (1992). Logan and Conture (1995) were not able to replicate these results; they found no significant difference in DSS scores between stuttered and perceptually fluent utterances.

Although it had previously been established that young children are more likely to stutter on utterances that have a higher degree of syntactic complexity or are longer (Bloodstein, 1995; Bernstein Ratner, 1997), separating the contributions of utterance length and complexity has proved difficult as longer utterances are more likely to be complex than shorter utterances (Bernstein Ratner & Sih, 1987). It should be noted that older participants may not exhibit the same relationship between stuttering and sentence length and complexity as younger participants because as participants age they become more skillful language users and gain mastery of linguistic structures (Silverman & Bernstein Ratner, 1997).

Consequently, identifying which specific aspects of syntax might predict the occurrence of stuttering behaviors was explored by Yaruss (1999). Utterances were analyzed according to sentence structure, clause structure, and phrase structure. Group averages revealed that stuttered utterances were significantly longer than fluent ones, with length being measured in number of words, syllables, morphemes, and clausal constituents. The same correlation held true for the utterances of individuals but the relationship did not achieve significance. No difference was found between grammatically correct and grammatically incorrect utterances regarding the incidence of stuttering. Utterances of greater grammatical complexity were more likely to be stuttered than grammatically simpler utterances, however. This finding is consistent with the research of Brown (1937) and Quarrington et al. (1962). Interestingly, questions were significantly more likely to be stuttered than declaratives. When examining clause structure, it was discovered that the main verb in stuttered utterances had greater valance (importance to the sentence), as well as a higher total number of arguments, than the main verb in fluent utterances. The presence of an elaborated noun phrase also significantly predicted the likelihood that an utterance would be stuttered. There was no significant relationship between the probability that an utterance would be stuttered and the presence of auxiliaries in the main verb phrase but a negative marker in the main verb phrase did significantly predict stuttering. A positive correlation was found between all the above syntactic factors and length except for the average valance of the main verb, clausal constituents, and negative markers. In summary, Yaruss found that:

> Stuttered utterances tended to be longer (whether measured in words, syllables, morphemes, or causal constituents),…complex (i.e., contain both a main and embedded clause), to be questions, to have a higher main verb valance or more arguments in the main clause, to have elaborated noun phrases, or to have negative makers in the main verb phrase. (1999, p. 10)

While these conclusions hold true for group averages, these differences did not always reach significance for individual speakers. Therefore it is likely that individuals who stutter will display speaking patterns that do not completely match these guidelines.

Table 2 gives an outline of the linguistic factors that affect the variability of stuttering. Although linguistic factors have been documented to contribute to the likelihood of stuttering they have not been able to predict stuttering entirely. Researchers are only able to predict that for a given speaker stuttered events are more likely to occur on consonants rather than vowels, content words rather than function words, and complex utterances rather than simple utterances. Thus, some explanation of variability has been obtained, though our understanding of these factors is still incomplete.

Table 2. Linguistic Effects on Stuttering Variability

Stuttering is more likely to occur:
On the initial position of a word (Johnson and Brown, 1935; Quarrington, Conway, & Siegel, 1962)
On words of more informational value/less predictability (Brown, 1937; Quarrington, 1965)
On words beginning with consonants rather than vowels (Johnson and Brown, 1935)
Regardless of syllable structure (Logan and Conture , 1997)
On content words rather than function words (Howell, Au-Young, & Sackin, 1999)
In the earlier position of a constituent/phrase/sentence (Bernstein, 1981; Quarrington, 1965; Taylor 1966)
In more grammatically complex sentences (Bernstein Ratner & Sih, 1987; Brown, 1937; Quarrington et al., 1962; Yaruss, 1999)
In longer sentences (Yaruss, 1999)
In more syntactically complex sentences (Bernstein Ratner, 1997; Bernstein Ratner & Sih, 1987; Bloodstein, 1995; Yaruss, 1999)
When the main verb has greater valance (Yaruss, 1999)
On longer words (Taylor, 1966)

1.1.2.4 Variability as it relates to sample size

Variation in stuttering frequency has also been investigated as it relates to the *size* of the speech sample collected. Donohue (1955) had people who stutter read magazine passages for three consecutive hours. An analysis of each hour to hour segment revealed an overall decrease in moments of stuttering. It is of note that there were significant differences between the first and third hours. This indicates that although the adaptability over the course of the reading was gradual it amounted to significant differences. This could have some interesting consequences for measuring stuttering. It is intuitive to think that the larger the speech sampled collected for assessing a speaker's stuttering behavior the more representative it will be of the true nature of their stutter. This may not be the case if adaption tends to decrease the amount of disfluencies a speaker experiences over time. Unfortunately Donohue's study only looked at this effect during a reading scenario; as such, this adaptation effect cannot be generalized to other assessment measures without further research. It must also be noted that three hours of continuous reading is not a normal speaking condition; another task that more closely approximates normal speaking circumstances, such as an extended conversation, may yield different results. Furthermore, this task has not been done with nonstutterers; the typical reaction to three consecutive hours of reading is unknown.

Sawyer and Yairi (2006) also examined how the length of a speech sample affects the assessment of stuttering. They observed how the sample size of an utterance might change the classification of the severity of a person's stuttering. The authors took 1,200-syllable speech samples of their participants and divided them into four 300-syllable sections. The frequency of stuttering varied from section to section. The section that contained the most stuttering-like disfluencies also varied from speaker to speaker. The adaptation effect described by Donohue (1955) was not seen by Sawyer and Yairi; however, Donohue used significantly longer samples in his study and therefore caution must be taken in comparing the two studies. Sawyer and Yairi recognized that stuttering is variable and came to the conclusion that, because larger sample sizes provide a more representative picture of the person's stuttering behavior, they are best for diagnosing people who stutter. The authors showed that stuttering varies, but they did not show *how* it varies. Without knowing how a client's stutter varies *within* a speech sample, it is impossible to know when a representative sample has been obtained. If the variability can be predicted to some extent this process can be streamlined and only specific parts of a speech sample would need to be analyzed.

1.1.2.5 Variability as it relates to Speech Rate

Speaking rate can be described in terms of two different but related measures: overall speaking rate (Johnson, 1961; Johnson, Darley, & Spriestersbach, 1963; Kelly & Conture, 1992) and articulatory speaking rate (sometimes called "articulation rate"; Kelly & Conture, 1992, Logan & Conture, 1995; Yaruss & Conture, 1995). Overall speaking rate is the total number of words spoken in a specified time limit or the number of words divided by time; it is conventional to measure overall speaking rate in words per minute. Due to the nature of this measurement (number of words/time) pauses between words and disfluencies are included in the calculation. For example, if both a fluent individual and a person with a moderate to severe stutter read the same passage and the number of words that were spoken in the first minute are used to calculate the overall speaking rate, the person who stutters will likely say fewer words in the first minute due to their disfluencies. They will therefore have a lower overall speaking rate compared to the fluent person.

This is in contrast to articulatory speaking rate which is the number of *fluent* syllables spoken in a specified time limit or fluent syllables divided by time. It is conventional to measure articulatory speaking rate in syllables per second. Since articulatory speaking rate, by definition, only takes into account fluent syllables, pauses between words and disfluencies are not included in the calculation.

Speaking rate has long been considered to be at least partially responsible for the frequency of disfluencies in speech (Rieber & Wollock, 1977). There is evidence that individuals who stutter speak at speeds that their speech mechanism cannot handle (Karniol, 1995; Perkins, Kent, & Curlee, 1991; Postma & Kolk, 1993; Starkweather & Gottwald, 1990). This is further evidenced by the vast amount of studies that show that fluency can be increased in speakers by slowing speaking rate, often by pausing more in between words and phrases (Conture, 2001; Conture, Louko, & Edwards, 1993; Costello, 1983; Guitar, 2005; Kelly & Conture, 1991; Manning, 2010; Ryan 1984; Starkweather, Gottwald, & Halfond, 1990).

Articulatory speaking rate is strongly correlated with overall speaking rate (Kelly & Conture, 1992); however, research does not support a link between articulatory speaking rate and stuttering. Yaruss and Conture (1995) found no difference between the articulatory speaking rate of children who stutter and children who do not stutter. Logan and Conture (1995) found no difference between the articulatory speaking rate of stuttered utterances and perceptually fluent (fluent from the perspective of the listener) utterances in children who stutter. Yaruss (1997c) found no relationship between the severity of children's stuttering and their articulatory speaking rate.

Most treatments for stuttering involve a reduction in the speaking rate of the speaker or, if the speakers are pre-school age, their caretakers to some degree (Conture, 2001; Conture, Louko, & Edwards, 1993; Costello, 1983; Guitar, 2005; Kelly & Conture, 1991; Manning, 2010; Ryan 1984; Starkweather et al., 1990; Yaruss, 2010b, Yaruss, Coleman, & Hammer, 2006; Zebrowski, Weiss, Savelkoul, & Hammer, 1996). For some therapies the goal of speaking rate reduction is only one goal to be seen within a milieu of others (Yaruss, 2010b). In other therapies it is seen as a powerful tool and is the main focus of treatment (Shames & Florance, 1980). Regardless of speaking rate's priority in treatment it is important that the speaker still sound natural. The importance of naturalness is two-fold: 1) clinicians do not want to replace stuttered speech with slow speech that may be just as stigmatizing to the client and 2) speakers are more likely to use reduced rate outside of the clinic setting if their speech sounds natural to them; many adult speakers do not prefer new speaking patterns that they feel are awkward or unnatural (Yaruss et al., 2002).

Reducing the speaking rate of children's caretakers has been shown to be helpful in reducing their frequency of stuttering. This is not because it reduces the speaking rate of the children (Bernstein Ratner, 1992; Marchinkoski & Guitar, 1993; Stephenson-Opsal & Bernstein Ratner, 1988). Instead, it decreases their communicative time pressure (Yaruss, Coleman, & Hammer, 2006; Zebrowski, Weiss, Savelkoul, & Hammer, 1996). Communicative time pressure is the pressure placed on a speaker to produce speech within a certain time limit. Increases in communicative time pressure has been suggested to increase the frequency of stuttering in some children (Conture, 1990b; Starkweather et al., 1990).

1.1.2.6 Variability over Time

The vast majority of research into the variability of stuttering has been cross-sectional in design, meaning that participants are not followed for any significant amount of time. These studies have provided an abundance of clinical and theoretical knowledge, but due to their nature do not give a picture of how stuttering changes over time. Longitudinal studies would provide a better picture of this aspect of variability but there are not many.

Yairi and Ambrose (1992a, 1992b, 2005, pp. 23-44) conducted the Illinois Stuttering Research Project, a large-scale longitudinal study that followed three groups of children for several years. The groups consisted of 146 children who were originally referred within a year of stuttering onset, 17 additional children who were seen more than one year after onset of stuttering, and 59 fluent children. One aspect of the Illinois Stuttering Research Project focused on the frequency of stuttered events of 27 preschool children over a two year period (Yairi & Ambrose, 1992a). The authors educated the parents of all the participants on indirect treatment techniques at the initial visit and provided some direct treatment to a number of participants. Their data showed a marked degree of variability in the frequency of stuttering in these children. For example, participant 31 had 77.00 stuttering-like disfluencies per 100 syllables on visit number two and 1.20 stuttering-like disfluencies on visit number four. Many of their participants exhibited a sharp decline from the first to second visit, others exhibited a more gradual decline, and still others exhibited a fluctuating up-and-down course, showing that there can be significant variability in stuttering behaviors over time, even for children who have been exposed to treatment.

Although not long enough to be a true longitudinal study, Gutierrez and Caruso (1995) conducted a case study on a three year, eight-month old boy who stuttered that looked at how the boy's stuttering changed over time. The participant received no direct therapy; however, the parents of the participant received indirect therapy instruction by the second author. The participant's mother made six audiotape recordings of informal play sessions involving the participant over the course of four months. Once again the variability of the participant's stuttering frequency was great. During a one-day period the participant's percent stuttering frequency per 300 words decreased by nearly 50% (7.0% to 4.0%). The most disfluent measurement was 14.3% disfluent and the least disfluent measurement was 4.0% disfluent, a nearly 72% decrease in stuttering frequency.

Throneburg and Yairi (2001) compared disfluencies over time of two groups of 10 children: one group of children whose stuttering persisted and one group who recovered. Speech samples were taken every six months for three years. For each group, three of the visits were analyzed for the study. For the persistent group the first analyzed session occurred less than 12 months post-onset of stuttering, the second visit was between 19 and 24 months post-onset, and the third visit was between 31 and 36 months post-onset. For the persistent group the mean frequency of stuttering-like disfluencies per 100 syllables for each visit was 9.47, 9.00, and 7.21 respectively. The changes in disfluencies over time were not significant for the persistent group. The recovered group had their first analyzed visit less than 12 months post-onset of stuttering, the second visit pre-recovery, and the third visit post-recovery. The differences in their frequency of stuttering-like disfluencies per 100 syllables for each visit were 16.17, 5.70, and 1.95 respectively. These changes over time did reach significance. Data on the frequency of stuttering-like disfluencies per 100 syllables for individual speakers were not available; however, the magnitude of standard deviations of the measures suggest that there was notable within-group variation.

Care should be taken in interpreting these results as they relate to the present study. Both Yairi and Ambrose (1992b) and Gutierrez and Caruso (1995) provided their participants with indirect treatment. Yaruss, Coleman, and Hammer (2006) demonstrated that around two-thirds of preschool children can recover from stuttering from receiving indirect treatment alone. Thus this education of the parents may be a confounding factor. Further confounding the results, Yairi and Ambrose (1992b) provided direct treatment to some of the children in their study. The provision of treatment is a possible explanation for the trend of declining stuttering frequency in the Yairi and Ambrose (1992b) study. In Throneburg and Yairi (2001), individual data were not available; while the group data may not show significant differences between the frequency of disfluencies between visits for the persistent group, individual data may paint a different picture. Also all three studies used children as their participants. This study will use adults who are currently receiving no therapy as participants. While there are differences between these studies and the present one, they do showcase how variable stuttered events can be. Some children achieved significant differences between frequencies of stuttered events on different visits while others did not.

1.1.3 Consequences and Implications

The body of research discussing the variability of stuttering is impressive. Researchers have tried to predict variability based on past stuttering events; factors that decrease disfluencies have been discovered; and situational, linguistic, and paralinguistic variables have been explored. Nonetheless, there is still a great deal that is unknown about the variability of stuttering. Researchers have clearly documented that stuttering is highly variable; yet, the degree of this variability has not been thoroughly examined. It is has not been determined if a speaker's frequency of stuttering operates within a restricted range, for example 20% to 40% syllables stuttered, or if their stutter can vary throughout the entire frequency range (0% to 100%). This is valuable information for clinicians. If a person's frequency of stuttering varies within a restricted range, then achieving a percentage of syllables stuttered through treatment that is outside and lower than this range may be judged to be clinically significant. Such an outcome would lend support to the idea that the treatment may be responsible for the change in stuttering frequency rather than normal variability.

Relatedly, it is not yet known how much variability exists in stuttering frequency from one day to another and one week to another. This gap in the literature has significant consequences for the validity of treatment outcomes. In treatment and in treatment outcomes studies a speaker's fluency is often assessed at baseline and then again following treatment. If stuttering varies significantly from one sample to the next, i.e. from week to week, when no treatment is delivered, it would be difficult, if not impossible, to interpret results of a treatment study that are based on a baseline and outcome comparison of fluency. As such, investigation into day-by-day and week-by-week variation of fluency has both clinical and research implications and is essential for the application of EBP to the treatment of stuttering.

The aim of this study is to evaluate the frequency of stuttering in adults on successive days and successive weeks with the objective of determining how much stuttering varies from one day or week to the next. The goal is to define this variability and to explore variables that may help to explain it. Comparisons of the range of variability will be made within individual speakers and between speakers on successive days and weeks.

2.0 METHOD

In this study six speakers were assessed in five different speaking situations: three spontaneous speaking tasks and two reading tasks. After an initial data collection session (on Day 1) they subsequently returned to the clinic for a repeated data collection session for two consecutive days (Day 2 and Day 3). They then returned again one week following the initial data collection session (Day 7) and again one week after that (Day 14). The frequencies of stuttering and disfluency obtained in each sample were compared across tasks, over time, and between speakers. Key aspects of the speech samples were analyzed in an attempt to identify possible reasons for the variability that was observed.

2.1 PARTICIPANTS

The participants were six adults who stutter. They were recruited based on personal contacts of the first author. Participants were purposely chosen based on personal contacts of the author. This study attempts to explore the nature of stuttering variability and it has been documented that emotions and stress can impact fluency (Blood, Wertz, Blood, & Bennett, 1997). There was some concern that as the participants acclimated to the author there could be a corresponding increase in fluency. This was avoided by choosing participants who were already comfortable with the author.

Five participants were initially chosen for the study but the data for one of the participant's (Participant 1) sessions was lost due to a computer malfunction. A sixth participant was incorporated into the study to make up for the lost data. Not all of the data for Participant 1 was lost and his remaining data was used in the study. The number of participants was chosen so that speakers with different stuttering characteristics and severities could be compared to one another. This is a preliminary study; therefore, a relatively small samples size was used and care was taken in the interpretation of the data.

Participants were made aware of the fact that they would be returning to the laboratory for several speaking samples, but they were naïve to the specific purposes of the study. They were all native mono-lingual English speakers over the age of 21 and self-identified as being a person who stutters. In addition to considering themselves a person who stutters, they also demonstrated at least mild stuttering severity as measured by the *Stuttering Severity Instrument-Fourth Edition* (SSI-4; Riley, 2009) and mild adverse impact as measured by the *Overall Assessment of the Speaker's Experience of Stuttering* (OASES; Yaruss & Quesal, 2010) based on the initial speech sample. The author excluded any participants who were currently receiving speech-language therapy or had any known speech, language, hearing, psychological or neurological disorders, with the exception of stuttering.

2.2 DATA COLLECTION

2.2.1 Tasks

2.2.1.1 Demographic Questionnaire

A brief demographic questionnaire was administered to all of the participants prior to the first session (see Appendix A). This questionnaire documented the participant's age, gender, age of onset of stuttering, family history of stuttering, and history of treatment.

2.2.1.2 Spontaneous Speaking Tasks

The spontaneous speaking tasks included a conversation, a monologue, and a picture description task. The conversation was a 10-minute speech sample conducted with the author. It represented a normal clinical conversation that would take place between a clinician and their client. A series of questions were asked and commented on, including but not limited to: Why are you here? How do you feel about your stuttering? Are you or have you ever been a covert stutterer? How long have you been stuttering? How has it changed? Have you had past therapy? What worked for you? What did not work for you? What do you know about stuttering? What restrictions on your life has stuttering caused? Do you have a family history of stuttering? Do you have any other speech or language disorders?

The conversation for each session was conducted for 10 minutes. After the 10 minute mark was reached the conversation was allowed to continue but no further clinical questions were asked. The clinical conversation was continued during the following session with the questions that were not yet asked. The author actively commented on what the speaker was saying and added his own personal input; this is distinct from the monologue where the only input from the author was prompts to keep the speaker talking.

The monologue was a five minute uninterrupted speech sample. Questions used to elicit the sample included but were not limited to, “tell me about your job,” “tell me about your family,” “tell me about where you are going on vacation this year,” “tell me about a prior year’s vacation,” and “tell me about where you live.”

The picture description task had the speakers describe a different picture for five minutes each session. A number of different pictures were used, including pictures from SSI-4 (Riley, 2009). The speakers described the pictures with minimal cueing from the first author. When the speakers were having trouble thinking of more things to say, the author cued the speakers by asking them open ended questions about the picture. For example, “What do you think about the dinosaurs eating pizza?”

2.2.1.3 Reading Tasks

The reading tasks included reading aloud an adapted version of “Arthur the Rat” (Dictionary of American Regional English, 1965; see Appendix B) and selected passages that were changed every session (see Appendices C through G) for the “random reading” task. “Arthur the Rat" is a short story that contains all of the phonemes found in American English. The other passages included adapted versions of “Comma Gets a Cure” (McCullough & Somerville, draft 2000; see Appendix C), “The North Wind and the Sun” (International Phonetic Association, 1999; see Appendix D), “The Grandfather Passage” (Van Riper, 1963; see Appendix E), “The Rainbow Passage” (Fairbanks, 1960; see Appendix F), and passages on plate XIII and XIV of the *SSI 4* (Riley, 2009; see Appendix G). The passages were selected based on their readability statistics and word count from an analysis done in Microsoft Word 2010. Passages had a Flesch Reading

Ease score between 50.0 and 100.0 and were less than Flesch-Kincaid Grade level 11.1. The passages were adapted to change any difficult or uncommon words that the author judged to be more likely to be stuttered. This was in order to avoid unfamiliar words artificially increasing frequencies of stuttering in the participants.

One passage was read during each of the five sessions and the passages were arranged in a different random order for each participant. For one session, two passages were paired together due to their short length. The two passages that were paired together were the “The North Wind and the Sun” (International Phonetic Association, 1999) and the “Grandfather Passage” (Van Riper, 1963).

2.2.1.4 Comprehensive Assessment

In addition to providing speech samples, the participants were also asked to provide some information about their attitudes regarding stuttering and its impact on their lives. This was assessed through the OASES (Yaruss & Quesal, 2010) and a “Daily Questionnaire” that contained open-ended questions (See Appendix H). The questionnaire contained questions that were answered at the start of each session and one follow up question that was answered at the end of each session. The questions given at the start of each session were, “How are you feeling today in general?”, “How fluent have you been lately?”, and for the first session, “How have you felt about your speech recently?” or “How have you felt about your speech since our last session?” for subsequent sessions. At the end of every session the question, “How did you think you did during today’s session?” was asked. Participants were required to give a written answer and a numerical answer. The quantitative responses were chosen from a one through seven scale, with one being the worst and seven being the best.

2.2.2 Data Collection Sessions

2.2.2.1 Collection

The sessions took place in a quiet testing room on the University of Pittsburgh's campus. The room was the same for every session. The tasks were done in the same order for every session, first the conversation, then the "Arthur" reading, followed by the monologue, then the random reading, and finally the picture description task. The data were collected through audio/video recordings done with a Sony DCR-TRV11 video camera with a Sony ECM-MSD1 Electret Condenser Microphone attachment. These were digitized directly onto a computer and the files were saved on a password protected external hard drive.

2.2.2.2 Blinding and Randomization

The author participated in every session and also counted and analyzed the data from every session. In order to avoid any bias that the author may have had, the sessions were ordered with randomly assigned numbers by an associate of the author. The data were labeled with these numbers when they were taken. When the author counted the data he was blinded to the session number he was analyzing and could only identify the data by the randomly assigned number. After the data was counted, it was relabeled with the correct session number for analysis.

2.2.2.3 Standardization

In order to ensure that all of the participants had as similar an experience as possible to each other, the procedures that the author used to conduct the sessions were standardized. The verbal directions for every task for each specific session were stored in a binder. The author opened the binder to the session he was conducting and read the directions off the page. As mentioned above, the tasks were performed in the same order in every session for every participant. This was to ensure that variability in frequency of stuttering was due to the nature of the speaker's stuttering and not due to the way the sessions were conducted.

2.3 DATA ANALYSIS

The data collected was mostly descriptive in nature. The frequency, duration, and types of stuttered events that occurred on the various tasks were compared between the different sessions of the same speaker and between speakers. Three-hundred syllable speech samples have frequently been used in past research studies to analyze moments of stuttering (Conture & Kelly, 1991; Gutierrez & Caruso, 1995; Pellowski & Conture, 2002; Riley, 1972; Schwartz, Zebrowski, & Conture, 1990b; Zebrowski, 1991) and have been suggested to be of adequate length to assess variation in stuttering (Adams, 1977; Conture, 1990b, Yaruss, 1997b). Using the middle of a speech sample has also been advocated (Riley, 1972). For these reasons, the middle 300 syllables of every speech sample were used for analysis. Participant 1 had two tasks, the picture description task on Day 1 and Day 2, which were less than 300 syllables. For these tasks the entire sample was used. The picture description task for Participant 1 contained 187 syllables on Day 1 and 272 syllables on Day 2.

Results were calculated for the percentage of syllables that were stuttered and percentage of syllables that were disfluent. The percentage of syllables that were stuttered was solely concerned with stuttering-like disfluencies (Yairi, 1996; Yairi & Ambrose, 1992; Yairi, Ambrose, & Niermann, 1993; Yairi, Ambrose, Paden, & Throneburg, 1996; Yaruss, 1997b) while the percentage of disfluent syllables took into account all disfluencies. Both types of disfluency were counted in order to paint a more complete picture of the day-to-day variability. It was of interest whether only stuttering-like disfluencies varied from day to day or if all disfluencies varied from day to day. Correlations between these measures, along with SSI-4 scores, were made to try and explain the variability. The conversation and "Arthur" tasks were used to calculate scores for the SSI-4. The focus was on capturing patterns of stuttering frequency and duration within speakers with additional attention paid to the detection of consistent patterns shared between the speakers. The range of variability was defined for each speaker and for the cohort as a whole.

Qualitative data from the questionnaires were also analyzed and connections to the session data were made. Comprehensive assessment techniques were correlated with the range of variability. This was accomplished by correlating the participants' OASES scores, quantitative responses to attitudinal questions, and physical concomitant scores of the SSI-4 to their range of variability.

2.4 RELIABILITY ASSESSMENT

In order to ensure that all data were both reliably collected and scored, both intra-judge and inter-judge reliability measures were performed. To ensure intra-judge reliability 20% of the data were selected at random and rescored by the author. To ensure inter-judge reliability another qualified individual scored this data as well. This individual, along with the author, were trained by the thesis advisor, a board-recognized specialist in fluency disorders with more than 20 years of experience in coding stuttering, to reliably count moments of stuttering in the speech of people who stutter. Observers have been documented to disagree considerably on both the location and number of stuttered events within a speech sample (Cordes & Ingham, 1994); therefore, it was important that both observers received thorough and similar training.

The assessment of reliability is particularly important to this investigation. In this study the variability of the stuttering behavior is being assessed, but variability of measurement also exists. In order to interpret the variability of the behavior being evaluated the variability of the measurement techniques must first be established. The measurement variability must be lower than the range of variability calculated from the data. Without this, there would be no way of knowing if the observed variability is due to the nature of the disorder itself or to variability in the author's measurements. For these reasons, intra-rater reliability is much more important than inter-rater reliability to this study. Intra-rater reliability demonstrates the amount variability present in the measurement of the data while inter-rater reliability concerns itself with the validity of the measurement as compared to a standard of measurement or 'gold standard'. The variability of the measurements is what is under investigation here.

2.4.1 Intra-rater Reliability

The mean difference between the original data and the date rescored by the author was 0.90% for percent stuttered syllables with a standard deviation of 1.02 and 1.05% for percent disfluent syllables with a standard deviation of 1.06. Pearson product moment correlation coefficients (r) were also calculated between the original data and the data rescored by the author in order to obtain an estimate of the reliability coefficient (Crocker & Algina, 1986; Cronbach, 1947; Suen, 1990) as recommended by Cordes (1994). There was significant agreement between the original data for percentage of syllables stuttered and the rescored data, $r = 0.991$, and between the original data for percentage of syllables disfluent and the rescored data, $r = 0.994$, at the 0.01

level (2-tailed). These indicated a high level of agreement between the original data and the rescored data and do not show enough variability in measurement to account for the magnitude of variability found in the data.

2.4.2 Inter-rater Reliability

The mean difference between the original data and the data rescored by the second observer was 1.74% for percent stuttered syllables with a standard deviation of 1.63 and 2.37% for percent disfluent syllables with a standard deviation of 1.86. Pearson product moment correlation coefficients were also calculated between the original data and the data rescored by the second observer to obtain an estimate of the reliability coefficient (Crocker & Algina, 1986; Cronbach, 1947; Suen, 1990). There was significant agreement between the original data for percentage of syllables stuttered and the rescored data, $r = 0.971$, and between the original data for percentage of syllables disfluent and the rescored data, $r = 0.964$, at the 0.01 level (2-tailed). These coefficients indicate a great deal of agreement between the author and the second observer.

3.0 RESULTS

The data are represented in graphs and tables below. First the data are presented by comparing each participant's frequency of stuttering and disfluency across the individual tasks on each of the days. In other words, each participant is compared to themselves; how they performed on each task is shown for each day. For example, Participant 1 is shown with frequency data for every task during every session; this is followed by the data for Participant 2. Frequency data are presented first: the percentage of syllables stuttered for each participant across the different tasks are shown followed by the percentage of syllables disfluent for each participant across the different tasks.

For these data, the minimum (Min), maximum (Max), and mean percentage of syllables stuttered and disfluent for each task across all the sessions are reported in the tables for each participant. The standard deviation (SD) and coefficient of variance (CV) for each task are also shown. The SD showed the magnitude of the variability while CV helped to determine the magnitude of the variability relative to the magnitude of the percentages of syllables stuttered or disfluent. Next the broader "characteristic" scores for each participant are shown across all the measures. These measures include stuttering severity as measured by the SSI-4, adverse impact of the disorder as measured by the OASES, and attitude and emotional state as measured by the Daily Questionnaire (DQ). The minimum (Min), maximum (Max), and mean scores for each measure across all the sessions are reported in the tables for each participant. The standard deviation (SD) and coefficient of variance (CV) for each measure are also shown.

The data are then presented by comparing the performances on the individual tasks across participants on each of the days. In other words, the participants are compared to each other on each task. For example, the conversation task is shown with the frequency data for every participant during every session; this is followed by the data for the “Arthur” reading. Frequency data are again presented first: the percentage of syllables stuttered for each task across the different participants are shown followed by the percentage of syllables disfluent for each task across the different participants.

For both of these sets of data the minimum (Min), maximum (Max), and mean percentage of syllables stuttered and disfluent for each participant across all the sessions are reported. The standard deviation (SD) and coefficient of variance (CV) for each participant are also shown. Next the broader characteristic scores for each measure are shown across all the participants. The minimum (Min), maximum (Max), and mean scores for each participant across all the sessions are reported in the tables for each measure. The standard deviation (SD) and coefficient of variance (CV) for each participant are also shown.

3.1 PARTICIPANTS COMPARED TO THEMSELVES

3.1.1 Frequency Data

When the participants are compared to themselves on the different tasks, a great deal of variability is apparent in frequency of stuttering and disfluency. This variability exists from day to day and also from task to task. No global pattern of variability is discernible from the data, although some individual patterns are detectable. The ranges of variability for both percentages of syllables stuttered and disfluent are shown in Table 3.

Table 3. Range of Variability for each Participant

			% Syllables Stuttered		% Syllables Disfluent	
Participant	**Sex**	**Age**	**Range (%)**	**Difference (%)**	**Range (%)**	**Difference (%)**
P1	Male	29	18.00 - 36.33	18.33	20.33 - 36.90	16.57
P2	Male	35	1.33 - 7.33	6.00	1.67 - 9.00	7.33
P3	Female	25	1.00 - 7.33	6.33	1.33 - 8.00	6.67
P4	Male	24	4.67 - 27.00	22.23	4.67 - 29.33	24.66
P5	Male	51	0.00 - 21.67	21.67	0.33 - 24.33	24.00
P6	Female	30	3.00 - 20.67	17.67	3.33 - 25.00	21.67

3.1.1.1 Participant 1 Frequency Data

Table 4 and Table 5 show the data for Participant 1 (P1) across all of the tasks. There are data missing on the Day 7 because those data were lost due to a computer malfunction, as mentioned above. Table 4 shows that P1 ranged from 18.00% to 36.33% of syllables stuttered. This is a range of 18.33% of syllables stuttered. It can be seen in Figure 1 that P1 stuttered more on the two reading tasks than on the speaking tasks. The reading “Arthur the Rat,” which was repeated every session, was the task that elicited the most stuttering. After “Arthur,” the random reading task contained P1’s next highest percentage of syllables stuttered across all the sessions. Figure 1 also shows that P1’s overall percentage of syllables stuttered decreased slightly over the course of the sessions.

Table 5, which summarizes P1’s percentage of syllables disfluent across tasks, shows that P1 ranged from 20.33% to 36.90% of syllables disfluent. This is a range of 16.57% of syllables disfluent. When percentage of syllables stuttered were counted P1 was most disfluent on the reading tasks but this pattern is lost when overall disfluencies are counted instead of moments of stuttering. “Arthur” continues to contain the highest percentage of syllables disfluent on all the days but the first, where it had a similar and just slightly smaller percentage of syllables disfluent than the picture description task. The conversation, monologue, and picture description tasks all contain higher percentage of syllables disfluent on specific days than the random reading task. This outlines a pattern that will be repeated by nearly all the participants, there were more nonstuttered disfluencies during the speaking tasks than during the reading tasks. Overall, both P1’s percentage of syllables stuttered and percentage of syllables disfluent decreased from session to session.

Table 4. Participant 1's Percentage of Syllables that were Stuttered Across Tasks

	Percentage of Syllables that were Stuttered (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	21.00	23.67	21.33	23.00	22.67	22.33	21.00	23.67	1.13	0.05
Arthur	36.33	36.00	35.33	*	30.33	34.50	30.33	36.33	2.81	0.08
Monologue	26.00	22.00	18.00	*	18.33	21.08	18.00	26.00	3.75	0.18
Reading	29.00	27.67	27.33	*	27.33	27.83	27.33	29.00	0.79	0.03
Picture	27.81	24.26	20.33	*	18.67	22.77	18.67	27.81	4.10	0.18
Overall	28.05	26.77	24.47	23.00	23.47	25.15	23.00	28.05	2.18	0.09

Note: Min=Minimum percentage of syllables that were stuttered for the task, Max=Maximum percentage of syllables that were stuttered for the task, SD=standard deviation of stuttered syllables for the task, CV=Coefficient of Variation for the task
* Data are missing due to computer malfunction

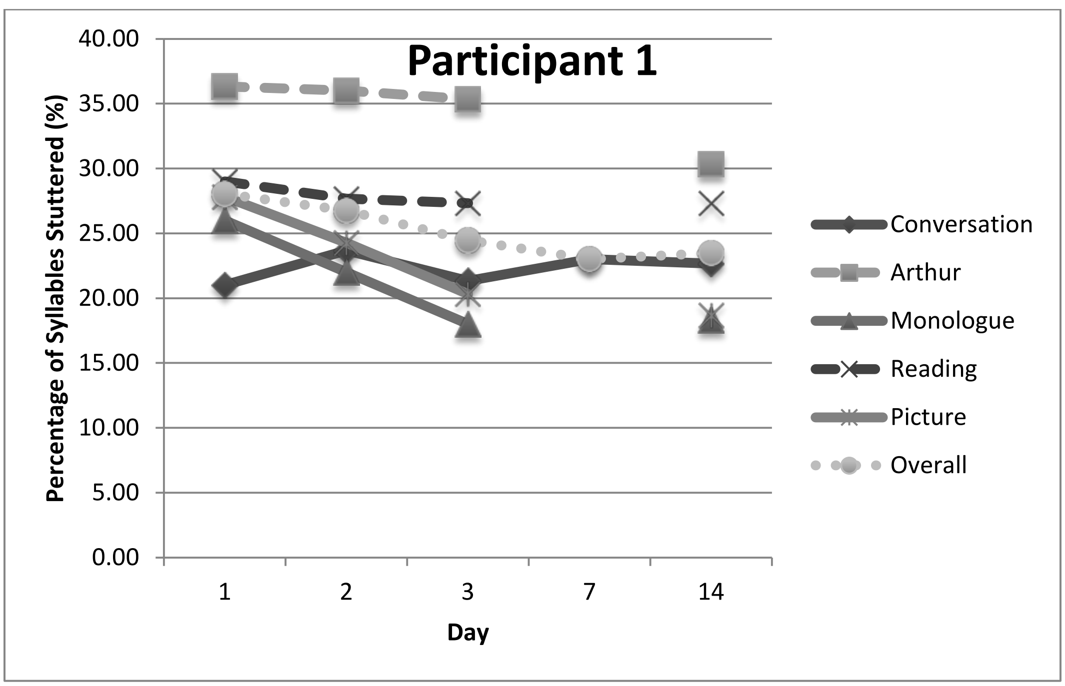

Figure 1. Participant 1's Percent Syllables Stuttered Across Tasks

Table 5. Participant 1's Percentage of Syllables that were Disfluent Across Tasks

	Percent of Syllables that were Disfluent (%)									
	Day									
Task	1	2	3	7	14	Mean	Min	Max	SD	CV
Conversation	26.00	29.67	23.00	26.00	25.33	26.00	23.00	29.67	2.39	0.09
Arthur	36.33	36.33	36.00	*	30.67	34.83	30.67	36.33	2.78	0.08
Monologue	33.67	28.33	20.33	*	23.00	26.33	20.33	33.67	5.91	0.22
Reading	29.00	28.33	27.33	*	27.33	28.00	27.33	29.00	0.82	0.03
Picture	36.90	27.21	24.00	*	21.33	27.36	21.33	36.90	6.80	0.25
Overall	32.01	30.03	26.13	26.00	25.53	27.94	25.53	32.01	2.90	0.10

Note: Min=Minimum percentage of syllables that were disfluent for the task, Max=Maximum percentage of syllables that were disfluent for the task, SD=standard deviation of disfluent syllables for the task, CV=Coefficient of Variation for the task

* Data are missing due to computer malfunction

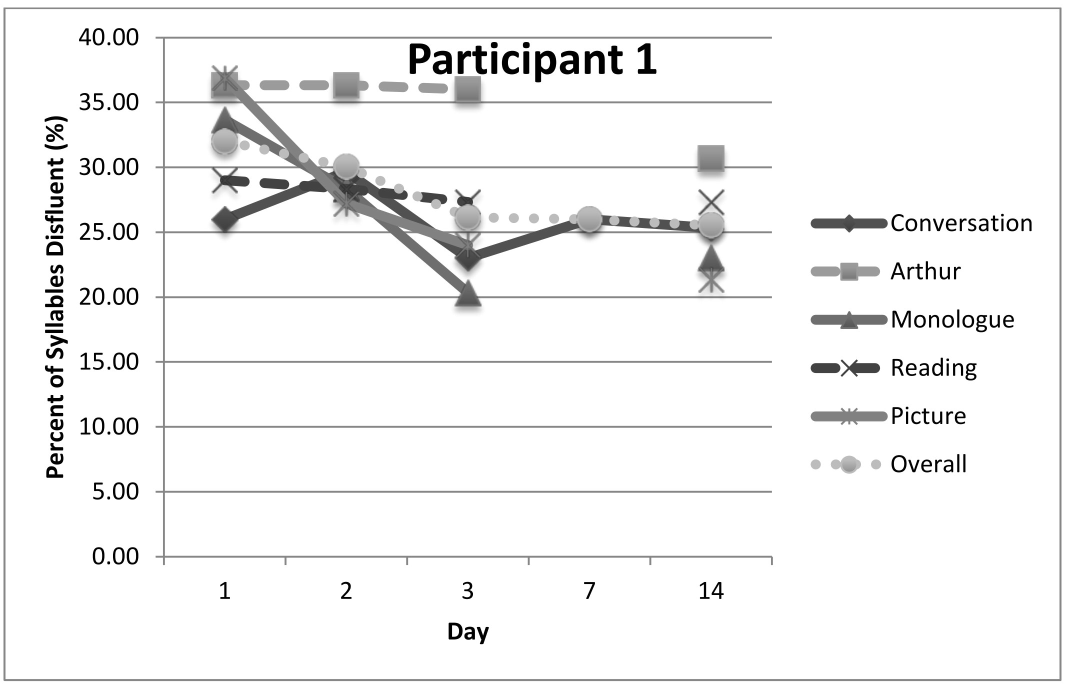

Figure 2. Participant 1's Percentage of Syllables that were Disfluent across Tasks

3.1.1.2 Participant 2 Frequency Data

Participant 2 (P2) showed a wide range of variability between tasks and days. Table 6, which summarizes P2's percentage of syllables stuttered across tasks shows that P2 ranged from 1.33% to 7.33% of syllables stuttered. This is a range of 6% of syllables stuttered. Figure 3 shows that there is no pattern to P2's percentage of syllables stuttered and performance on the tasks vary independent of each other. P2's overall percentages of syllables stuttered and disfluent was not as high as some of the other participants. This reduced P2's range of variability; however, within this range, P2 was highly variable. The conversation task contained both P2's highest and lowest percentage of syllables stuttered. On Day 7, P2 experienced a sharp increase in percentage of syllables stuttered from Day 3 on all tasks except for "Arthur," where he experienced a sharp decrease in percentage of syllables stuttered.

Table 7, which summarizes P2's percentage of syllables disfluent across tasks, shows that participant 2 ranged from 1.67% to 9.00% of syllables disfluent. This is a range of 7.33% of syllables disfluent. Figure 4 is similar to Figure 3 in that P2's performance varies greatly from day to day but there is more stratification by task. When total disfluencies are examined it is revealed that the monologue and picture description task contained the greatest amount of nonstuttered disfluencies. This is consistent with what was exhibited by P1: spontaneous speaking tasks contained more nonstuttered disfluencies than reading tasks. Interestingly, the two reading tasks followed opposite trends from day to day. As P2 increased in percent syllables stuttered and disfluent during "Arthur," he decreased on percent syllables stuttered and disfluent during the random reading. On Day 7, the percentage of syllables stuttered increased on all tasks except for "Arthur." The percentage of syllables disfluent increased on all tasks except for "Arthur" and the picture description task on Day 7.

P2 shows no overall trend in the percentage of syllables stuttered and disfluent from day to day. The fluctuations on the different tasks tended to balance each other out; the percentage of syllables or disfluent stuttered would increase for some tasks but decrease for others. Day 7 is an exception to this relatively flat trend, as most of the tasks on that day contained a higher percentage of syllables stuttered and disfluent compared to the previous days.

Table 6. Participant 2's Percentage of Syllables that were Stuttered Across Tasks

	Percentage of Syllables that were Stuttered (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	3.67	1.33	4.33	7.33	2.67	3.87	1.33	7.33	2.24	0.58
Arthur	3.00	3.67	3.67	1.67	4.33	3.27	1.67	4.33	1.01	0.31
Monologue	3.67	5.33	4.67	6.67	4.00	4.87	3.67	6.67	1.19	0.25
Reading	5.67	5.33	3.33	5.67	3.00	4.60	3.00	5.67	1.32	0.29
Picture	3.67	5.00	1.67	2.67	3.33	3.27	1.67	5.00	1.23	0.38
Overall	3.93	4.13	3.53	4.80	3.47	3.97	3.47	4.80	0.54	0.14

Note: Min=Minimum percentage of syllables that were stuttered for the task, Max=Maximum percentage of syllables that were stuttered for the task, SD=standard deviation of stuttered syllables for the task, CV=Coefficient of Variation for the task

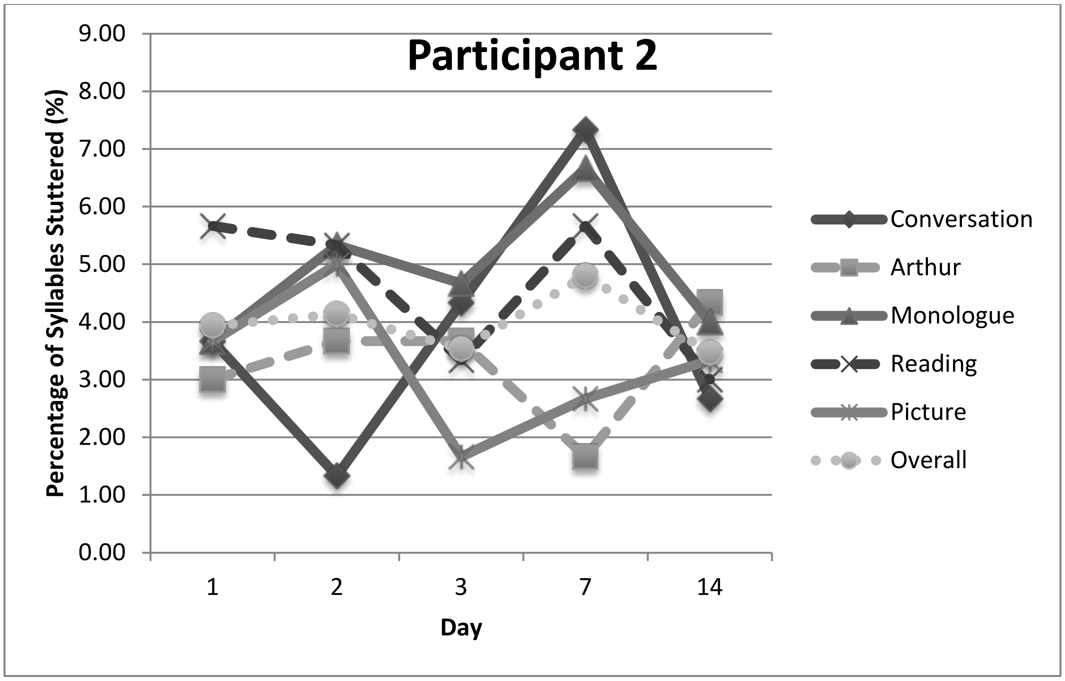

Figure 3. Participant 2's Percentage of Syllables that were Stuttered Across Tasks

Table 7. Participant 2's Percentage of Syllables that were Disfluent Across Tasks

	Percent of Syllables that were Disfluent (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	4.67	1.67	5.33	8.00	3.00	4.53	1.67	8.00	2.41	0.53
Arthur	3.00	3.67	3.67	1.67	4.33	3.27	1.67	4.33	1.01	0.31
Monologue	6.00	6.00	6.00	9.00	5.33	6.47	5.33	9.00	1.45	0.22
Reading	5.67	5.33	3.67	6.00	3.33	4.80	3.33	6.00	1.22	0.25
Picture	5.67	6.67	4.67	4.00	5.00	5.20	4.00	6.67	1.02	0.20
Overall	5.00	4.67	4.67	5.73	4.20	4.85	4.20	5.73	0.57	0.12

Note: Min=Minimum percentage of syllables that were disfluent for the task, Max=Maximum percentage of syllables that were disfluent for the task, SD=standard deviation of disfluent syllables for the task, CV=Coefficient of Variation for the task

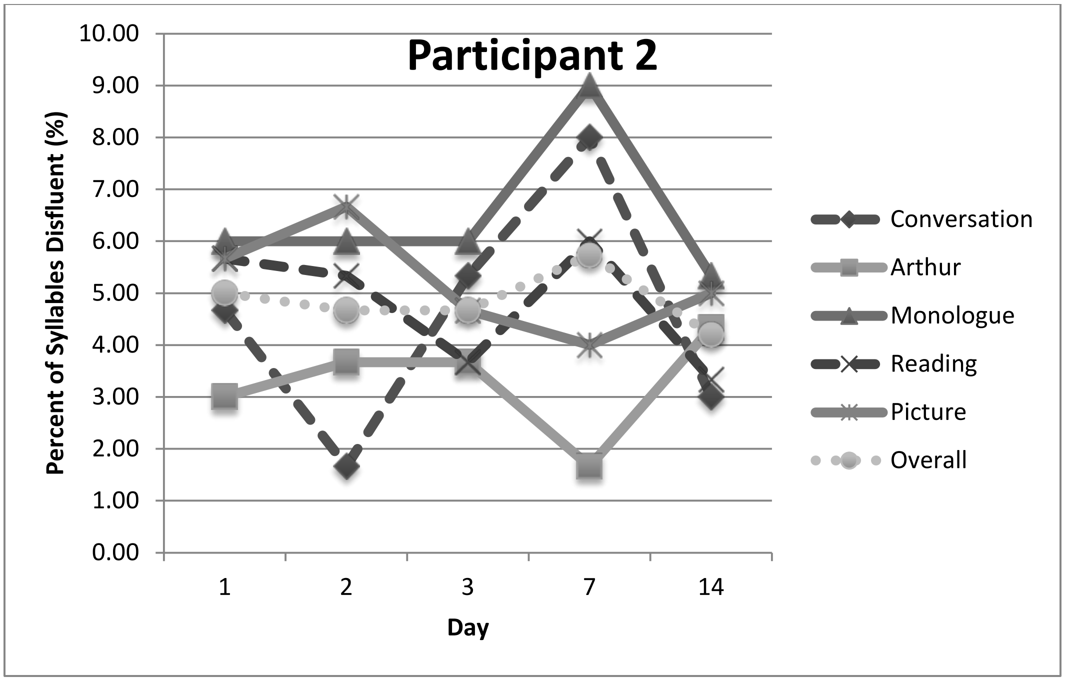

Figure 4. Participant 2's Percentage of Syllables that were Disfluent Across Tasks

3.1.1.3 Participant 3 Frequency Data

Table 8 shows Participant 3's (P3) percentage of syllables stuttered across tasks. P3 ranged from 1.00% to 7.33% of syllables stuttered; a range of 6.33%. Figure 5 shows that, for P3, "Arthur" contained a higher percentage of syllables stuttered than any other task across all the sessions. The monologue often contained the lowest percentage of syllables stuttered. The difference between the percentage of syllables stuttered during "Arthur" and the other tasks was marked on every day except Day 7. On Day 7, P3 experienced a decrease in the percentage of syllables stuttered on all the tasks to within one percentage point of each other. The percentage of syllables stuttered for the conversation and the picture description tasks followed the same pattern from day to day, decreasing between Day 1 and Day 2 and between Day 4 and Day 7 and increasing between Day 2 and Day 3 and again between Day 7 and Day 14.

According to Table 9, P3's percentage of syllables disfluent ranged from 1.33% to 8.00%; a range of 6.67%. When total disfluencies were counted instead of moments of stuttering "Arthur" contained the highest percentage of syllables disfluent on the first two days only. This is characteristic of the pattern observed by the prior participants: more nonstuttered disfluencies were present during spontaneous speaking tasks than during reading tasks.

Figure 6 does not show the same pattern on Day 7 for percentage of syllables disfluent as seen in percentage of syllables stuttered. While all the tasks, except for the monologue, did contain a lower percentage of syllables disfluent, there was not the same collapse to a similar percentage as seen with percentage of syllables stuttered on that day.

Table 8. Participant 3's Percentage of Syllables that were Stuttered Across Tasks

	Percentage of Syllables that were Stuttered (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	2.33	1.67	3.00	1.33	3.00	2.27	1.33	3.00	0.76	0.34
Arthur	7.33	6.33	5.67	2.33	4.67	5.27	2.33	7.33	1.91	0.36
Monologue	1.00	1.00	2.33	1.33	1.67	1.47	1.00	2.33	0.56	0.38
Reading	2.00	4.00	3.67	1.67	1.00	2.47	1.00	4.00	1.30	0.53
Picture	2.67	2.00	2.33	2.00	3.00	2.40	2.00	3.00	0.43	0.18
Overall	3.07	3.00	3.40	1.73	2.67	2.77	1.73	3.40	0.64	0.23

Note: Min=Minimum percentage of syllables that were stuttered for the task, Max=Maximum percentage of syllables that were stuttered for the task, SD=standard deviation of stuttered syllables for the task, CV=Coefficient of Variation for the task

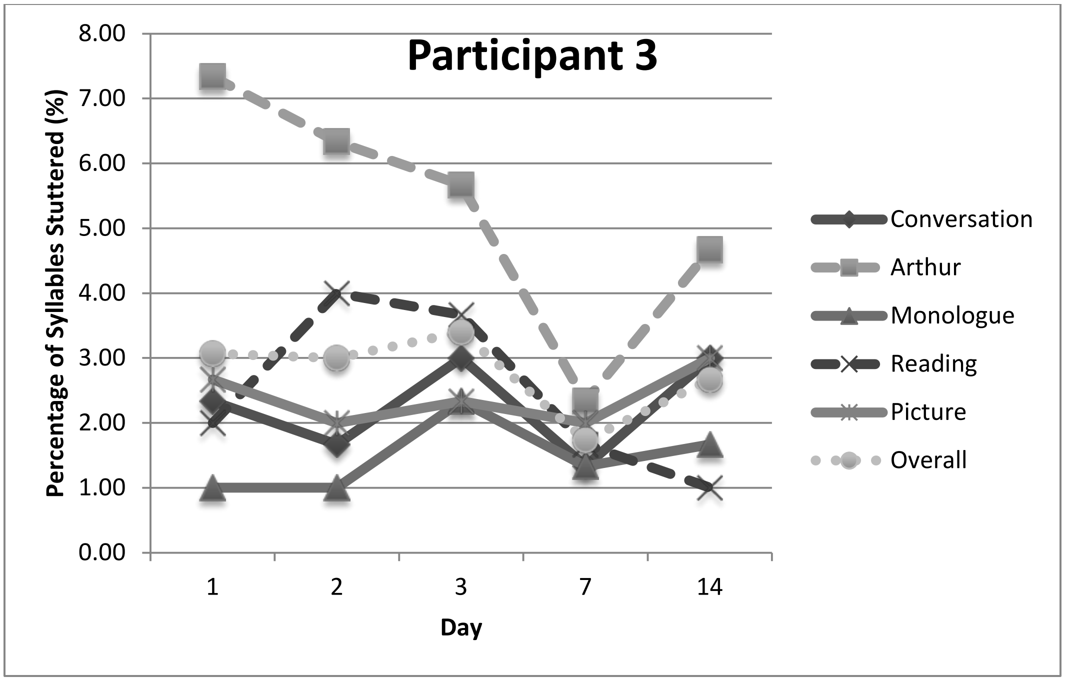

Figure 5. Participant 3's Percentage of Syllables that were Stuttered Across Tasks

Table 9. Participant 3's Percentage of Syllables that were Disfluent Across Tasks

	Percent of Syllables that were Disfluent (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	3.00	3.67	3.67	2.67	3.33	3.27	2.67	3.67	0.43	0.13
Arthur	8.00	7.00	5.67	2.33	4.67	5.53	2.33	8.00	2.19	0.40
Monologue	5.00	3.33	4.67	4.67	4.00	4.33	3.33	5.00	0.67	0.15
Reading	3.00	4.00	4.67	2.00	1.33	3.00	1.33	4.67	1.37	0.46
Picture	6.67	5.00	5.67	4.00	6.00	5.47	4.00	6.67	1.02	0.19
Overall	5.13	4.60	4.87	3.13	3.87	4.32	3.13	5.13	0.81	0.19

Note: Min=Minimum percentage of syllables that were disfluent for the task, Max=Maximum percentage of syllables that were disfluent for the task, SD=standard deviation of disfluent syllables for the task, CV=Coefficient of Variation for the task

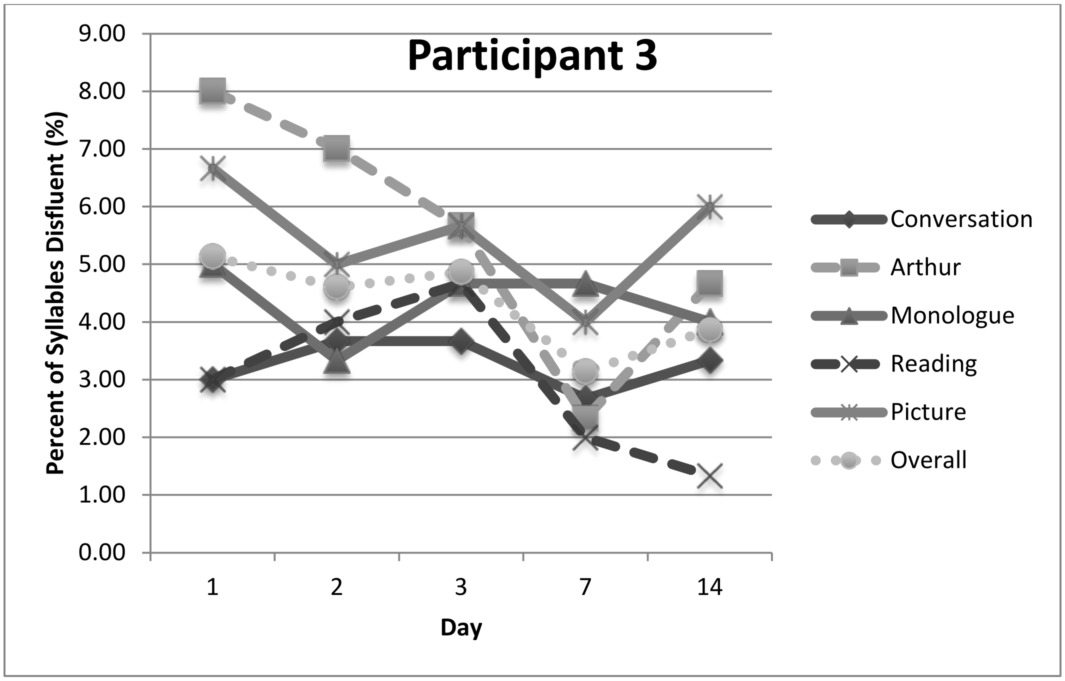

Figure 6. Participant 3's Percentage of Syllables that were Disfluent Across Tasks

3.1.1.4 Participant 4 Frequency Data

Table 10 shows Participant 4's (P4) percentage of syllables stuttered across tasks. P4 ranged from 4.67% to 27.00% of syllables stuttered. This is a range of 22.33%. Figure 7 shows that, for P4, the spontaneous speaking tasks contained a higher percentage of syllables stuttered than the reading tasks during every session. The conversation task contained the highest percentage of syllables stuttered on every day except for Day 2. The monologue always contained a higher percentage of syllables stuttered than the picture description task.

P4's percentages of syllables disfluent are shown in Table 11, which ranged from 4.67% to 29.33% across tasks. This is a range of 24.66%. Figure 8 shows that, similar to Figure 7, the spontaneous speaking tasks were more disfluent than the reading tasks for every session. When total disfluencies were measured instead of moments of stuttering the difference between the spontaneous speech tasks and the reading tasks was even more apparent. This highlights the greater number of nonstuttered disfluencies found in the spontaneous speaking tasks than the reading tasks.

The conversation task contained the highest percentage of syllables disfluent in every session except for Day 3. The monologue always contains a higher percentage of syllables disfluent than the picture description task. The two readings followed opposite patterns from session to session when measuring both percentage of syllables stuttered and percentage of syllables disfluent. These two tasks had opposite session-to-session patterns for P2, as well.

Table 10. Participant 4's Percentage of Syllables that were Stuttered Across Tasks

	Percentage of Syllables that were Stuttered (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	18.00	12.00	27.00	19.00	24.67	20.13	12.00	27.00	5.91	0.29
Arthur	5.00	4.67	7.00	5.67	9.00	6.27	4.67	9.00	1.77	0.28
Monologue	12.33	16.00	19.00	14.00	23.00	16.87	12.33	23.00	4.23	0.25
Reading	9.67	10.33	8.33	9.33	8.33	9.20	8.33	10.33	0.87	0.09
Picture	10.00	13.33	10.33	12.00	14.00	11.93	10.00	14.00	1.77	0.15
Overall	11.00	11.27	14.33	12.00	15.80	12.88	11.00	15.80	2.09	0.16

Note: Min=Minimum percentage of syllables that were stuttered for the task, Max=Maximum percentage of syllables that were stuttered for the task, SD=standard deviation of stuttered syllables for the task, CV=Coefficient of Variation for the task

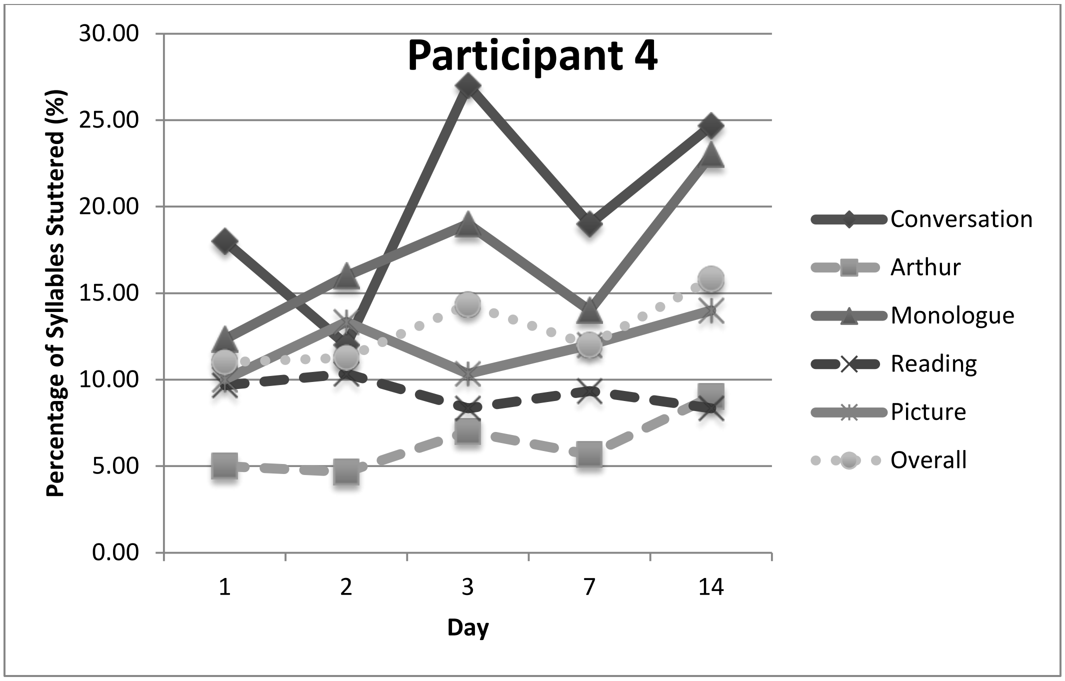

Figure 7. Participant 4's Percentage of Syllables that were Stuttered Across Tasks

Table 11. Participant 4's Percentage of Syllables that were Disfluent Across Tasks

	Percent of Syllables that were Disfluent (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	24.33	16.33	29.33	23.00	26.67	23.93	16.33	29.33	4.88	0.20
Arthur	5.67	4.67	7.33	6.33	9.00	6.60	4.67	9.00	1.66	0.25
Monologue	17.00	22.00	20.00	20.33	24.67	20.80	17.00	24.67	2.81	0.14
Reading	9.67	10.33	8.67	10.67	8.67	9.60	8.67	10.67	0.92	0.10
Picture	14.00	18.00	14.00	18.00	18.67	16.53	14.00	18.67	2.33	0.14
Overall	14.13	14.27	15.87	15.67	17.53	15.49	14.13	17.53	1.39	0.09

Note: Min=Minimum percentage of syllables that were disfluent for the task, Max=Maximum percentage of syllables that were disfluent for the task, SD=standard deviation of disfluent syllables for the task, CV=Coefficient of Variation for the task

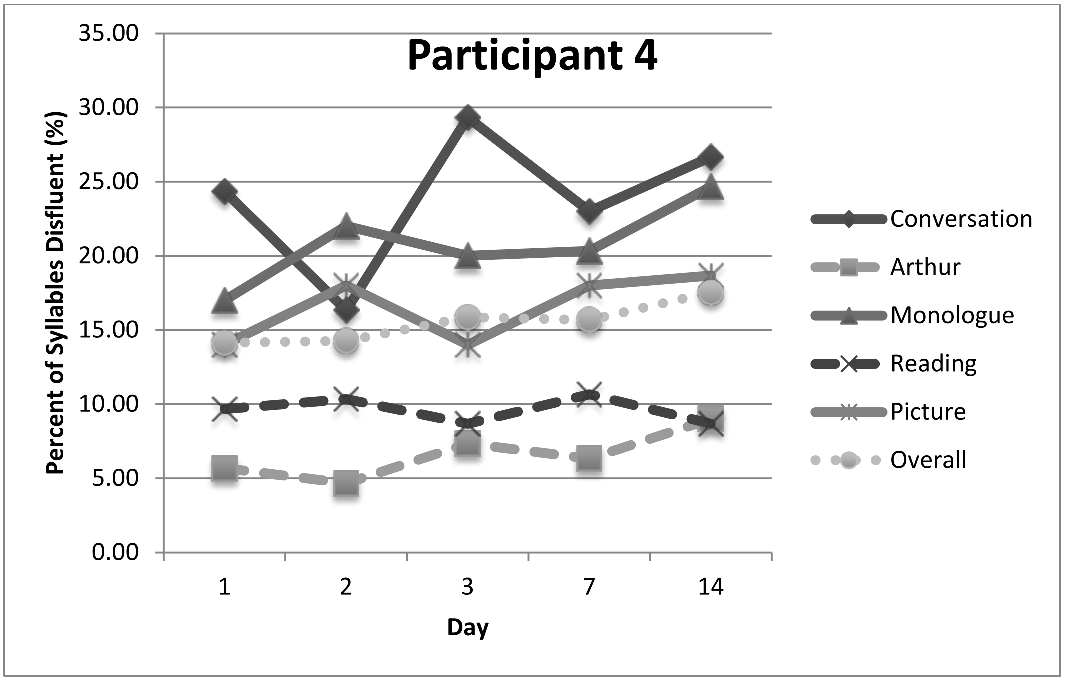

Figure 8. Participant 4's Percentage of Syllables that were Disfluent Across Tasks

3.1.1.5 Participant 5 Frequency Data

According to Table 12, the percentage of syllables stuttered for Participant 5 (P5) ranged from 0% to 21.67% across tasks; a range of 21.67% of syllables stuttered. P5 has the most obvious patterns to his percentages of syllables stuttered and disfluent across the spontaneous speaking tasks. Figure 9 shows that there are days where the percentages of syllables stuttered and disfluent increased for all spontaneous speaking tasks and days where the percentages of syllables stuttered and disfluent decreased for all spontaneous speaking tasks. Percentages of syllables stuttered and disfluent decreased sharply from Day 1 to Day 2 and then rose sharply on Day 3 for all spontaneous speaking tasks. After Day 3, the percentages of syllables stuttered and disfluent gradually decreased across the remaining sessions. In addition, the spontaneous speaking tasks always contain higher percentages of syllables stuttered and disfluent than the reading tasks across all the sessions, much like P4. The reading tasks were also spared from the steep up and down changes in percentages of syllables stuttered and disfluent seen in the spontaneous speaking tasks.

It is shown by Table 13 that P5's percentage of syllables disfluent ranged from 0.33% to 24.33% across tasks. This is a range of 24.00%. The patterns seen in Figure 10 are similar to those shown in Figure 9. Spontaneous speaking tasks were more disfluent than reading tasks. There was a steep decrease in disfluencies during the second session. For the spontaneous speaking tasks, this was followed by a step increase in disfluencies on the third day and then a gradual decrease on the seventh and fourteenth day. The picture description task contained the most nonstuttered disfluencies and the spontaneous speaking tasks, in general, contain more nonstuttered disfluencies than the reading tasks.

Table 12. Participant 5's Percentage of Syllables that were Stuttered Across Tasks

	Percentage of Syllables that were Stuttered (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	12.00	4.67	21.67	13.67	8.67	12.13	4.67	21.67	6.34	0.52
Arthur	3.33	1.00	2.00	1.67	2.00	2.00	1.00	3.33	0.85	0.42
Monologue	18.00	7.33	19.00	12.67	9.33	13.27	7.33	19.00	5.16	0.39
Reading	2.00	0.33	2.33	0.00	0.67	1.07	0.00	2.33	1.04	0.97
Picture	15.67	5.67	19.67	16.33	8.33	13.13	5.67	19.67	5.88	0.45
Overall	10.20	3.80	12.93	8.87	5.80	8.32	3.80	12.93	3.60	0.43

Note: Min=Minimum percentage of syllables that were stuttered for the task, Max=Maximum percentage of syllables that were stuttered for the task, SD=standard deviation of stuttered syllables for the task, CV=Coefficient of Variation for the task

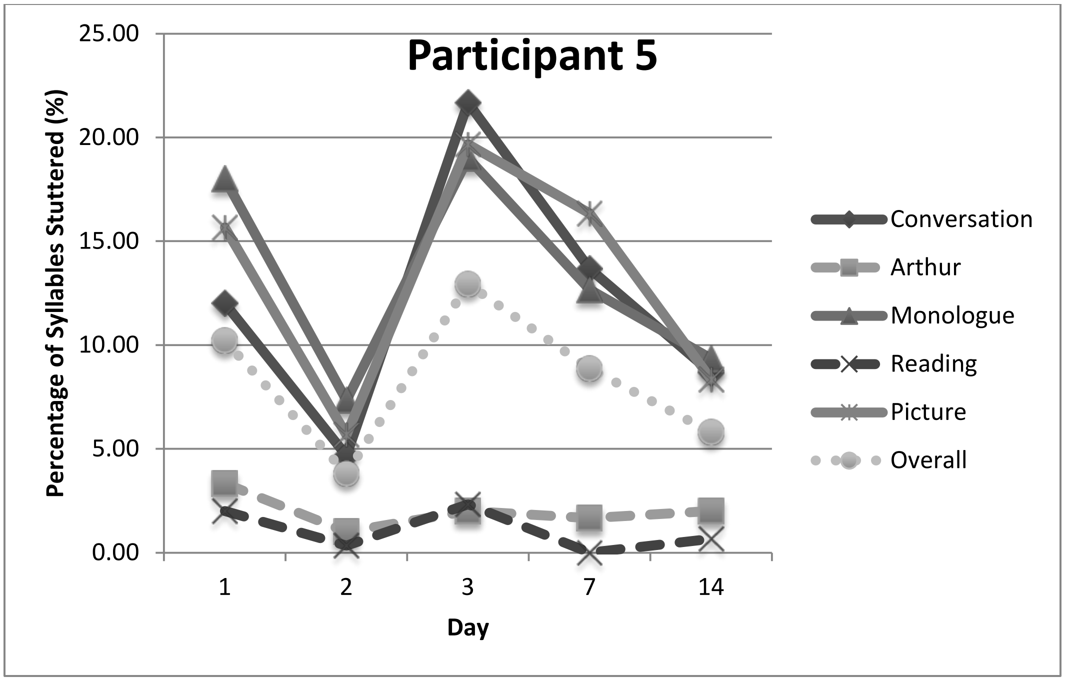

Figure 9. Participant 5's Percentage of Syllables that were Stuttered Across Tasks

Table 13. Participant 5's Percentage of Syllables that were Disfluent Across Tasks

	Percent of Syllables that were Disfluent (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	13.33	4.67	24.33	15.67	10.67	13.73	4.67	24.33	7.21	0.52
Arthur	4.67	1.67	2.00	2.67	2.33	2.67	1.67	4.67	1.18	0.44
Monologue	18.33	8.67	19.33	14.00	13.00	14.67	8.67	19.33	4.31	0.29
Reading	3.00	1.00	2.67	0.33	1.33	1.67	0.33	3.00	1.13	0.68
Picture	20.00	9.67	23.67	22.67	13.67	17.93	9.67	23.67	6.04	0.34
Overall	11.87	5.13	14.40	11.07	8.20	10.13	5.13	14.40	3.56	0.35

Note: Min=Minimum percentage of syllables that were disfluent for the task, Max=Maximum percentage of syllables that were disfluent for the task, SD=standard deviation of disfluent syllables for the task, CV=Coefficient of Variation for the task

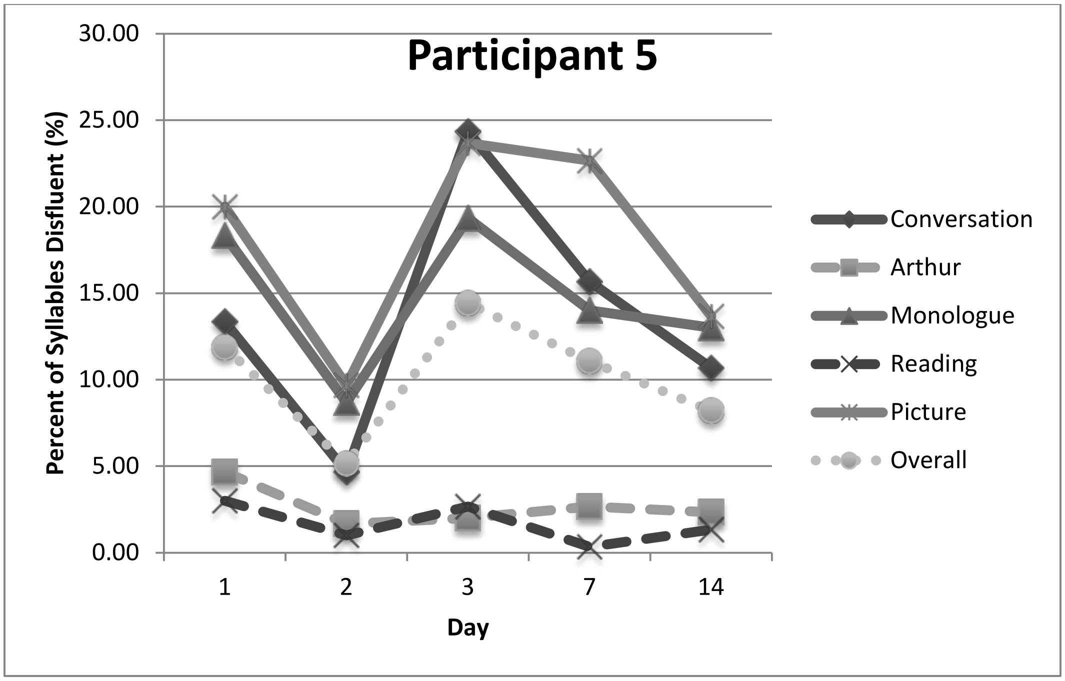

Figure 10. Participant 5's Percentage of Syllables that were Disfluent Across Tasks

3.1.1.6 Participant 6 Frequency Data

Table 14 shows that Participant 6 (P6) ranged from 3.00% to 20.67% of syllables stuttered across tasks. This is a range of 17.67% of syllables stuttered across tasks. Figure 11 shows that, for P6, the ranks of the tasks in terms of percentage of syllables stuttered stayed consistent for the first three days. Percentage of syllables stuttered increased for all the tasks on the seventh day to varying degrees.

On Day 1, Day 2, Day 3, and Day 7 the reading tasks contained a lower percentage of syllables stuttered than the spontaneous speaking tasks. "Arthur" always contained the lowest percentage of syllables stuttered. P6 had a greater percentage of syllables stuttered on the spontaneous speaking tasks than on the reading tasks on all the days except for the last day. On the last day, Day 14, the picture description task contained a lower percentage of syllables stuttered than the random reading task.

Table 15 shows that P6's percentage of syllables disfluent across tasks ranged from 3.33% to 25.00%. This is a range of 21.67% of syllables disfluent. Figure 12 shows that the ranking of the tasks according to percentage of syllables disfluent is not as consistent as according to percentage of syllables stuttered. The "Arthur" reading contains the lowest percentage of syllables disfluent during every session. In every session but the last, the reading tasks had a lower percentage of syllables disfluent than the spontaneous speaking tasks. P6 shows the same tendency to have a greater number of nonstuttered disfluencies during spontaneous speaking tasks than during reading tasks as the other participants.

Table 14. Participant 6's Percentage of Syllables that were Stuttered Across Tasks

	Percentage of Syllables that were Stuttered (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	15.00	16.67	13.33	19.67	20.67	17.07	13.33	20.67	3.09	0.18
Arthur	3.00	4.67	3.67	4.00	3.67	3.80	3.00	4.67	0.61	0.16
Monologue	16.33	18.33	15.33	18.33	15.33	16.73	15.33	18.33	1.52	0.09
Reading	8.33	7.33	7.00	13.33	14.33	10.07	7.00	14.33	3.49	0.35
Picture	12.33	9.00	9.67	17.00	6.00	10.80	6.00	17.00	4.13	0.38
Overall	11.00	11.20	9.80	14.47	12.00	11.69	9.80	14.47	1.74	0.15

Note: Min=Minimum percentage of syllables that were stuttered for the task, Max=Maximum percentage of syllables that were stuttered for the task, SD=standard deviation of stuttered syllables for the task, CV=Coefficient of Variation for the task

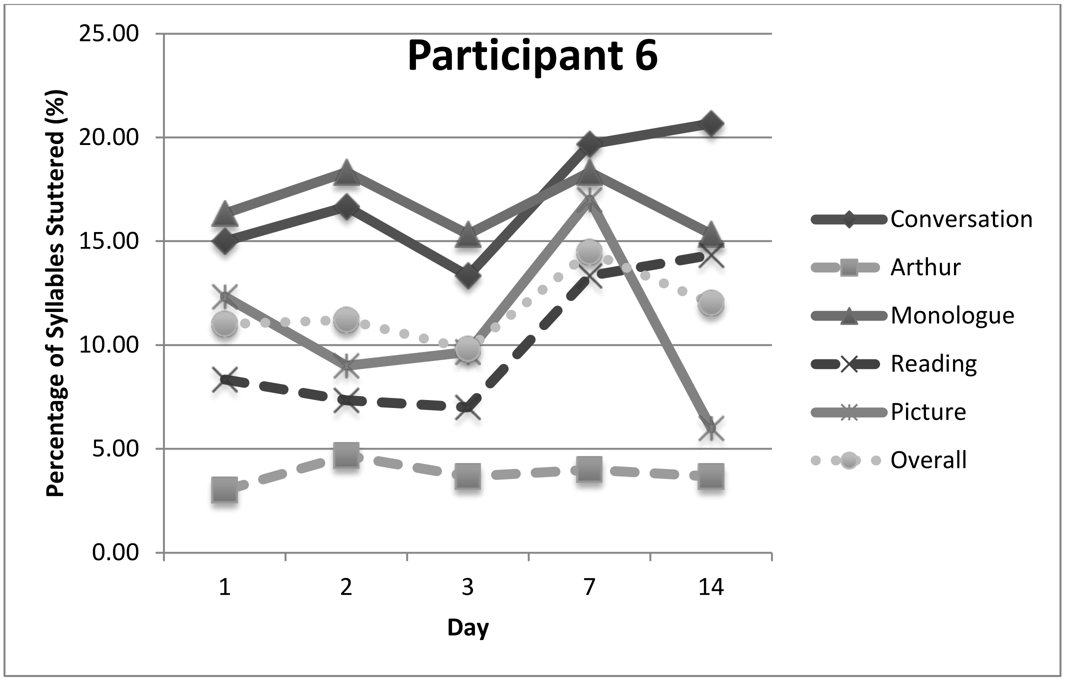

Figure 11. Participant 6's Percentage of Syllables that were Stuttered Across Tasks

Table 15. Participant 6's Percentage of Syllables that were Disfluent Across Tasks

	Percent of Syllables that were Disfluent (%)									
	Day									
Task	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
Conversation	18.67	18.00	13.67	25.00	24.00	19.87	13.67	25.00	4.66	0.23
Arthur	3.33	5.00	4.67	4.00	4.33	4.27	3.33	5.00	0.64	0.15
Monologue	22.00	22.67	19.67	24.00	20.00	21.67	19.67	24.00	1.83	0.08
Reading	9.00	8.00	7.33	13.33	15.00	10.53	7.33	15.00	3.42	0.32
Picture	19.67	14.00	14.00	20.67	11.33	15.93	11.33	20.67	4.03	0.25
Overall	14.53	13.53	11.87	17.40	14.93	14.45	11.87	17.40	2.03	0.14

Note: Min=Minimum percentage of syllables that were disfluent for the task, Max=Maximum percentage of syllables that were disfluent for the task, SD=standard deviation of disfluent syllables for the task, CV=Coefficient of Variation for the task

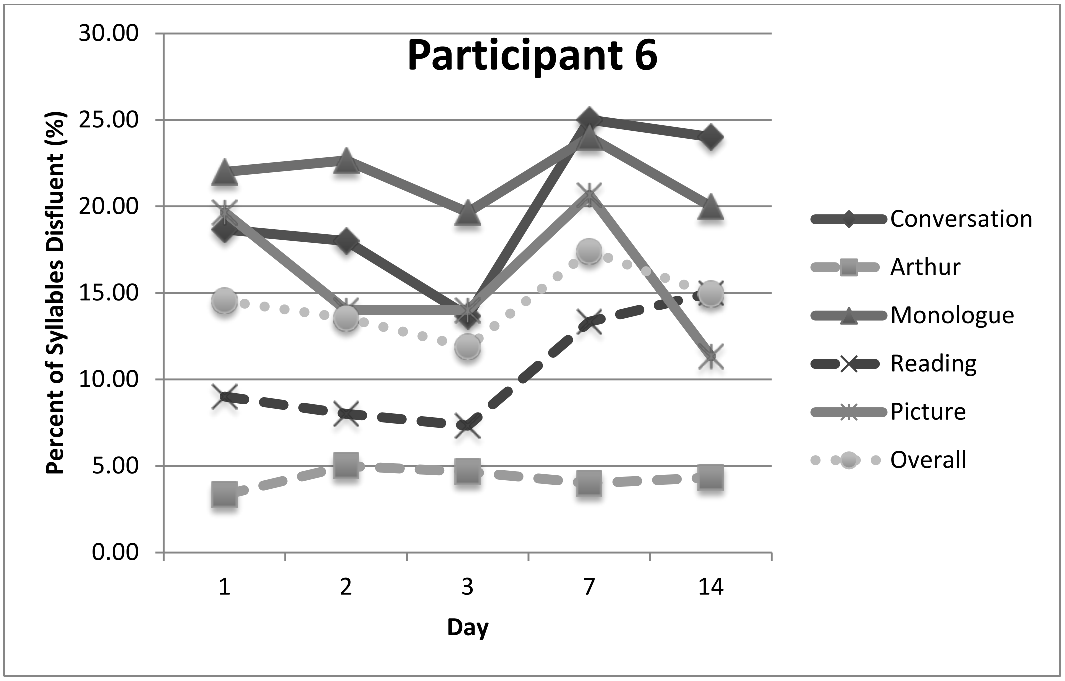

Figure 12. Participant 6's Percentage of Syllables that were Disfluent Across Tasks

There was no participant that showed a clear pattern on all of the tasks; although, there were participants who shared similar patterns among some of the tasks. P5 in particular showed a clear pattern shared among all the spontaneous speaking tasks; however, this pattern was not found in any other participants. A pattern shared by all the participants was a greater number of nonstuttered disfluencies during spontaneous speaking tasks than during reading tasks. Also, participants tended to show a separation between performance on the spontaneous speaking tasks and the reading tasks. Half of the participants almost always had lower percentages of syllables stuttered and disfluent on the reading tasks than on the spontaneous speaking tasks. Two of the participants that did not have lower percentages of syllables stuttered on the reading tasks had the greatest percentage of syllables stuttered during “Arthur the Rat,” a reading task. The broader characteristic data for each participant will now be shown.

3.1.2 Characteristics Data

The broader characteristic scores on measures of stuttering for each participant are shown below. The adverse impact of the stuttering disorder was measured by the OASES, the severity of the stuttering disorder was measured by the SSI-4, and the participants’ attitude and emotional state were measured by the Daily Questionnaire. All these measures were compared for each participant across sessions. The different measures show different amounts of variability. The OASES was very stable over every session for each of the participants. The OASES was expected to be fairly stable, as it had demonstrated test-retest reliability over a span of 10-14 days in a previous study (Yaruss & Quesal, 2006). However stability from day to day had not been looked at until now. The SSI-4 and Daily Questionnaire showed variability from day to day. Although there was no pattern to this variability shared by all of the participants, there were some patterns present in the scores of the individual participants.

3.1.2.1 Participant 1 Characteristic Data

Table 16 shows P1’s broader characteristic scores over time. P1’s average OASES score was 3.62, which indicates a “moderate/severe” impact rating. His average SSI-4 score was 34.20, a severity equivalent of “severe.” Figure 13 shows that P1’s variability is not explained by the broader characteristic data. Specifically, participant 1’s OASES and SSI-4 scores stayed consistent from day to day and, therefore, cannot explain the variability in the frequency of moments of stuttering and disfluency.

The score for the SSI-4 does decrease on day 7. Unfortunately, P1's frequency data for day 7 was lost. Therefore, it cannot be known whether this change in SSI-4 score corresponded to a change in the frequency data.

P1's Daily Questionnaire scores increased and decreased from day to day but not in a pattern that matched the overall decrease in percentage syllables stuttered and disfluent experienced by the individual across the sessions. The pattern of the Daily Questionnaire does, however, directly relate to the scores on the SSI-4. The poorer P1's attitude was on a particular day, as measured by the Daily Questionnaire, the more severe he was rated by the SSI-4. A poorer attitude could have contributed to an increase in the frequency of stuttering but it is also possible that an increase in the frequency of stuttering could have contributed to a poorer attitude.

Table 16. Participant 1's Broader Characteristic Scores Over Time

	Score on Measure									
	Day									
Measure	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
OASES	3.67	3.58	3.55	3.59	3.70	3.62	3.55	3.70	0.06	0.02
SSI	35.00	36.00	35.00	30.00	35.00	34.20	30.00	36.00	2.39	0.07
DQ	15.00	13.00	16.00	17.00	12.00	14.60	12.00	17.00	2.07	0.14

Note: Min=Minimum score on measure, Max=Maximum score on measure SD=standard deviation of score on measure, CV=Coefficient of Variation for the measure OASES=Overall Assessment of the Speaker's Experience of Stuttering, SSI=Stuttering Severity Instrument, DQ=Daily Questionnaire

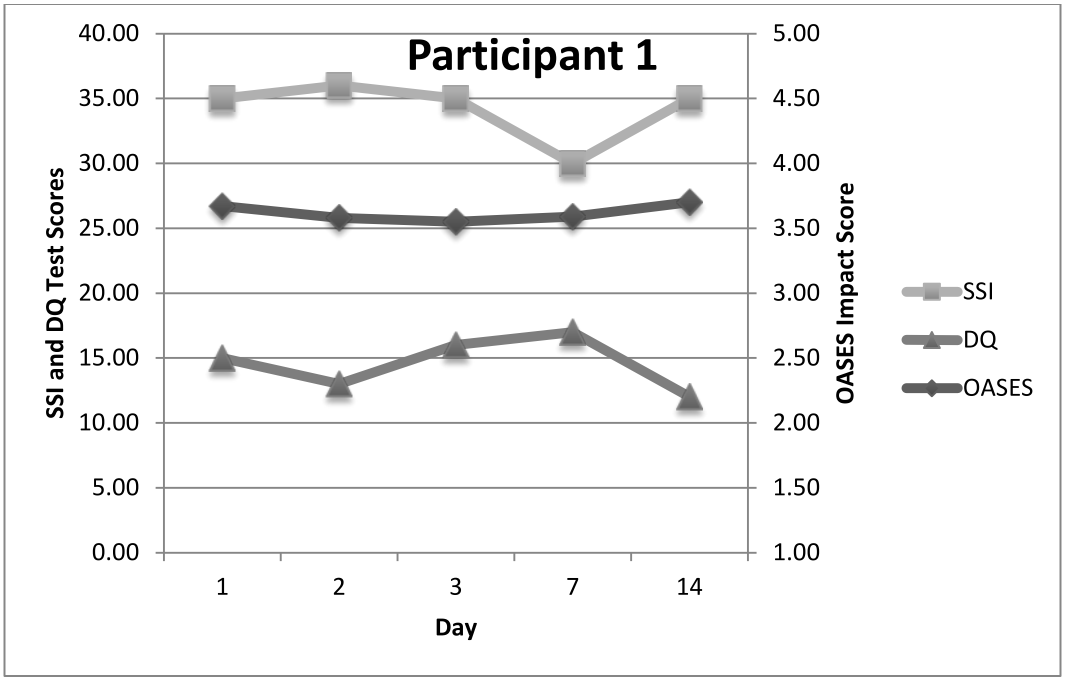

Figure 13. Participant 1's Broader Characteristic Scores Over Time

3.1.2.2 Participant 2 Characteristic Data

P2's broader characteristic scores over time are shown in Table 17. He had an average OASES score of 3.33. This is a "moderate/severe" impact rating. His average SSI-4 score of 12.60 indicates a very mild severity equivalent. Figure 14 shows that, similar to P1, P2's OASES scores remained consistent across sessions. Unlike P1, the SSI-4 and Daily Questionnaire scores for P2 inversely related to each other. For a number of sessions the more favorably P2 rated his attitude in the Daily Questionnaire the more severe he was rated by the SSI-4. It is unclear why this would be the case.

The broader characteristic data for P2 contains some points of interest. The OASES scores, although very stable, reached a maximum on day 7 which was also the day when P2 had his atypical increases in both percentages of syllables stuttered and disfluent in many of the tasks. P2's day 7 is interesting for other reasons. On Day 7, even though P2 had his highest overall percentages of syllables stuttered and disfluent, he received his lowest SSI-4 score. P2 was scored as having no stuttering disorder on Day 7 by the SSI-4 (a score of less than 10 for adults). On Day 7, he also received his lowest Daily Questionnaire score, indicating poorer attitude. The SSI-4 score is explained by P2's low percentage of syllables stuttered and disfluent during "Arthur," which was used for the SSI-4 calculation. P2 also had shorter durations of moments of stuttering and less physical concomitants during Day 7, furthering lowering his SSI-4 score. It is possible that P2's unusually low score on the Daily Questionnaire could show that a decline in attitude contributed to the increased stuttering on that day; however, Day 2 would be the only day on which these two measures aligned. It is also possible that the reverse is true and the increased stuttering could have contributed to the decline in attitude.

Table 17. Participant 2's Broader Characteristic Scores Over Time

	Score on Measure									
	Day									
Measure	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
OASES	3.19	3.28	3.36	3.43	3.38	3.33	3.19	3.43	0.09	0.03
SSI	12.00	17.00	13.00	7.00	14.00	12.60	7.00	17.00	3.65	0.29
DQ	23.00	23.00	20.00	13.00	20.00	19.80	13.00	23.00	4.09	0.21

Note: Min=Minimum score on measure, Max=Maximum score on measure SD=standard deviation of score on measure, CV=Coefficient of Variation for the measure OASES=Overall Assessment of the Speaker's Experience of Stuttering, SSI=Stuttering Severity Instrument, DQ=Daily Questionnaire

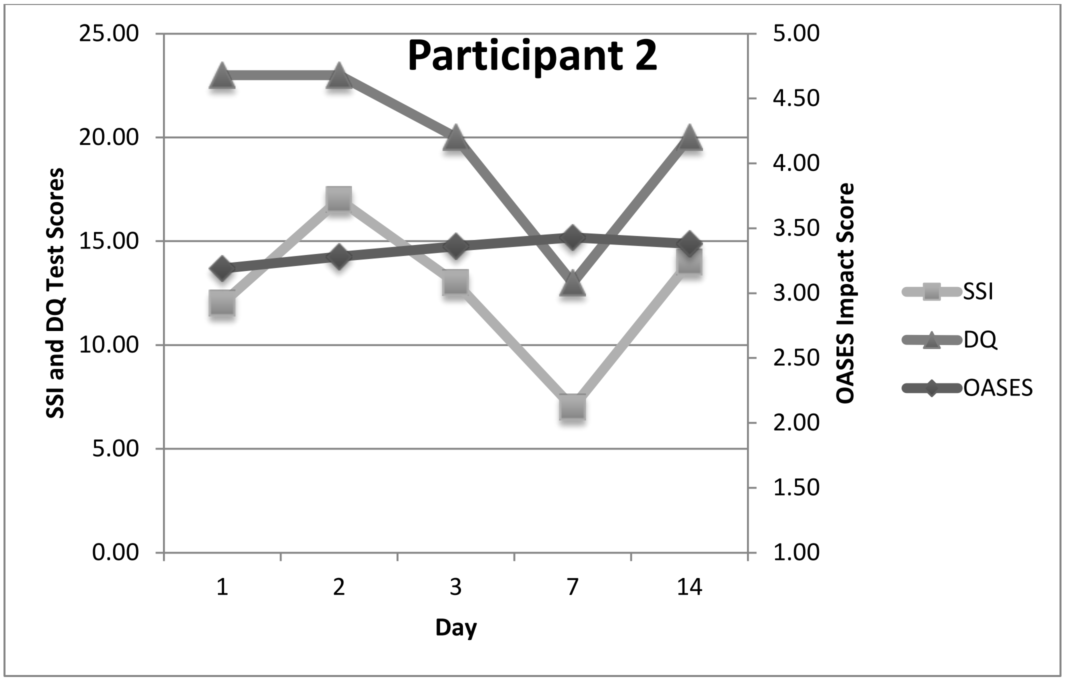

Figure 14. Participant 2's Broader Characteristic Scores Over Time

3.1.2.3 Participant 3 Characteristic Data

Table 18 shows P3's broader characteristic scores over time. P3's average OASES score was 1.51, indicating a "mild/moderate" impact rating. P3's average SSI-4 score was 9.60, this does not indicate a stuttering disorder according to the SSI-4 (a score of less than 10 for adults). It should be noted that P3 did qualify for the study based on the initial session's SSI-4 standard score of 22.00. This is a "mild" severity rating. She also self-identified as having a stutter and received a score of 1.57, a "mild/moderate" impact rating, on the OASES during the first session.

Figure 15 shows that, similar to the previous participants, the OASES scores of P3 remained stable and so cannot reveal much about the variability seen in percentage of syllables stuttered and disfluent. The Daily Questionnaire was the same on the first three sessions and the same on the last two sessions. The score on the last two sessions was higher than the score on the first three sessions, indicating a better attitude during the last two sessions. The overall percentages of syllables stuttered and disfluent were also lowest during these last two sessions.

The SSI-4 shows a striking pattern for P3. The SSI-4 sharply decreased across every session but the last one, where it increased slightly. By Day 3, P3 no longer scored as having a stuttering disorder on the SSI-4. This decrease in severity over time is not represented in the frequency data, except for the reading of "Arthur," which also decreased in percentage of syllables stuttered and disfluent across all the sessions except for the last one. P3 showed a decrease in the duration of moments of stuttering and physical concomitants from session to session, which contributed to the decreasing SSI-4 scores, along with decreases in percentages of syllables stuttered in the "Arthur" task.

Table 18. Participant 3's Broader Characteristic Scores Over Time

	Score on Measure									
	Day									
Measure	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
OASES	1.57	1.50	1.49	1.50	1.49	1.51	1.49	1.57	0.03	0.02
SSI	22.00	12.00	7.00	2.00	5.00	9.60	2.00	22.00	7.83	0.82
DQ	21.00	21.00	21.00	24.00	24.00	22.20	21.00	24.00	1.64	0.07

Note: Min=Minimum score on measure, Max=Maximum score on measure SD=standard deviation of score on measure, CV=Coefficient of Variation for the measure OASES=Overall Assessment of the Speaker's Experience of Stuttering, SSI=Stuttering Severity Instrument, DQ=Daily Questionnaire

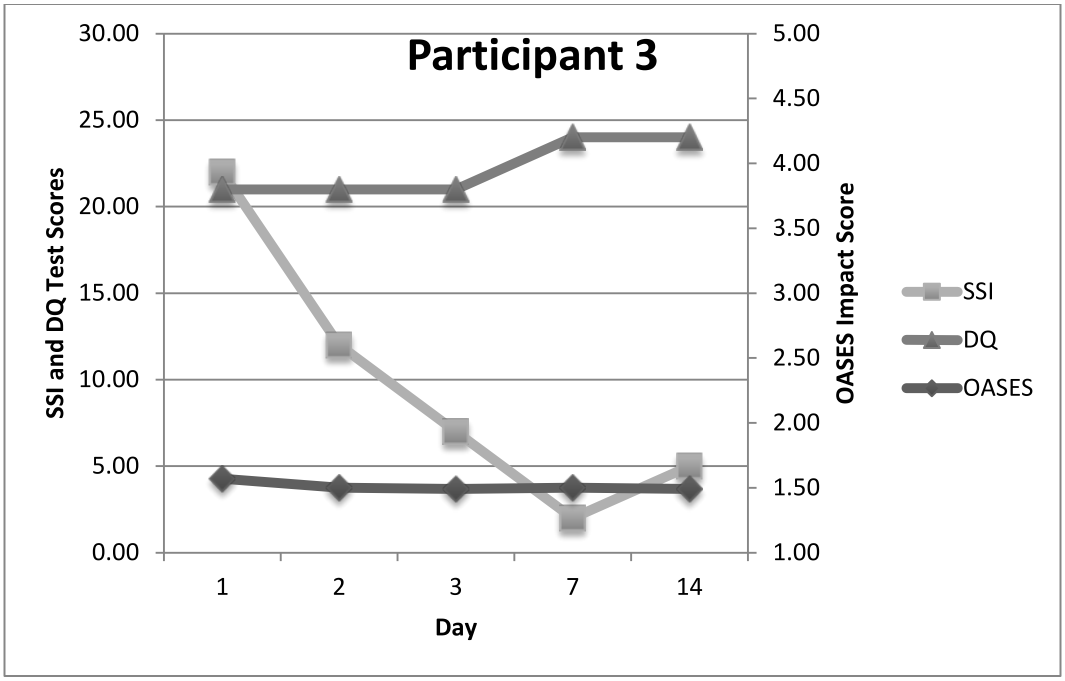

Figure 15. Participant 3's Broader Characteristic Scores Over Time

3.1.2.4 Participant 4 Characteristic Data

P4's broader characteristic scores over time are shown in Table 19. P4's average OASES score was a 1.16, indicating a "mild" impact rating. His average SSI-4 score was 26.60, indicating a "moderate" severity score. Figure 16 shows that OASES scores were lowest during the last two sessions; however, this did not correspond with a decrease in either percentages of syllables stuttered or disfluent.

P4 exhibited the highest overall percentages of syllables stuttered and percentages of syllables disfluent across all tasks on Day 14. This was also the day he scored the highest on the SSI-4. This is an expected result, as the SSI-4 is a measure of listener perceived stuttering severity. The Daily Questionnaire did vary from session to session but this variability was not mirrored in the overall percentage of syllables stuttered and percentage of syllables disfluent measures. The percentage of syllables stuttered during the monologue task increased as attitudinal scores on the Daily Questionnaire improved and decreased as attitudinal scores worsened. This was the only task that showed this pattern.

Table 19. Participant 4's Broader Characteristic Scores Over Time

	Score on Measure									
	Day									
Measure	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
OASES	1.17	1.18	1.22	1.14	1.08	1.16	1.08	1.22	0.05	0.05
SSI	25.00	26.00	24.00	24.00	34.00	26.60	24.00	34.00	4.22	0.16
DQ	14.00	20.00	22.00	17.00	22.00	19.00	14.00	22.00	3.46	0.18

Note: Min=Minimum score on measure, Max=Maximum score on measure SD=standard deviation of score on measure, CV=Coefficient of Variation for the measure OASES=Overall Assessment of the Speaker's Experience of Stuttering, SSI=Stuttering Severity Instrument, DQ=Daily Questionnaire

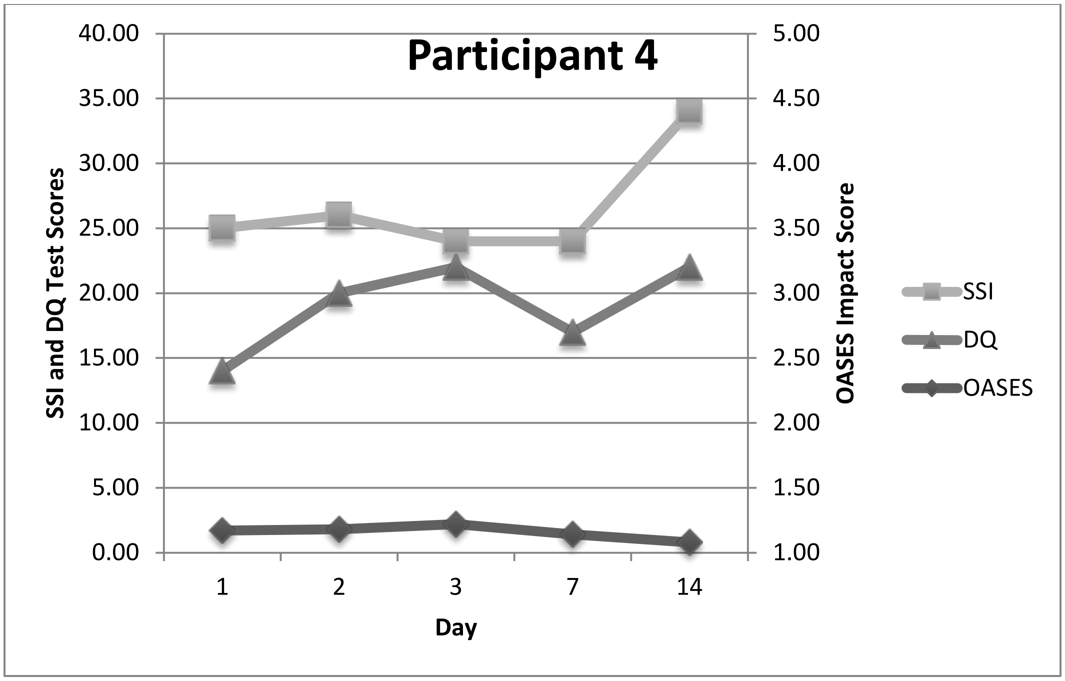

Figure 16. Participant 4's Broader Characteristic Scores Over Time

3.1.2.5 Participant 5 Characteristic Data

P5's broader characteristic scores over time are shown in Table 20. P5 had an average OASES score of 1.93, this is a "mild/moderate" impact score. His average SSI-4 score was 20.60, this indicates a "mild" severity equivalent. P5 had the most obvious patterns to his percentages of syllables stuttered and disfluent but these patterns were not represented in the broader characteristic data.

Figure 17 shows that SSI-4 and OASES score were fairly consistent from session to session. The drastic decrease in percentage of syllables stuttered during the second day was not mirrored in the SSI-4 scores due to an increase in duration of individual moments of stuttering and physical concomitants that day. The Daily Questionnaire varied but not in a pattern similar to the percentages of syllables stuttered and disfluent.

Table 20. Participant 5's Broader Characteristic Scores Over Time

	Score on Measure									
	Day									
Measure	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
OASES	1.98	1.94	1.88	1.95	1.92	1.93	1.88	1.98	0.04	0.02
SSI	20.00	22.00	20.00	20.00	21.00	20.60	20.00	22.00	0.89	0.04
DQ	21.00	18.00	15.00	16.00	14.00	16.80	14.00	21.00	2.77	0.17

Note: Min=Minimum score on measure, Max=Maximum score on measure SD=standard deviation of score on measure, CV=Coefficient of Variation for the measure OASES=Overall Assessment of the Speaker's Experience of Stuttering, SSI=Stuttering Severity Instrument, DQ=Daily Questionnaire

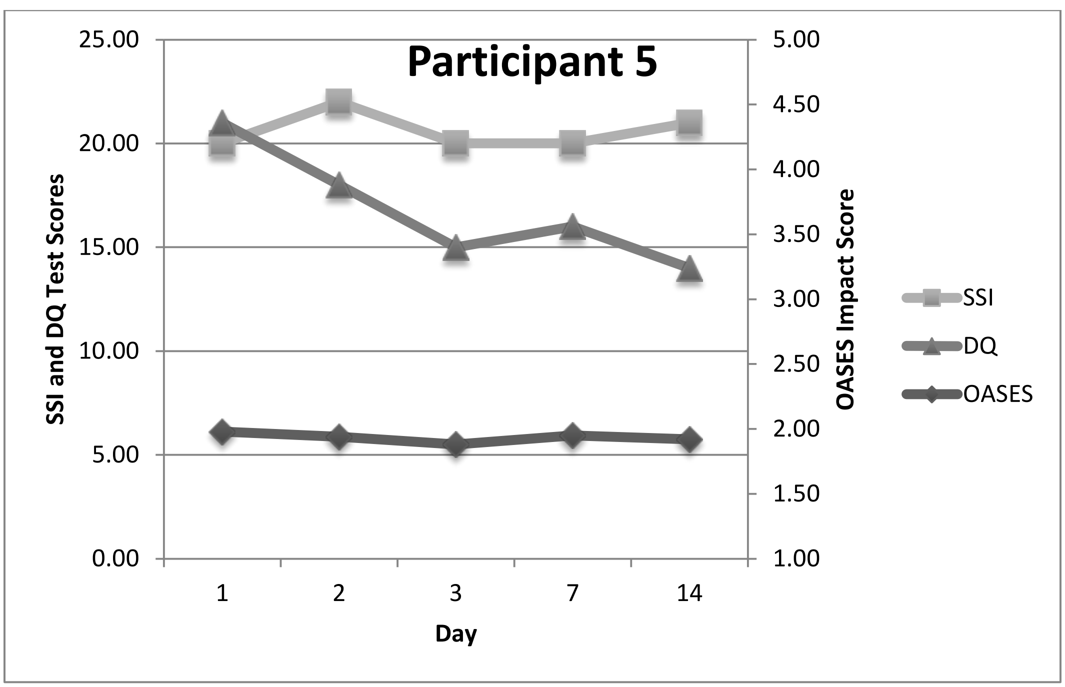

Figure 17. Participant 5's Broader Characteristic Scores Over Time

3.1.2.6 Participant 6 Characteristic Data

Table 21 shows P6's broader characteristic scores over time. Her average OASES score was 2.46, an impact rating of "moderate." P6's average SSI-4 score was 30.20, this is a "moderate" severity equivalent. Figure 18 shows that the OASES score was highest on the last day but this did not correspond to an increase in either percentages of syllables stuttered or disfluent. The day of the highest score on the Daily Questionnaire, indicating most positive attitude, occurred on a day where every task increased in percentage of syllables stuttered from the prior day. The SSI-4 increased in score until Day 3 and then decreased across the remainder of the sessions. This pattern was not shown in the percentages of syllables stuttered or disfluent of any of the tasks.

Table 21. Participant 6's Broader Characteristic Scores Over Time

	Score on Measure									
	Day									
Measure	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
OASES	2.37	2.43	2.41	2.44	2.66	2.46	2.37	2.66	0.11	0.05
SSI	27.00	28.00	33.00	32.00	31.00	30.20	27.00	33.00	2.59	0.09
DQ	19.00	19.00	18.00	20.00	17.00	18.60	17.00	20.00	1.14	0.06

Note: Min=Minimum score on measure, Max=Maximum score on measure SD=standard deviation of score on measure, CV=Coefficient of Variation for the measure OASES=Overall Assessment of the Speaker's Experience of Stuttering, SSI=Stuttering Severity Instrument, DQ=Daily Questionnaire

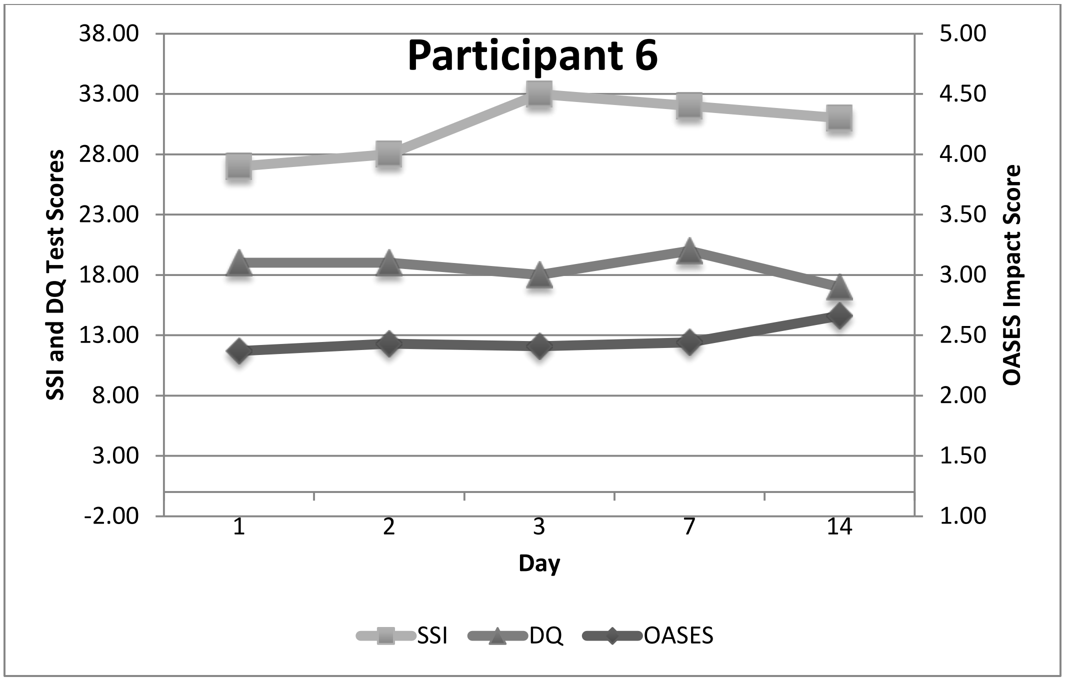

Figure 18. Participant 6's Broader Characteristic Scores Over Time

3.2 PARTICIPANTS COMPARED TO EACH OTHER

3.2.1 Frequency Data

When the participants were compared to each other on the individual tasks, a great deal of variability was apparent in frequency of both stuttering and disfluency. This variability existed from day to day and also from participant to participant. Variability between individuals' frequency of stuttering was expected; it was whether or not they exhibited similar patterns in the direction of their variability from day to day that was of interest.

No global pattern of variability was discernible from the data, although some patterns exhibited by each participant during each task were detectable. There were some tasks in which two participants shared a pattern but there were never any more than two participants that were similar. When the data is looked at across participants it is still clear that there was a greater number of nonstuttered disfluencies during spontaneous speaking tasks than during reading tasks. Participants were also more similar to each other in terms of magnitude of percentage of syllables stuttered and percentage of syllables disfluent during reading tasks than spontaneous speaking tasks.

3.2.1.1 Conversation Frequency Data

Table 22 shows the percentage of syllables stuttered in the conversation across participants. The percentage of syllables stuttered during the conversation ranged from 1.33% to 27.00%, this is a range of 25.67%. Figure 19 shows that P2 and P3 had the smallest percentage of syllables stuttered across all the sessions in the conversation. P4 and P5 both had sharp decreases in the percentage of syllables stuttered in the conversation on Day 2 and then sharp increases on Day 3. Both P1 and P3 remained fairly consistent across all of the sessions.

Table 23 shows that percentage of syllables that were disfluent during the conversation task across participants. The percentage of syllables disfluent ranged from 1.67% to 29.67% during the conversation; a range of 28%. Figure 20 shows that there was more variation in the percentage of syllables that were disfluent during the conversation than percentage of syllables stuttered (Figure 19). P2 and P3 were the least disfluent across all the sessions. Figure 20 shows that P3, similar to Figure 19, remained very consistent across all of the days. This is in contrast with P1's range of variability, which increased when disfluencies were counted instead of moments of stuttering. P1 and P3 moved in opposite directions for percentage of syllables stuttered, alternating increasing and decreasing slightly from day to day but this pattern was not maintained when percentage of syllables disfluent were measured.

Table 22. Percentage of Syllables that were Stuttered in the Conversation across Participants

	Percentage of Syllables that were Stuttered (%)									
	Day									
Participant	1	2	3	7	14	Mean	Min	Max	SD	CV
P1	21.00	23.67	21.33	23.00	22.67	22.33	21.00	23.67	1.13	0.05
P2	3.67	1.33	4.33	7.33	2.67	3.87	1.33	7.33	2.24	0.58
P3	2.33	1.67	3.00	1.33	3.00	2.27	1.33	3.00	0.76	0.34
P4	18.00	12.00	27.00	19.00	24.67	20.13	12.00	27.00	5.91	0.29
P5	12.00	4.67	21.67	13.67	8.67	12.13	4.67	21.67	6.34	0.52
P6	15.00	16.67	13.33	19.67	20.67	17.07	13.33	20.67	3.09	0.18

Note: Min=Minimum percentage of syllables that were stuttered for the participant, Max=Maximum percentage of syllables that were stuttered for the participant, SD=standard deviation of stuttered syllables for the participant, CV=Coefficient of Variation for the participant

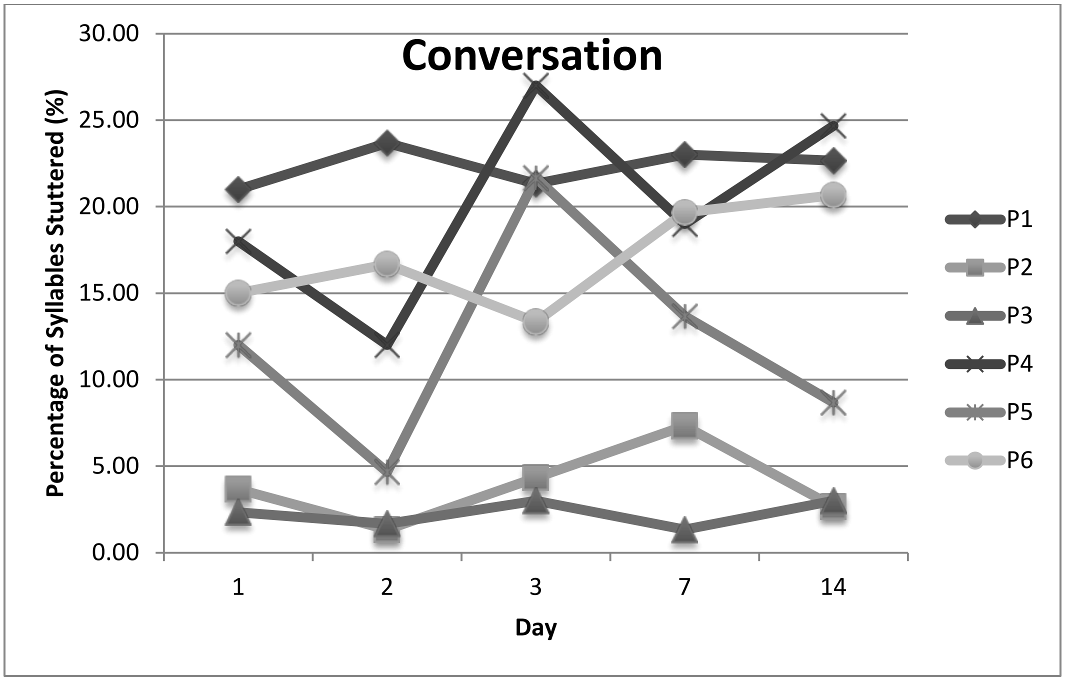

Figure 19. Percentage of Syllables that were Stuttered in the Conversation across Participants

Table 23. Percentage of Syllables that were Disfluent in the Conversation across Participants

	Percent of Syllables that were Disfluent (%)									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	26.00	29.67	23.00	26.00	25.33	26.00	23.00	29.67	2.39	0.09
P2	4.67	1.67	5.33	8.00	3.00	4.53	1.67	8.00	2.41	0.53
P3	3.00	3.67	3.67	2.67	3.33	3.27	2.67	3.67	0.43	0.13
P4	24.33	16.33	29.33	23.00	26.67	23.93	16.33	29.33	4.88	0.20
P5	13.33	4.67	24.33	15.67	10.67	13.73	4.67	24.33	7.21	0.52
P6	18.67	18.00	13.67	25.00	24.00	19.87	13.67	25.00	4.66	0.23

Note: Min=Minimum percentage of syllables that were disfluent for the participant, Max=Maximum percentage of syllables that were disfluent for the participant, SD=standard deviation of disfluent syllables for the participant, CV=Coefficient of Variation for the participant

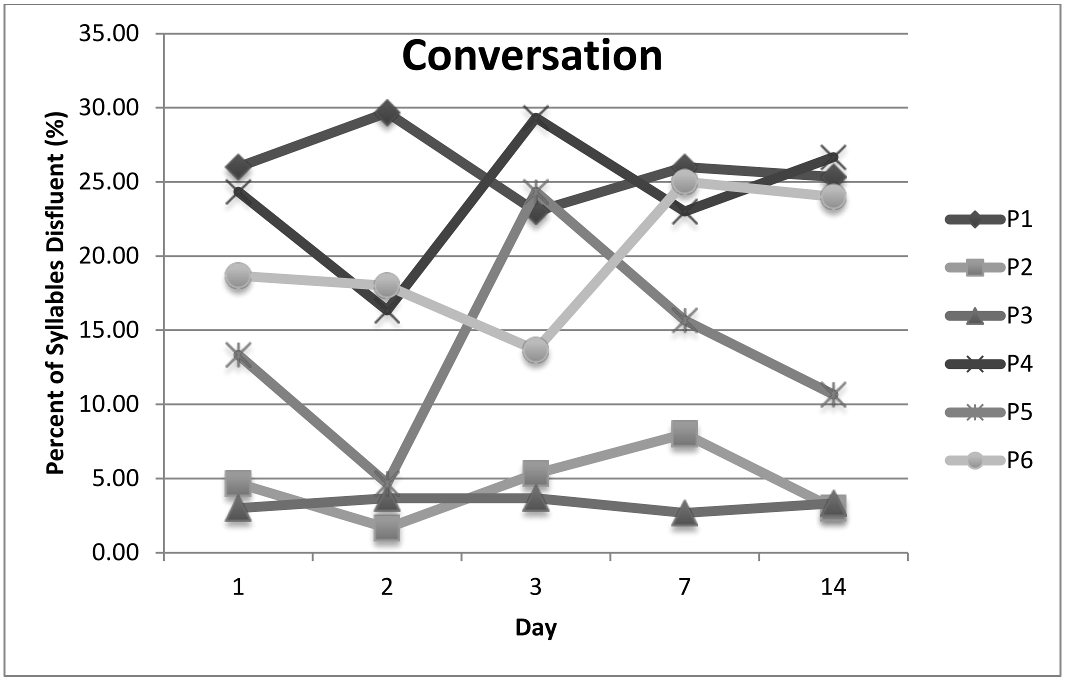

Figure 20. Percentage of Syllables that were Disfluent in the Conversation across Participants

3.2.1.2 Arthur Frequency Data

According to Table 24, the percentage of syllables stuttered in the "Arthur" reading across participants ranged from 1.00% to 36.33%; a range of 35.33%. Figure 21 shows that all of the participants, except for P1, experienced stuttering on less than 10% of their syllables during the reading of "Arthur." There was no observable pattern from day to day.

Table 25 shows a range from 1.67% to 36.33% of syllables disfluent during the reading of "Arthur" across participants; a range of 34.66%. Figure 22 shows that all of the participants, except for P1, experienced disfluency of less than 10% of their syllables during this reading. For the "Arthur" task, the percentage of syllables stuttered were very similar to the percentage of syllables disfluent for each of the participants. This is consistent with what was seen during the exploration of participants across tasks: the reading tasks had less nonstuttered disfluencies than the spontaneous speaking tasks.

During this task the participants were the most similar to each other than any other task when the percentages of syllables stuttered and disfluent are compared; although, they share no pattern with one another. P1 was an outlier and maintained a fairly high percentage of syllables stuttered and disfluent during the “Arthur” task. P1 also decreased percentage of syllables stuttered across every session, this was not seen in any of the other participants. It is unknown why P1 is an outlier on this task.

Table 24. Percentage of Syllables that were Stuttered in Arthur reading across Participants

	Percentage of Syllables that were Stuttered (%)									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	36.33	36.00	35.33	*	30.33	34.50	30.33	36.33	2.81	0.08
P2	3.00	3.67	3.67	1.67	4.33	3.27	1.67	4.33	1.01	0.31
P3	7.33	6.33	5.67	2.33	4.67	5.27	2.33	7.33	1.91	0.36
P4	5.00	4.67	7.00	5.67	9.00	6.27	4.67	9.00	1.77	0.28
P5	3.33	1.00	2.00	1.67	2.00	2.00	1.00	3.33	0.85	0.42
P6	3.00	4.67	3.67	4.00	3.67	3.80	3.00	4.67	0.61	0.16

Note: Min=Minimum percentage of syllables that were stuttered for the participant, Max=Maximum percentage of syllables that were stuttered for the participant, SD=standard deviation of stuttered syllables for the participant, CV=Coefficient of Variation for the participant
* Data are missing due to computer malfunction

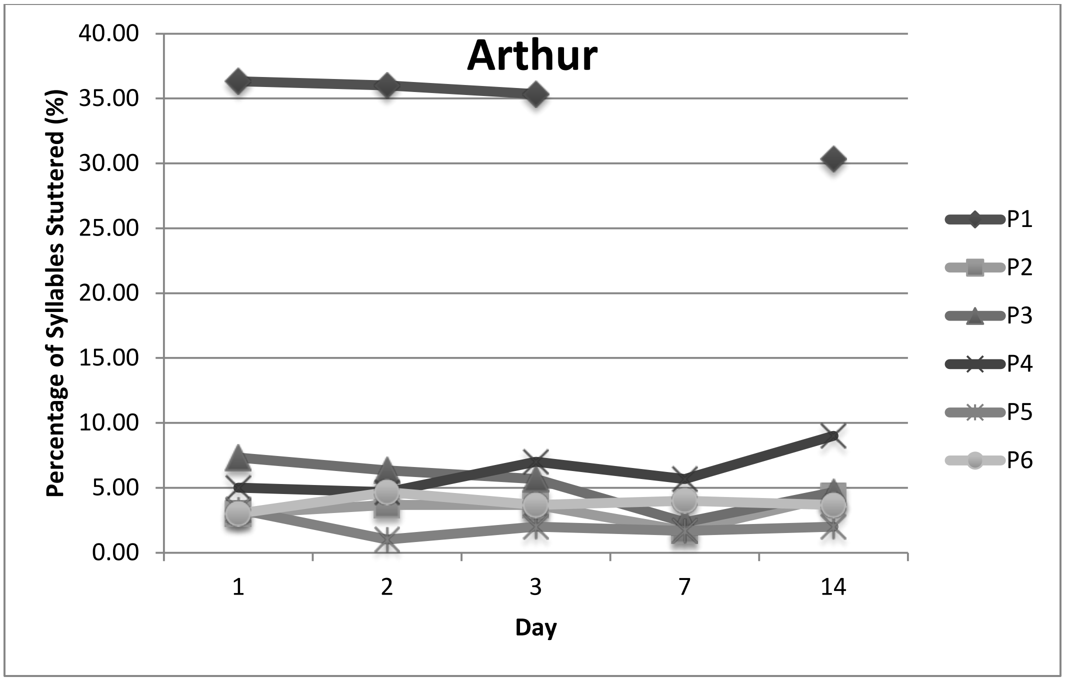

Figure 21. Percentage of Syllables that were Stuttered in Arthur reading across Participants

Table 25. Percentage of Syllables that were Disfluent in Arthur reading across Participants

	Percent of Syllables that were Disfluent (%)									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	36.33	36.33	36.00	*	30.67	34.83	30.67	36.33	2.78	0.08
P2	3.00	3.67	3.67	1.67	4.33	3.27	1.67	4.33	1.01	0.31
P3	8.00	7.00	5.67	2.33	4.67	5.53	2.33	8.00	2.19	0.40
P4	5.67	4.67	7.33	6.33	9.00	6.60	4.67	9.00	1.66	0.25
P5	4.67	1.67	2.00	2.67	2.33	2.67	1.67	4.67	1.18	0.44
P6	3.33	5.00	4.67	4.00	4.33	4.27	3.33	5.00	0.64	0.15

Note: Min=Minimum percentage of syllables that were disfluent for the participant, Max=Maximum percentage of syllables that were disfluent for the participant, SD=standard deviation of disfluent syllables for the participant, CV=Coefficient of Variation for the participant
* Data are missing due to computer malfunction

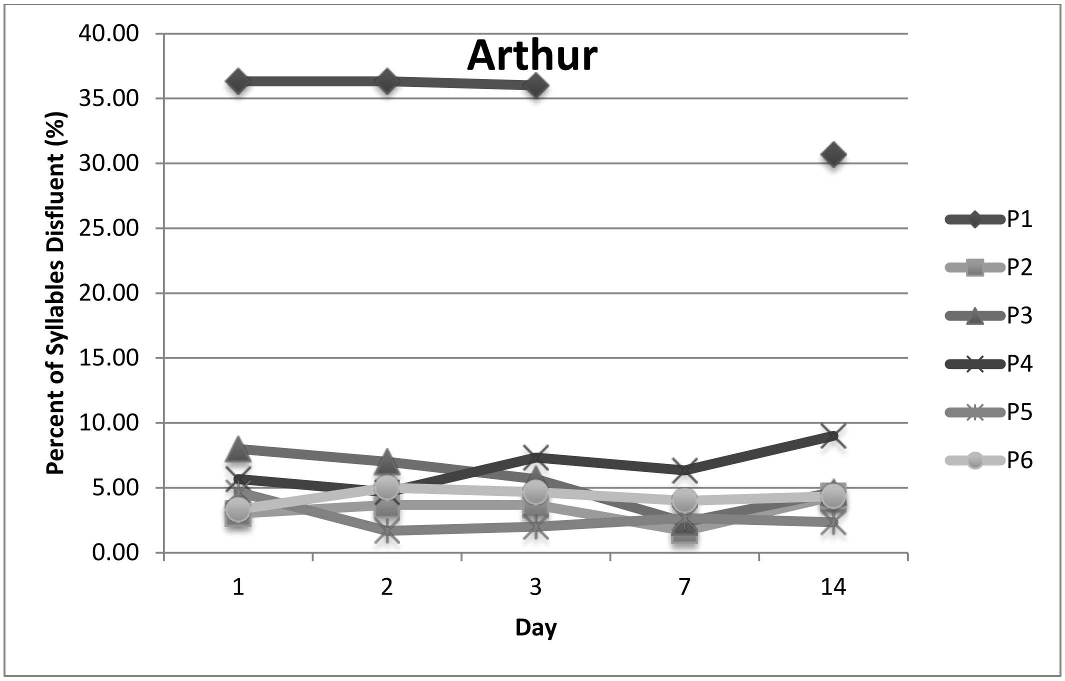

Figure 22. Percentage of Syllables that were Disfluent in Arthur reading across Participants

3.2.1.3 Monologue Frequency Data

Table 26 shows the percentage of syllables that were stuttered during the monologue across participants. These ranged from 1.00% to 26.00% or a range of 25.00% of syllables stuttered. Figure 23 shows that performance on the monologue task varied greatly from session to session and there was no pattern shared between any of the participants. P2 and P3 varied the least amount and also had the least amount of syllables stuttered during the monologue task.

Table 27 shows the percentage of syllables disfluent during the monologue task across all participants. The percentage of syllables disfluent during the monologue ranged from 3.33% to 33.67%. This is a range of 30.34%. Figure 24 shows that P2 and P3 were the least variable and also the least disfluent on the monologue task. Except for the last session, P1 decreased across every session for both percentage of syllables stuttered and percentage of syllables disfluent. This decrease from session to session was not scene in any of the other participants.

Table 26. Percentage of Syllables that were Stuttered in the Monologue across Participants

	Percentage of Syllables that were Stuttered (%)									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	26.00	22.00	18.00	*	18.33	21.08	18.00	26.00	3.75	0.18
P2	3.67	5.33	4.67	6.67	4.00	4.87	3.67	6.67	1.19	0.25
P3	1.00	1.00	2.33	1.33	1.67	1.47	1.00	2.33	0.56	0.38
P4	12.33	16.00	19.00	14.00	23.00	16.87	12.33	23.00	4.23	0.25
P5	18.00	7.33	19.00	12.67	9.33	13.27	7.33	19.00	5.16	0.39
P6	16.33	18.33	15.33	18.33	15.33	16.73	15.33	18.33	1.52	0.09

Note: Min=Minimum percentage of syllables that were stuttered for the participant, Max=Maximum percentage of syllables that were stuttered for the participant, SD=standard deviation of stuttered syllables for the participant, CV=Coefficient of Variation for the participant
* Data are missing due to computer malfunction

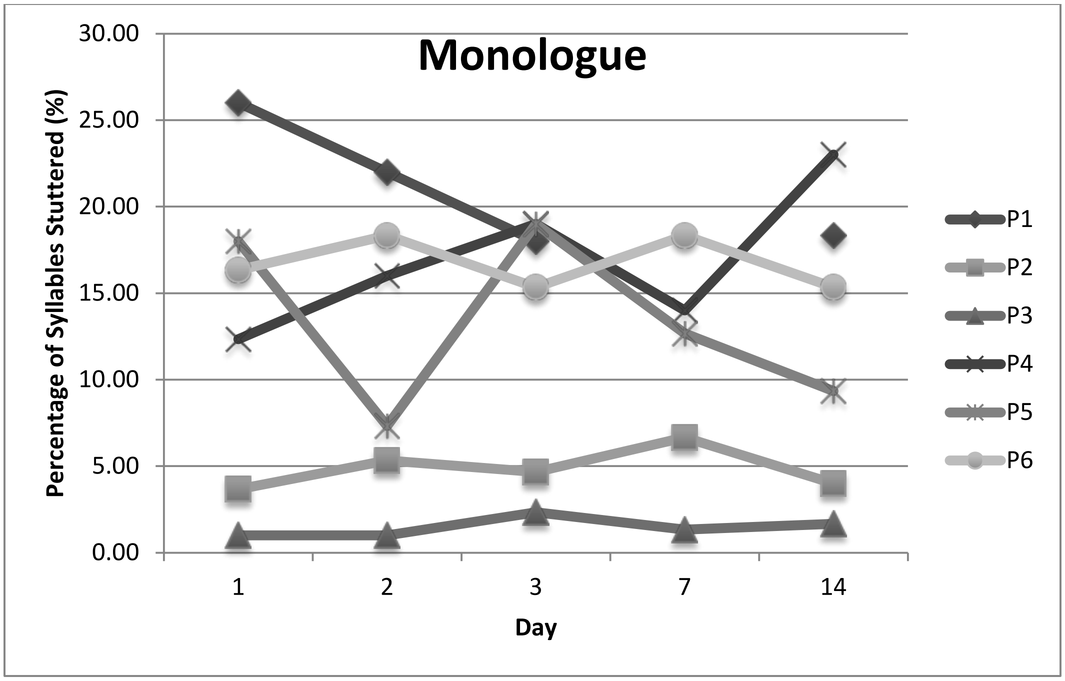

Figure 23. Percentage of Syllables that were Stuttered in the Monologue across Participants

Table 27. Percentage of Syllables that were Disfluent in the Monologue across Participants

	Percent of Syllables that were Disfluent (%)									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	33.67	28.33	20.33	*	23.00	26.33	20.33	33.67	5.91	0.22
P2	6.00	6.00	6.00	9.00	5.33	6.47	5.33	9.00	1.45	0.22
P3	5.00	3.33	4.67	4.67	4.00	4.33	3.33	5.00	0.67	0.15
P4	17.00	22.00	20.00	20.33	24.67	20.80	17.00	24.67	2.81	0.14
P5	18.33	8.67	19.33	14.00	13.00	14.67	8.67	19.33	4.31	0.29
P6	22.00	22.67	19.67	24.00	20.00	21.67	19.67	24.00	1.83	0.08

Note: Min=Minimum percentage of syllables that were disfluent for the participant, Max=Maximum percentage of syllables that were disfluent for the participant, SD=standard deviation of disfluent syllables for the participant, CV=Coefficient of Variation for the participant
* Data are missing due to computer malfunction

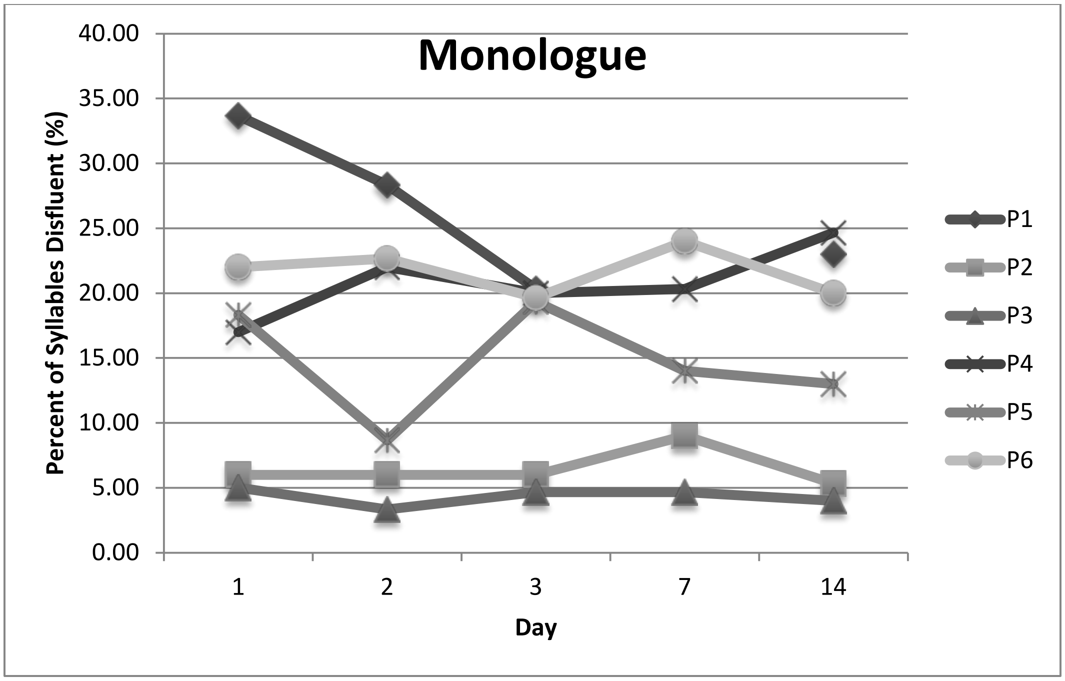

Figure 24. Percentage of Syllables that were Disfluent in the Monologue across Participants

3.2.1.4 Random Reading Frequency Data

According to Table 28, the percentage of syllables stuttered during the random reading task ranged from 0.00% to 29.00% across participants. This is a range of 29.00%. Table 29 shows the percentage of syllables disfluent during the random reading task ranged from 0.33% to 29.00% across participants. This is a range of 28.67%.

Figure 25 and Figure 26 show that during the random reading task the percentages of syllables stuttered were very similar to the percentages of syllables disfluent for each of the participants, once more consistent with the finding that nonstuttered disfluencies occurred less frequently on the reading tasks than on the spontaneous speaking tasks. P1 was again an outlier in terms of the magnitude of the percentage of syllables stuttered and percentage of syllables disfluent.

P2 and P4 both exhibited an alternating pattern of increasing then decreasing percentages of syllables stuttered and disfluent. P5 showed the opposite of this pattern, first decreasing then increasing, for both percentage of syllables stuttered and percentage of syllables disfluent. P6 had a noticeably higher percentage of both syllables stuttered and syllables disfluent on the last two days than during the first three days. P1 decreased both percentages syllables stuttered and disfluent across the first three days and then remained consistent on the last day.

Table 28. Percentage of Syllables that were Stuttered in the Random Reading across Participants

	Percentage of Syllables that were Stuttered (%)									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	29.00	27.67	27.33	*	27.33	27.83	27.33	29.00	0.79	0.03
P2	5.67	5.33	3.33	5.67	3.00	4.60	3.00	5.67	1.32	0.29
P3	2.00	4.00	3.67	1.67	1.00	2.47	1.00	4.00	1.30	0.53
P4	9.67	10.33	8.33	9.33	8.33	9.20	8.33	10.33	0.87	0.09
P5	2.00	0.33	2.33	0.00	0.67	1.07	0.00	2.33	1.04	0.97
P6	8.33	7.33	7.00	13.33	14.33	10.07	7.00	14.33	3.49	0.35

Note: Min=Minimum percentage of syllables that were stuttered for the participant, Max=Maximum percentage of syllables that were stuttered for the participant, SD=standard deviation of stuttered syllables for the participant, CV=Coefficient of Variation for the participant
* Data are missing due to computer malfunction.

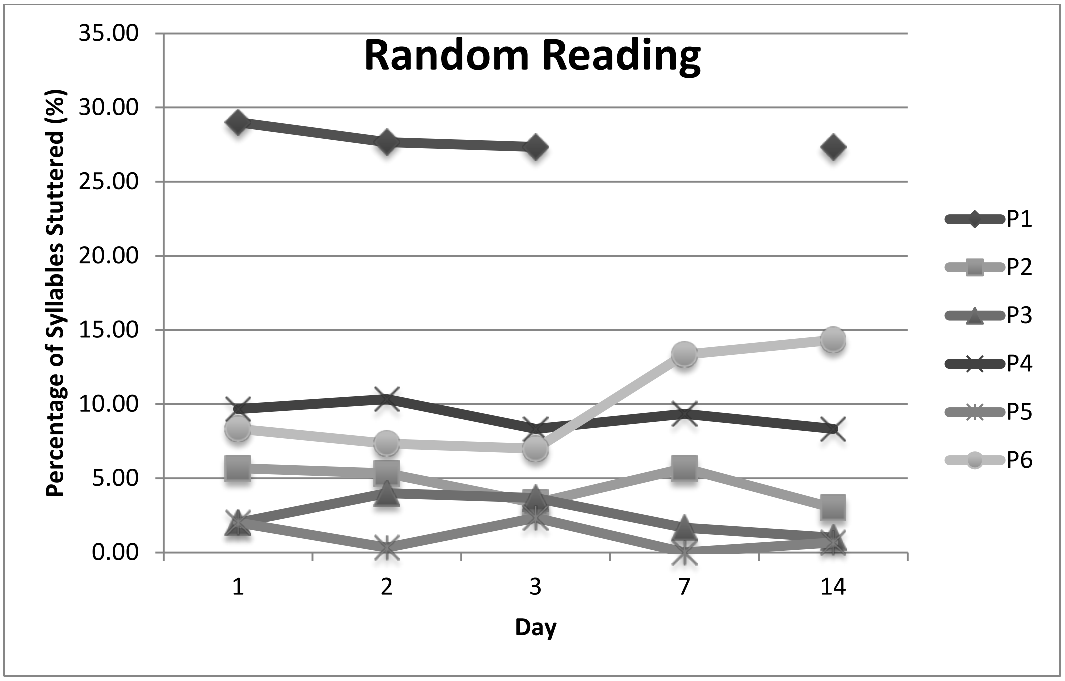

Figure 25. Percentage of Syllables that were Stuttered in the Random Reading across Participants

Table 29. Percentage of Syllables that were Disfluent in the Random Reading across Participants

	Percent of Syllables that were Disfluent (%)									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	29.00	28.33	27.33	*	27.33	28.00	27.33	29.00	0.82	0.03
P2	5.67	5.33	3.67	6.00	3.33	4.80	3.33	6.00	1.22	0.25
P3	3.00	4.00	4.67	2.00	1.33	3.00	1.33	4.67	1.37	0.46
P4	9.67	10.33	8.67	10.67	8.67	9.60	8.67	10.67	0.92	0.10
P5	3.00	1.00	2.67	0.33	1.33	1.67	0.33	3.00	1.13	0.68
P6	9.00	8.00	7.33	13.33	15.00	10.53	7.33	15.00	3.42	0.32

Note: Min=Minimum percentage of syllables that were disfluent for the participant, Max=Maximum percentage of syllables that were disfluent for the participant, SD=standard deviation of disfluent syllables for the participant, CV=Coefficient of Variation for the participant
* Data are missing due to computer malfunction.

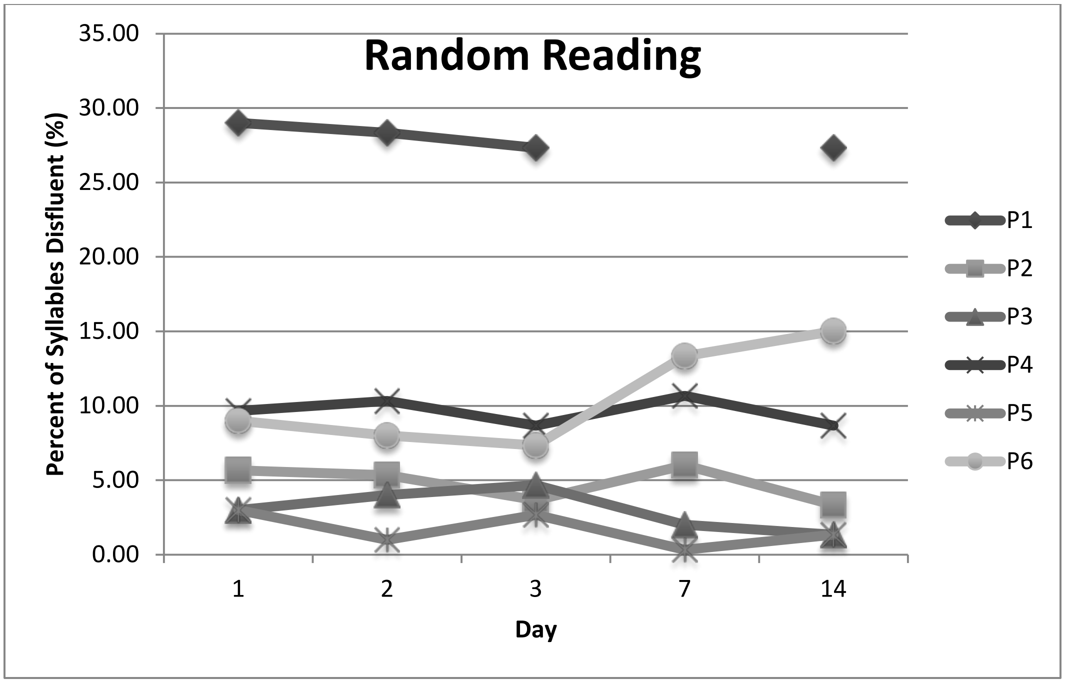

Figure 26. Percentage of Syllables that were Disfluent in the Random Reading across Participants

3.2.1.5 Picture Description Frequency Data

Table 30 shows the percentage of syllables that were stuttered on the picture description task across participants, which ranged from 1.67% to 27.81%. This is a range of 26.14%. Figure 27 shows that the two participants that stuttered the least on the picture description task, P2 and P3, were also the least variable.

In Table 31, the percentage of syllables disfluent during the picture description task across participants are shown. Across the participants the minimum amount of stuttering was 4.00% of syllables disfluent and the maximum was 36.90% of syllables disfluent. This is a range

32.90%. Figure 28 shows that the two participants that were least disfluent on the picture description task, P2 and P3, were again the least variable.

For the picture description task, P1 decreased on both percentage of syllables stuttered and percentage of syllables disfluent across all sessions. P2 and P4 shared a common pattern for percentage of syllables stuttered. They first increased percentage of syllables stuttered from Day 1 to Day 2, then decreased from Day 2 to Day 3, and then increased from Day 3 to Day 14. P4 continued to follow this pattern for percentage of syllables disfluent but P2 did not. P5 followed the exact opposite of this pattern for both percentage of syllables stuttered and percentage of syllables disfluent. P3 alternated pack and forth, first decreasing then increasing across all the sessions for both percentages of syllables stuttered and disfluent.

Table 30. Percentage of Syllables that were Stuttered on the Picture Description across Participants

	Percentage of Syllables that were Stuttered (%)									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	27.81	24.26	20.33	*	18.67	22.77	18.67	27.81	4.10	0.18
P2	3.67	5.00	1.67	2.67	3.33	3.27	1.67	5.00	1.23	0.38
P3	2.67	2.00	2.33	2.00	3.00	2.40	2.00	3.00	0.43	0.18
P4	10.00	13.33	10.33	12.00	14.00	11.93	10.00	14.00	1.77	0.15
P5	15.67	5.67	19.67	16.33	8.33	13.13	5.67	19.67	5.88	0.45
P6	12.33	9.00	9.67	17.00	6.00	10.80	6.00	17.00	4.13	0.38

Note: Min=Minimum percentage of syllables that were stuttered for the participant, Max=Maximum percentage of syllables that were stuttered for the participant, SD=standard deviation of stuttered syllables for the participant, CV=Coefficient of Variation for the participant
* Data are missing due to computer malfunction.

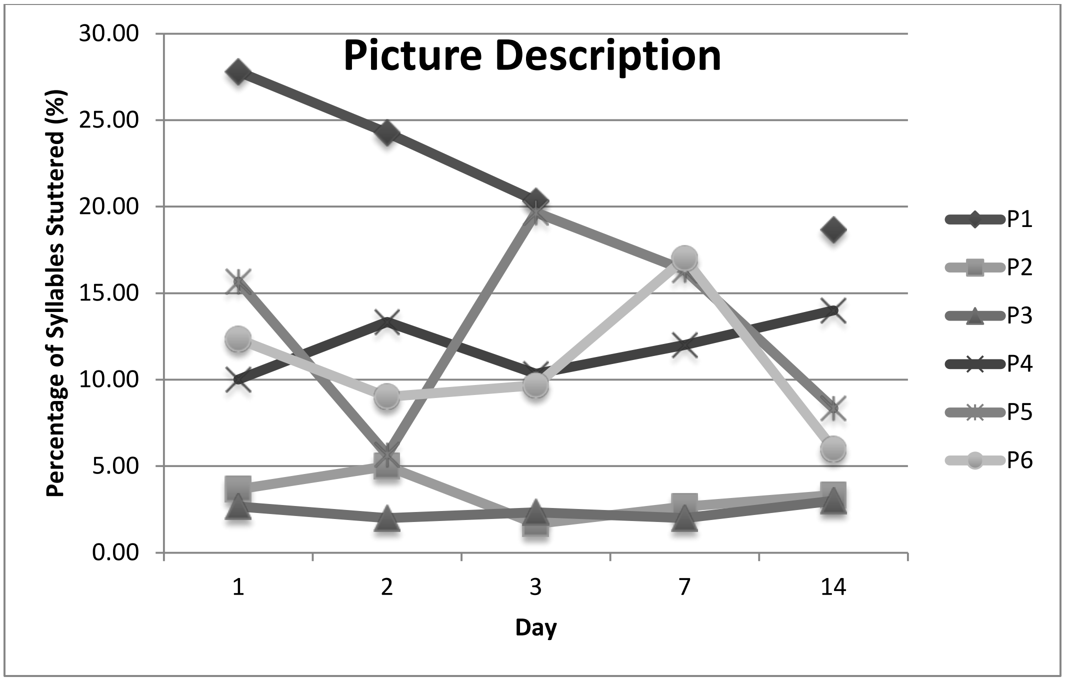

Figure 27. Percentage of Syllables that were Stuttered on the Picture Description across Participants

Table 31. Percentage of Syllables that were Disfluent on the Picture Description across Participants

	Percent of Syllables that were Disfluent (%)									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	36.90	27.21	24.00	*	21.33	27.36	21.33	36.90	6.80	0.25
P2	5.67	6.67	4.67	4.00	5.00	5.20	4.00	6.67	1.02	0.20
P3	6.67	5.00	5.67	4.00	6.00	5.47	4.00	6.67	1.02	0.19
P4	14.00	18.00	14.00	18.00	18.67	16.53	14.00	18.67	2.33	0.14
P5	20.00	9.67	23.67	22.67	13.67	17.93	9.67	23.67	6.04	0.34
P6	19.67	14.00	14.00	20.67	11.33	15.93	11.33	20.67	4.03	0.25

Note: Min=Minimum percentage of syllables that were disfluent for the participant, Max=Maximum percentage of syllables that were disfluent for the participant, SD=standard deviation of disfluent syllables for the participant, CV=Coefficient of Variation for the participant
* Data are missing due to computer malfunction

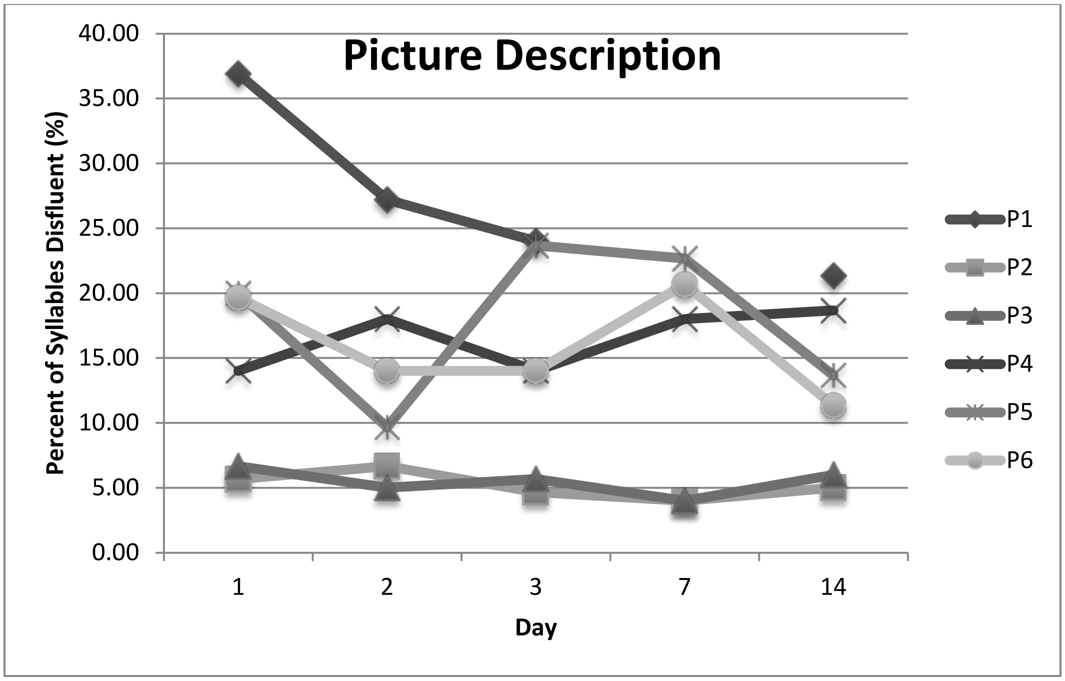

Figure 28. Percentage of Syllables that were Disfluent on the Picture Description across Participants

3.2.2 Characteristic Data

The broader characteristic scores for the participants on each measure of stuttering are shown below. The adverse impact of the stuttering disorder as measured by the OASES is compared across participants over time. The severity of stuttering as measured by the SSI-4 is also compared across participants over time. Finally the data from the Daily Questionnaire are shown as measured across participants over time. The different measures show different amounts of variability. The OASES scores remained very stable for all of the participants regardless of severity and showed no pattern between participants. The SSI-4 and Daily Questionnaire showed a great deal of variability from day to day. Although there was no pattern to this variability shared by all of the participants, there were some patterns present in the scores of the individual participants. None of these patterns were shared by more than two participants.

3.2.2.1 OASES Characteristic Data

Table 32 shows how the impact scores on the OASES varied across participants. The lowest score was 1.08 and the highest score was 3.70. Figure 29 shows that the scores on the OASES remained consistent across the sessions for every participant. There was no pattern from day to day.

Table 32. OASES Impact Scores across Participants

	OASES Impact Score									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	3.67	3.58	3.55	3.59	3.70	3.62	3.55	3.70	0.06	0.02
P2	3.19	3.28	3.36	3.43	3.38	3.33	3.19	3.43	0.09	0.03
P3	1.57	1.50	1.49	1.50	1.49	1.51	1.49	1.57	0.03	0.02
P4	1.17	1.18	1.22	1.14	1.08	1.16	1.08	1.22	0.05	0.05
P5	1.98	1.94	1.88	1.95	1.92	1.93	1.88	1.98	0.04	0.02
P6	2.37	2.43	2.41	2.44	2.66	2.46	2.37	2.66	0.11	0.05

Note: OASES=Overall Assessment of the Speaker's Experience of Stuttering, Min=Minimum OASES score, Max=Maximum OASES score, SD=standard deviation of OASES scores, CV=Coefficient of Variation for OASES scores

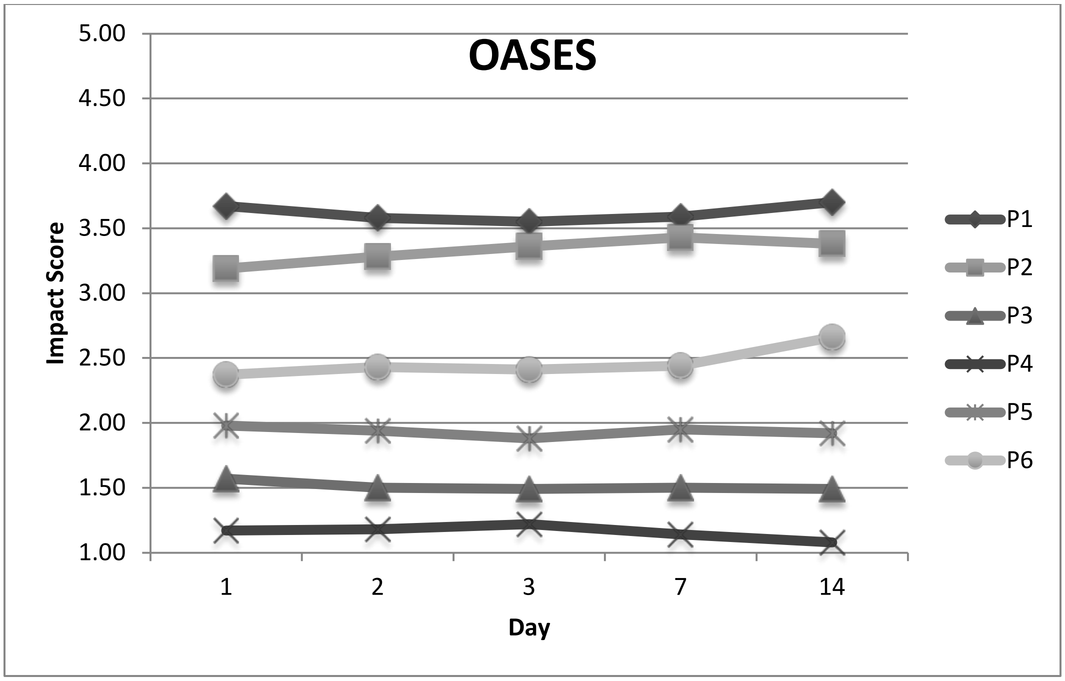

Figure 29. OASES Impact Scores across Participants

3.2.2.2 SSI-4 Characteristic Data

Table 33 shows how the standard scores on the SSI-4 varied across participants. The lowest score was 2.00 and the highest score was 36.00. Figure 30 shows that for some of the participants the scores varied greatly from session to session but other participants remained consistent from session to session. Most participants showed no pattern in the direction their scores varied; however, P3 showed a general trend of improving from session to session. There were no obvious trends shared by all of the participants.

There were some patterns that were shared by, at most, two participants. With so few participants behaving similarly it cannot be known for certain whether these similarities were actual trends in the data or just coincidences. The first pattern was shared by P1 and P2. Their scores on the SSI-4 increased from Day 1 to Day 2, then decreased from Day 2 to Day7, and then increased from day 7 to 14. P4 and P5 also shared a pattern on the SSI-4 from session to session. Their scores first increased from Day 1 to Day 2 and then decreased from Day 2 to Day 3. Their scores then stayed the same from Day 3 to Day 7 and increased again on Day 14. P3 and P6 did not share patterns with each other or any other participants. P3 did have interesting SSI-4 results in her own right. She showed sharp decreases from session to session on every session except for the last one.

Table 33. SSI Standard Scores across Participants

	SSI Standard Score									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	35.00	36.00	35.00	30.00	35.00	34.20	30.00	36.00	2.39	0.07
P2	12.00	17.00	13.00	7.00	14.00	12.60	7.00	17.00	3.65	0.29
P3	22.00	12.00	7.00	2.00	5.00	9.60	2.00	22.00	7.83	0.82
P4	25.00	26.00	24.00	24.00	34.00	26.60	24.00	34.00	4.22	0.16
P5	20.00	22.00	20.00	20.00	21.00	20.60	20.00	22.00	0.89	0.04
P6	27.00	28.00	33.00	32.00	31.00	30.20	27.00	33.00	2.59	0.09

Note: SSI=Stuttering Severity Instrument, Min=Minimum SSI score, Max=Maximum SSI score, SD=standard deviation of SSI scores, CV=Coefficient of Variation for SSI scores

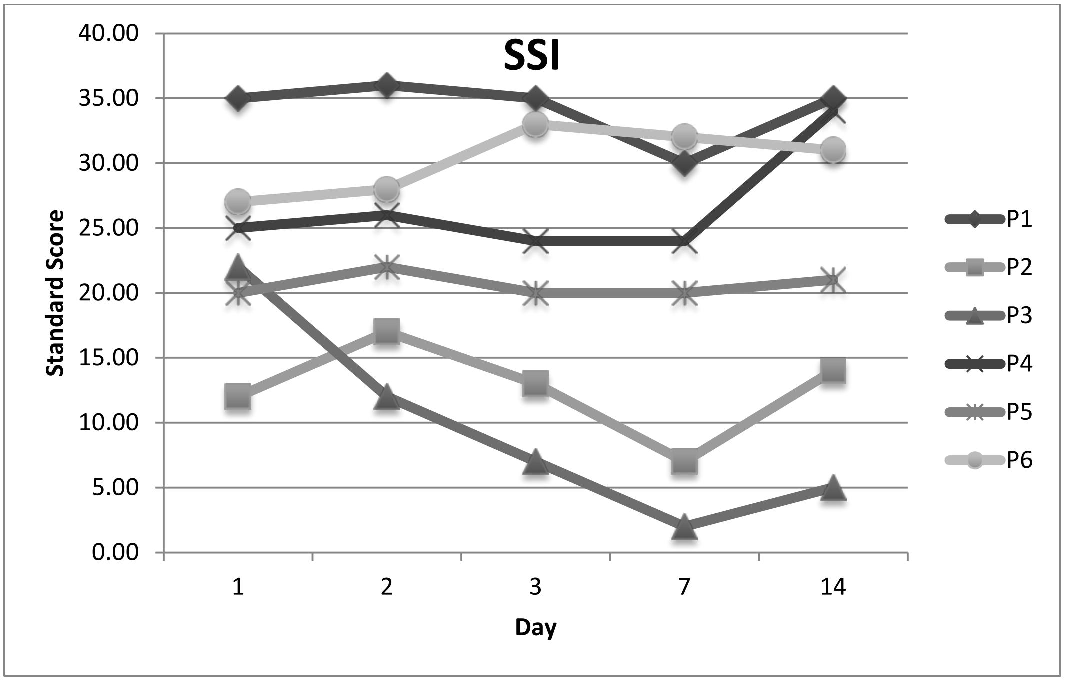

Figure 30. SSI Standard Scores across Participants

3.2.2.3 Daily Questionnaire Characteristic Data

Table 34 shows how the scores on the Daily Questionnaire varied across participants. Figure 31 shows that none the participants exhibited any patterns from session to session on the Daily Questionnaire. It is interesting that there is a lot of variability in how people think about themselves and rate their attitude across days. It is uncertain what this means.

Table 34. Daily Questionnaire Scores across Participants

	Daily Questionnaire Score									
	Day									
Participant	**1**	**2**	**3**	**7**	**14**	**Mean**	**Min**	**Max**	**SD**	**CV**
P1	15.00	13.00	16.00	17.00	12.00	14.60	12.00	17.00	2.07	0.14
P2	23.00	23.00	20.00	13.00	20.00	19.80	13.00	23.00	4.09	0.21
P3	21.00	21.00	21.00	24.00	24.00	22.20	21.00	24.00	1.64	0.07
P4	14.00	20.00	22.00	17.00	22.00	19.00	14.00	22.00	3.46	0.18
P5	21.00	18.00	15.00	16.00	14.00	16.80	14.00	21.00	2.77	0.17
P6	19.00	19.00	18.00	20.00	17.00	18.60	17.00	20.00	1.14	0.06

Note: For Daily Questionnaire lower scores indicate more positive rating. Min=Minimum Daily Questionnaire score, Max=Maximum Daily Questionnaire score, SD=standard deviation of Daily Questionnaire scores, CV=Coefficient of Variation for Daily Questionnaire scores

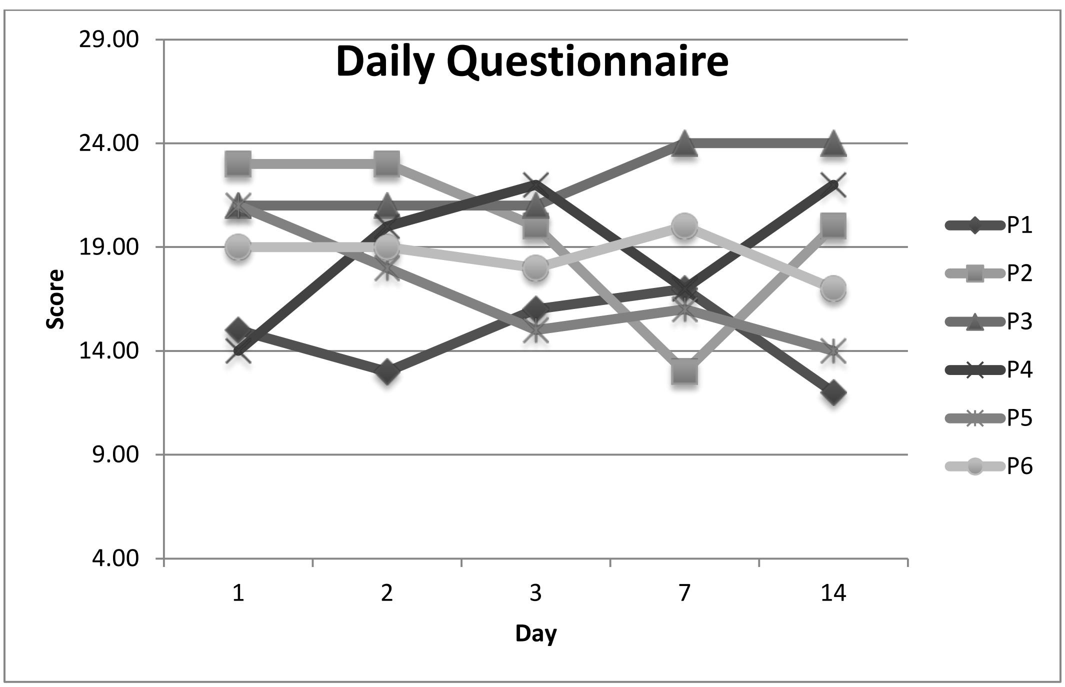

Figure 31. Daily Questionnaire Scores across Participants

When the participants are compared to each other some patterns emerge. Some participants were more disfluent on certain tasks and on certain days. Other participants showed no obvious pattern to their disfluencies. Globally there was no pattern from day to day. The broader characteristic data, as measured by the SSI-4, OASES, and Daily Questionnaire, are not able to explain the magnitude or the direction of variability observed from day to day during this study.

3.3 CORRELATIONS

There was a great deal of variability for each participant from session to session as demonstrated in the data above. To see if any of this variability could be explained by the characteristics of the individual participants, the data from the various measures of stuttering were correlated with one another. This was done by finding the Pearson product moment correlation coefficients (r) for measures of interest. Table 35 shows the different r values and their levels of significance. Since this is a preliminary study only the actual significance levels for each correlation are reported. These have not been corrected for multiple comparisons. Several of the correlations reach significance and are discussed below.

The average percentage of syllables stuttered were taken for each participant on each day and used for the “Mean %SS” correlations. The average percentage of syllables disfluent were taken for each participant on each day and used for the “Mean %SD” correlations. The coefficient of variation for the percentage of syllables stuttered and syllables disfluent for each participant on each day were used for the “CV %SS” and “CV %SD” correlations, respectively. The SSI-4, OASES, and Daily Questionnaire score for each participant on each day were used for the “SSI-4,” “OASES,” and “DQ” correlations. Finally, the physical concomitant portion of the SSI-4 for each participant on each day was used for the “Physical” correlation. For this analysis, r values over 0.70 were considered strong correlations and r values less than 0.35 were considered weak correlations.

The average percentage of syllables stuttered for each participant on each day correlated strongly with the average percentage of syllables disfluent for each participant on each day. There was also a strong correlation between the coefficients of variance for percentage of syllables stuttered on each day for each participant and the coefficient of variance for percentage of syllables disfluent on each day for each participant. These correlations were both significant at the 0.001 level. These correlations were expected. An increase in percentage of syllables stuttered would also increase percentage of syllables disfluent because stuttered syllables are included in the disfluent syllables measure.

The scores for the SSI-4 on each day correlated highly with both the average percentage of syllables stuttered and percentage of syllables disfluent for each participant on each day. The physical concomitant score for each participant on each day also correlated highly with SSI-4 score. These correlations were significant at the 0.001 level. These correlations were also unsurprising. A large portion of the SSI-4 score is a measure of stuttering frequency and should increase with an increase of the percentages of syllables stuttered and disfluent. Similarly, an increase in the physical concomitant score also increases the SSI-4 score.

There were moderate correlations between the OASES scores, both the average percentage of syllables stuttered and percentage of syllables disfluent for each participant on each day, and the physical concomitant scores for each participant on each day. These correlations were significant at the 0.05 level. There were also moderate correlations between the physical concomitant scores and both the average percentage of syllables stuttered and average percentage of syllables disfluent for each participant on each day. These correlations were significant at the 0.001 level.

Moderate inverse correlations existed for the coefficient of variance of the percentage of syllables stuttered and both the average percentage of syllables stuttered and average percentage of syllables disfluent for each participant on each day. The former correlation reached significance at the 0.05 level but the latter correlation did not. The OASES had moderate inverse correlations with both the coefficient of variance for percentage of syllables stuttered on each day for each participant and coefficient of variance for percentage of syllables disfluent on each day for each participant. These correlations were significant at the 0.01 level. The Daily Questionnaire had moderate inverse correlations with the average percentage of syllables stuttered, average percentage of syllables disfluent for each participant on each day, and daily SSI-4 scores. These correlations were also significant at the 0.01 level. The Daily questionnaire had moderate inverse correlations that were significant at the 0.05 level with the physical concomitant scores and OASES scores for each participant on each day.

There was a weak correlation between SSI-4 scores and OASES scores for each participant on each day. This correlation did not reach significance. A weak inverse correlation, that also did not reach significance, existed between the coefficient of variance of average percentage of syllables stuttered for each participant on each day and the physical concomitant score for each participant on each day. Weak inverse correlations also existed between the coefficient of variance for percentage of syllables disfluent for each participant on each day and the average percentage of syllables stuttered for each participant on each day, the average percentage of syllables disfluent for each participant on each day, and the physical concomitant score for each participant on each day; none of these correlations reached significance.

There were no correlations between the coefficient of variance for percentage of syllables stuttered for each participant on each day and both the SSI-4 and Daily Questionnaire for each participant on each day. There was also no correlations between coefficient of variance for percentage of syllables disfluent for each participant on each day and both the SSI-4 and Daily Questionnaire for each participant on each day.

Table 35. Correlations Between the Various Measures

	Pearson Product Moment Correlation Coefficients, r							
	Mean %SS	**Mean %SD**	**CV %SS**	**CV %SD**	**SSI-4**	**OASES**	**DQ**	**PC**
Mean %SS	**X**							
Mean %SD	0.996***	**X**						
CV %SS	-0.370*	-0.348	**X**					
CV %SD	-0.287	-0.266	0.820***	**X**				
SSI-4	0.802***	0.816***	-0.068	0.006	**X**			
OASES	0.404*	0.380*	-0.494**	-0.479**	0.242	**X**		
DQ	-0.553**	-0.567**	0.021	-0.040	-0.481**	-0.380*	**X**	
Physical	0.667***	0.677***	-0.254	-0.271	0.849***	0.401*	-0.409*	**X**

Note: *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed). ***Correlation is significant at the 0.001 level (2-tailed).
Overall %SS = Overall Percentage of syllables that were stuttered, Overall %SD = Overall percentage of syllables that were disfluent, SD %SS = Standard deviation of the percentage of syllables stuttered, SD % SD = Standard deviation of the percentage of syllables disfluent, DQ = Daily Questionnaire, PC = Physical concomitant score from the SSI-4

4.0 DISCUSSION

This study revealed notable variability in frequency of stuttering between days for all of the participants. Participants varied from one task to another on the same day, as well as from one task on one day to the same task on a different day. This variability did not correlate with common measures of stuttering severity nor was there any pattern of variability shared between the participants.

4.1 INTERPRETATION OF DATA

There were four primary findings in this study. The first and most important finding was the large range of variability seen in stuttering from day to day. Table 3 shows that participants could have ranges as large as almost 23% syllables stuttered and 25% syllables disfluent on different tasks on different days. Variations this large can greatly affect the interpretation of treatment outcome studies.

The patterns of this variability from day to day were unique for each of the participants. These data clearly show that stuttering is a variable disorder and gives an idea of the extent of this variability. It also highlights how little of this variability we are able to explain.

The second finding was that the amount of variability seen in percentage of syllables stuttered and percentage of syllables disfluent did not correlate at all with traditional measures of severity. The magnitude of the overall range of percentages of syllables stuttered and disfluent over which a participant varied was tied to frequency of stuttering. In other words, participants with larger percentages of syllables stuttered and disfluent had larger ranges of variability. This is to be expected. The higher the mean percentages of syllables stuttered and disfluent (the greater the frequency of stuttering), the more room the participants have to decrease in both these measures. Participants with low mean percentages of syllables stuttered and disfluent can only decrease very little in both these measures before they are at zero percent syllables stuttered or disfluent. Thus, there is a floor effect. This floor effect limits the amount those who stutter very little can vary.

Participants with high mean percentages of syllables stuttered and disfluent had larger standard deviations of percentage of syllables stuttered and disfluent across tasks and sessions. This effect was accounted for by using coefficients of variance to compare participants instead of standard deviation. When the coefficients of variance for both percentage of syllables stuttered across sessions and percentage of syllables disfluent across days were correlated, using the Pearson product-moment correlation coefficient (Table 33), to the mean percentages of syllables stuttered and disfluent across days the correlations were weak to moderate and negative. The same result was found when coefficients of variance were correlated to SSI-4 and OASES scores, indicating no correlations between amount of variability in percentage of syllables stuttered and disfluent and measures of severity.

There are a number of reasons that these correlations may not have been stronger. One reason may be that variability does not correlate to severity at all. Another reason may be that variability correlates to measures of severity that were not used in this study, such as a measure of response to and management of moments of stuttering. It seems possible that individuals who are better able to manage moments of stuttering would be less variable from day to day in regards to the severity of their stuttering. They would be more equipped to consistently apply their management skills to their speech. In such a case, frequency of stuttering might not diminish but severity of individual moments of stuttering would. There is currently no way to measure management skills; this is briefly discussed below in study limitations and ideas for future research.

This suggests that there may be two dimensions to variability. The frequency of moments of stuttering is variable, as demonstrated in this study, but the response to these moments of stuttering may be variable as well. It is possible that even though severity as measured by frequency of stuttering does not correlate with variability, severity as measured by skill at managing moments of stuttering does.

The third finding was that the spontaneous speaking tasks contained more nonstuttered disfluencies than the reading tasks. This was an unexpected finding. It is possible to explain some of the reasons for this phenomenon, although it is not yet fully understood. Nonstuttered disfluencies may be the result of uncertainty in speech and can be used as a place holder while the correct word is chosen by the speaker (Clark & Clark, 1977). The reading passages provide the words to be said and eliminate many of the nonstuttered disfluencies that may result from not knowing what to say next. Uncertainty could still exist if the readers lose their places in the reading or are uncertain of what they have read is correct. Revisions can still occur in oral reading.

Another reason nonstuttered disfluencies may have been more frequent in the spontaneous speaking situations is that some people who stutter use nonstuttered disfluencies to avoid words that they fear they will stutter on or to avoid the moment of stutter itself (Manning, 2010). For example, instead of stuttering on the word “store” in the sentence, “I am going to the s-s-store.” I person who stutters may avoid the moment of stuttering by saying, “I am going to the uh uh uh s-s uh I am going shopping.” In this example the speaker may have been uncomfortable being in the moment of stuttering and used the injection “uh” as a place holder until they felt they would be able to say the word “store” more fluently. However, when they tried to say “store” they still stuttered so they decided to say a different word altogether. The spontaneous speaking situations would allow the speakers more opportunities to alter what they were going to say if they feared a moment of stuttering. The reading situations provide the words to be said, which does not allow the speakers much room to manipulate their speech with nonstuttered disfluencies to avoid feared words and sounds.

The fourth finding was that certain speakers tended to have higher percentages of stuttered syllables on either all of the reading passages or all of the spontaneous speaking passages. In other words, the speakers tended to stutter less on either the reading tasks or the spontaneous speaking tasks. This is an interesting result and the reasons behind it are not clear. It is possible that some speakers’ avoidance of moments of stuttering during spontaneous speech increased their frequency of disfluency. As mentioned above, there are more opportunities for avoidance during spontaneous speech than during reading passages. For other speakers the constraints of reading passages and the inability to avoid feared words may increase moments of stuttering. Their inability to employ avoidance strategies forces them to stutter on words they would normally not say. This could be similar to the increase in disfluency some people who stutter experience at the onset of therapy when their avoidance behaviors are decreased (Manning, 2010).

4.2 IMPLICATIONS OF DATA

The present data are interesting because they demonstrate the magnitude of stuttering's variability in adults. The ranges shown in Table 3 are not small ranges of variability. Fluctuations of this magnitude could have implications for treatment outcome studies and treatment itself.

In a systematic review of stuttering treatment, Bothe, Davidow, Bramlett, and Ingham (2006) used a percentage of syllables stuttered at or below 5% as their primary outcome measure of successful treatment. P5 had an overall percentage of syllables stuttered on the first day of 10.20%, an overall percentage of syllables stuttered on the second day of 3.80%, and an overall percentage of syllables stuttered on the third day of 12.93%. This is extreme enough variation for P5 to be considered, according to the criteria used by Bothe et al., recovered from stuttering by Day 2 and then by Day 3 to have presented with the disorder even more severely than at baseline. This change was present without any treatment.

All of the participants, except P1, would have been classified as recovered at different points in this investigation using the Bothe et al. criteria. P2 and P3 had an overall percentage of syllables stuttered of less than 5% during all of the sessions. On specific tasks, however, their percentage of syllables stuttered did rise above the 5% mark. For example, P2 had a percentage of syllables stuttered during the conversation on Day 2 of 1.33% and on Day 3 of 7.33%. On Day 7, P2 experienced a decrease in percentage of syllables stuttered from 7.33% in the conversation task to 1.67% in the "Arthur" reading. P3 experienced a decrease in percentage of syllables stuttered from 7.33% in "Arthur" to 1.00% during the monologue.

P4 and P6, while remaining above 5% for their total percentage of syllables stuttered during every session, did drop below the Bothe et al. criteria on a number of occasions. P5 was

5% of syllables stuttered or lower during “Arthur” on Day 1 and Day 2. P6 was always below 5% of syllables stuttered during the “Arthur” reading.

Using the Bothe et al. criteria and depending on the tasks used to elicit speech samples: five out of six of the participants could have been seen as recovered from their stuttering disorder at different points in this study. It should be reiterated that this is without treatment. This calls into question whether frequency of stuttering should be used as an outcome measure in stuttering research. If the day-to-day variability of stuttering can cause an individual to be classified one day as having a stuttering disorder and the next day as being recovered, a more robust measure of severity may be called for.

Costello and Ingham (1984) have said that a baseline should be established with a large number of repeated measures. The results of this study support this recommendation and suggest that it would also be helpful to take repeated outcome measures. Such repeated measures may help to account for the fluctuations in frequency of stuttering between days and can be used to paint a more representative picture of a client’s or participant’s stuttering characteristics. Repeated measures can and should be used in the clinical setting, as well as in research studies.

Results of this study show such drastic variability that obtaining a stable baseline may be difficult, if not impossible, with some individuals who stutter. This should not discourage researchers and clinicians from taking multiple measures in order to try to establish a baseline. Meaningful change can still be demonstrated in treatment. Lowering the mean percentage of syllables stuttered, the maximum percentage of syllables stuttered, or the minimum percentage of syllables stuttered are all positive outcomes. In order to know whether these measures have indeed changed from pre to post treatment, multiple measures will need to be taken. This study, along with past research, suggests taking these measures during different speaking tasks, in different settings, with different speaking partners, and on different days (Bloodstein & Bernstein Ratner, 2008; Conture, 2001; Guitar, 2006; Gutierrez & Caruso, 1995; J. C. Ingham & Riley, 1998; Manning, 2010; Martin, Kuhl, & Haroldson, 1972; E. M. Silverman, 1971; Throneburg & Yairi, 2001; Wexler, 1982; Yairi & Ambrose 1992a, 1992b, 2005; Yaruss, 1997a, 1997b; Yaruss et al., 2002).

In light of these results, clinicians, researchers, and people who stutter should be skeptical of the results of treatment outcome studies that used frequency of stuttering as the primary outcome measurement, especially if they did not use repeated measures to define both baselines and treatment outcomes. It is possible that the results of these studies were contingent not on the application of treatment but on the day-to-day variability of the stuttering of the speakers involved in them. Treatment techniques that were shown to decrease the frequency of stuttering may have only captured a point in time where the day-to-day variability of the speakers led to a decrease in their stuttering frequency independent of the applied treatment. The reverse could also be true. Treatment techniques that were shown to be ineffective may have captured a point in time where the day-to-day variability of the speakers led to an increase in their stuttering frequency. Future studies need to make sure to use other outcome measures besides frequency of stuttering in order to determine the outcome of treatment and take care to use repeated baseline and outcome measures.

It should be noted that there are other reasons besides the instability of frequency of stuttering measurements that necessitate using more than one outcome measure. Stuttering treatment must be comprehensive, addressing all of the wide ranging aspects of the disorder. Comprehensive treatment will have more goals than solely increased fluency (Yaruss, 2007). Outcome measures are required for all of the goals of therapy. The OASES is able to address one of these goals: the impact of the stuttering disorder on the life of the individual (Yaruss & Quesal, 2006).

The OASES demonstrated a high degree of day-to-day consistency in this study. As mentioned earlier, the OASES had previously demonstrated stability over the course of two weeks (Yaruss & Quesal, 2006) but stability from day to day had not yet been measured. All of the participants had stable OASES scores, regardless of the severity of their stuttering as rated by the SSI-4, the magnitude of their percentages of syllables stuttered and disfluent, and the range of their variability. Scores on the OASES have also been shown to improve with treatment (Yaruss, 2010a). Its ability to remain stable in spite of the day-to-day fluctuations in speaker's fluency coupled with its ability to show meaningful changes in treatment make the OASES very useful as a treatment outcome measure. The caution needed to interpret the results of treatment outcome studies may be assuaged if the OASES is used along with repeated baseline and outcome measures of frequency of stuttering to determine treatment success.

The observed day-to-day variability in stuttering has implications for the clinical management of the disorder. Multiple and varied diagnostic sessions will be needed to get a complete picture of the client's stuttering, which has been suggested by authors in the past (Costello & Ingham, 1984; Yaruss, 1997a). It will also be important to not judge progress in therapy on single sessions or points in time. Progress will need to be considered over a large number of sessions in order to account for variability in performance.

4.3 COMPARISON TO PAST RESEARCH

The findings here support past research. Percentages of syllables stuttered and disfluent were expected to vary, as variability has long been known to be a characteristic of stuttering (Bloodstein & Bernstein Ratner, 2008; Costello & Ingham, 1984; Sawyer & Yairi, 2006; Yaruss, 1997a, 1997b). Yaruss (1997a) also found a great deal of variability in the speech of children who stuttered in different speaking situations. He found that his participants were most disfluent during the picture description task and he found a significant positive correlation between overall frequency of less typical disfluencies and degree of variability. These last two results were not found in this study.

There are several differences between the two studies that may account for these inconsistencies. Yaruss's study was conducted with children while the present study was conducted with adults. The two studies also used different tasks. The children in Yaruss's study could not read and, therefore, would not have been able to take part in the reading tasks. The participants in Yaruss's study were also assessed in several settings while the participants in the present study were always assessed in the clinical setting.

4.4 STUDY LIMITATIONS AND DIRECTIONS FOR FURTHER RESEARCH

This study was limited by the small number of participants that took part in it. The author attempted to look for patterns of variability in stuttering; however, the accurate detection of patterns in populations requires a large sample size from that population. This paper was meant to serve as a preliminary study to start a line of research that looks more closely at the variability inherent to the disorder of stuttering and what this variability means. A large group of participants would be needed for more conclusive results.

Future research should continue to investigate the variability in moments of stuttering. This could be accomplished with studies of larger sample sizes, different speaking tasks, and longer periods of observation. It would be interesting to look at how stuttering varies over larger extended periods of time without treatment.

This study looked at variability on different tasks across days within the same situation and setting. Variability in different settings and situations must be investigated, as well. The range of variability is quite likely to increase when individuals who stutter are assessed within the clinical setting as well as out of it.

As mentioned earlier, it will also be important to investigate how the response to and management of moments of stuttering varies. Response and management of individual moments of stuttering will be difficult to measure in detail (Manning, 1977). One way to make such a measurement would be to induce moments of stuttering in individuals who stutter. Their response to and management of these induced stutters could then be systematically analyzed. Unfortunately, no tool has yet been developed to accomplish this.

The issue of variability and severity brings up many other interesting topics for future research. Factors that affect variability need to be explored. Of particular importance is whether variability changes over the course of treatment. If variability is tied to severity then variability becomes important in and of itself. If this is the case, it would follow that variability should be measured in clinical diagnostic settings and during the baseline measure of research studies as part of the assessment of severity, along with more traditional measures.

5.0 CONCLUSION

The primary result of this study was the large range over which frequency of stuttering can vary from day to day for the same individual. This variability did not correlate with any measures of stuttering severity. There was no global pattern to the variability from day to day within or between participants; however, there were some characteristics the participants had in common. There were always more nonstuttered disfluencies present during the spontaneous speaking tasks than during the reading tasks. Also, the participants tended to have greater percentages of syllables stuttered and disfluent on either all of the spontaneous speaking tasks or all of the reading tasks. The results of this study suggest that frequency of stuttering may not be the best measure to use for determining the effectiveness of treatment in treatment outcome studies and most certainly should not be the only measure used. In addition, repeated baseline and outcome measures must be made in order to determine the efficacy of treatment. These repeated measures should be taken on different days and during different speaking tasks.

APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

Participant: _______

Age:_________ Gender:___________

History of Stuttering:

1. To the best of your ability please state the age that you began stuttering: ___ years ___ months

2. Please list any other members of your family who stutter:

3. Please provide a brief description of your stuttering:

4. Please provide a brief description of your most recent treatment:

5. What have you learned in therapy that worked well for you?

6. What have you learned in therapy that you do not find helpful?

7. Which techniques that you learned in therapy do you still use?

8. How much do you think you stuttering varies from day to day?

9. How much do you think your stuttering varies from situation to situation?

10. Can you think of any things that make your stuttering more severe?

11. Can you think of anything that makes your stuttering less severe?

APPENDIX B

ARTHUR THE RAT

Once there was a young rat named Arthur, who could never make up his mind. Whenever his friends asked him if he would like to go out with them, he would only answer, "I don't know." He wouldn't say "yes" or "no" either. He would always avoid making a choice.

His aunt Helen said to him, "Now look here. No one is going to care for you if you carry on like this. You have no more mind than a blade of grass."

One rainy day, the rats heard a great noise in the loft. The pine rafters were all rotten, so that the barn was rather unsafe. At last the joists gave way and fell to the ground. The walls shook and all the rats' hair stood on end with fear and horror. "This won't do," said the captain. "I'll send out scouts to search for a new home."

Within five hours the ten scouts came back and said, "We found a stone house where there is room and board for us all. There is a kindly horse named Nelly, a cow, a calf, and a garden with an elm tree." The rats crawled out of their little houses and stood on the floor in a long line. Just then the old one saw Arthur. "Stop," he ordered coarsely. "You are coming, of course?" "I'm not certain," said Arthur. "The roof may not come down yet." "Well," said the angry old rat, "we can't wait for you to join us. Right about face. March!"

Arthur stood and watched them hurry away. "I think I'll go tomorrow," he calmly said to himself, but then again "I don't know; it's so nice and snug here."

That night there was a big crash. In the morning some men—with some boys and girls—rode up and looked at the barn. One of them moved a board and he saw a young rat, quite dead, half in and half out of his hole. Thus the idler got his due.

Adapted from Dictionary of American Regional English. (1965). *Arthur the Rat.*

APPENDIX C

COMMA GETS A CURE

Well, here's a story for you: Sarah Perry was a veterinary nurse who had been working daily at an old zoo in a deserted district of the territory, so she was very happy to start a new job at a superb private practice in north square near the Duke Street Tower. That area was much nearer for her and more to her liking. Even so, on her first morning, she felt stressed. She ate a bowl of oatmeal, checked herself in the mirror and washed her face in a hurry. Then she put on a plain yellow dress and a fleece jacket, picked up her kit and headed for work. When she got there, there was a woman with a goose waiting for her. The woman gave Sarah an official letter from the vet. The letter implied that the animal could be suffering from a rare form of foot and mouth disease, which was surprising, because normally you would only expect to see it in a dog or a goat. Sarah was sentimental, so this made her feel sorry for the beautiful bird.

Before long, that itchy goose began to strut around the office like a lunatic, which made an unsanitary mess. The goose's owner, Mary Harrison, kept calling, "Comma, Comma," which Sarah thought was an odd choice for a name. Comma was strong and huge, so it would take some force to trap her, but Sarah had a different idea. First she tried gently stroking the goose's lower back with her palm, then singing a tune to her. Finally, she administered ether. Her efforts were not ineffective. In no time, the goose began to tire, so Sarah was able to hold onto Comma and give her a relaxing bath.

Once Sarah had managed to bathe the goose, she wiped her off with a cloth and laid her on her right side. Then Sarah confirmed the vet’s diagnosis. Almost immediately, she remembered an effective treatment that required her to measure out a lot of medicine. Sarah warned that this course of treatment might be expensive—either five or six times the cost of penicillin. I can’t imagine paying so much, but Mrs. Harrison—a millionaire lawyer—thought it was a fair price for a cure.

Adapted from McCullough, J. & Somerville, B. (draft 2000). Comma Gets a Cure. In D.N. Honorof (Ed.), *A diagnostic passage for accent study*.

APPENDIX D

THE NORTH WIND AND THE SUN

The North Wind and the Sun were disputing which was the stronger, when a traveller came along wrapped in a warm cloak. They agreed that the one who first succeeded in making the traveller take his cloak off should be considered stronger than the other. Then the North Wind blew as hard as he could, but the more he blew the more closely did the traveller fold his cloak around him, and at last the North Wind gave up the attempt. Then the Sun shone out warmly, and immediately the traveller took off his cloak. And so the North Wind was obliged to confess that the Sun was the stronger of the two.

Adapted from International Phonetic Association (1999). *Handbook of the International Phonetic Association*. Cambridge University Press. p. 44.

APPENDIX E

THE GRANDFATHER PASSAGE

You wished to know all about my grandfather. Well, he is nearly ninety-three years old; he dresses himself in an ancient black frock coat, usually minus several buttons; yet he still thinks as swiftly as ever. A long, flowing beard clings to his chin, giving those who observe him a pronounced feeling of the utmost respect. When he speaks, his voice is just a bit cracked and quivers a trifle. Twice each day he plays skilfully and with zest upon our small organ. Except in the winter when the ooze or snow or ice prevents, he slowly takes a short walk in the open air each day. We have often urged him to walk more and smoke less, but he always answers, “Banana oil!” Grandfather likes to be modern in his language.

Adapted from Van Riper, C., 1963. Speech Correction: Principles and Methods. (4th ed.), Prentice Hall, Englewood Cliffs, NJ.

APPENDIX F

THE RAINBOW PASSAGE

When the sunlight strikes raindrops in the air, they act as a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is , according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow. Throughout the centuries people have explained the rainbow in various ways. Some have accepted it as a miracle without physical explanation. To the Hebrews it was a token that there would be no more universal floods. The Greeks used to imagine that it was a sign from the gods to foretell war or heavy rain. The Norsemen considered the rainbow as a bridge over which the gods passed from earth to their home in the sky. Others have tried to explain the phenomenon physically. Aristotle thought that the rainbow was caused by reflection of the sun's rays by the rain. Since then physicists have found that it is not reflection, but refraction by the raindrops which causes the rainbows. Many complicated ideas about the rainbow have been formed. The difference in the rainbow depends considerably upon the size of the drops, and the width of the colored band increases as the size of the drops increases. The actual primary rainbow observed is said to be the effect of super-imposition of a number of bows. If the red of the second bow falls upon the green of the first, the result is to give a bow with an abnormally wide yellow band, since red and green light when mixed form yellow. This is a very common type of bow, one showing mainly red and yellow, with little or no green or blue.

Adapted from Fairbanks, G. (1960). Voice and articulation drillbook, 2nd edn. New York: Harper & Row. pp124-139.

APPENDIX G

SELECTED PASSAGES FROM SSI-4

G.1 SSI-4 PASSAGE 9

Reading, Adult Level (369 syllables) Plate XIII

So here we are in Freeport, tucked away in a remote corner of the Alpine foothills in northeastern Italy, at a little restaurant. I have to admit that when I travel, history is not the first thing on my mind. Food and wine are. And that's what sold me on Freeport. It is famous as a source of some of Italy's best white wines. We went primarily in search of wines, unaware that we soon would make a culinary detour.

Occupying the extreme northeast corner of Italy, Freeport's scenery ranges from rugged coastline along the eastern border to placid plains in the west and the majestic Alps in the north, where Italy butts up against Austria. Directly to the south is Venice, just a little more than an hour and a half away.

Though off the beaten tourist track, Freeport is hard in the path of history. Standing at one of the major crossroads between Western Europe and the East, it was conquered by just about everyone who passed by. As a result, things look different here. Rather than the familiar cultural overlay of most of Italy, the central European influence is readily apparent in Freeport. The architecture tends more toward Austrian grandeur than Tuscan simplicity. Here you'll find gray stone castles rather than sun-drenched villas. The people look different, too, taller and blonder than southern Italians, and with plenty of German and Central European surnames.

Adapted from Riley, G.D. (2009). *SSI-4: Stuttering Severity Instrument*. Austin, TX: PRO-ED.

G.2 SSI-4 PASSAGE 10

Reading, Adult Level (378 syllables) Plate XIV

The talk over salad and cheese was about ghosts. My English friend Christopher Neville informed me that two of them haunt his house in southern France, on the sunny terrace of which we were now having lunch. I don't normally believe in spirits, but it seemed wise to suspend disbelief for the moment, since I would soon be entering a region of sorcery and hidden Grails, where heretics often marched defiantly into the bonfires of bloodthirsty crusaders: the land of the Cadets. Christopher's ghosts were said to be knights from those medieval times. I don't know whether he began studying the Middle Ages because of the ghosts or whether the ghosts arrived one day because he had taken up an unusually keen interest in the Cadets. I do know that his knowledge proved invaluable.

The Cadets, I had read, were a kind and gentle people. They were dualists (man is bad, the spirit is good), they viewed the material world as corrupt, and they rejected certain important tenets of the powerful Catholic Church, including priests, the trinity and the sacraments. The laying on of hands was thought to transform believers into the "Perfects" or Good Christians, who were from then on expected to abstain from milk and meat. The popularity of this new faith threatened the reign of Pope Innocent III. In 1208, he sent Simon Michael on a crusade against the heretics. The crusade took its name from the town of Abraham and was followed 25 years later by the Inquisition.

Adapted from Riley, G.D. (2009). SSI-4: Stuttering Severity Instrument. Austin, TX: PRO-ED.

APPENDIX H

DAILY QUESTIONNAIRE

H.1 DAILY QUESTIONNAIRE FOR FIRST SESSION

Daily Questionnaire
Session 1

1. How are you feeling today in general?
   Rating out of 7 (1 is the worst, 7 is the best): 1 2 3 4 5 6 7
   Please explain:

2. How fluent have you been lately?
   Rating out of 7 (1 is the worst, 7 is the best): 1 2 3 4 5 6 7
   Please explain:

3. How have you felt about your speech recently?
   Rating out of 7 (1 is the worst, 7 is the best): 1 2 3 4 5 6 7
   Please explain:

4. How do you think your speech was during today's session?
   Rating out of 7 (1 is the worst, 7 is the best): 1 2 3 4 5 6 7
   Please explain:

H.2 DAILY QUESTIONNAIRE FOR SESSIONS TWO THROUGH FIVE

Daily Questionnaire
Session: ___

1. How are you feeling today in general?
   Rating out of 7 (1 is the worst, 7 is the best): 1 2 3 4 5 6 7
   Please explain:

2. How fluent have you been lately?
   Rating out of 7 (1 is the worst, 7 is the best): 1 2 3 4 5 6 7
   Please explain:

3. How have you felt about your speech since our last session?
   Rating out of 7 (1 is the worst, 7 is the best): 1 2 3 4 5 6 7
   Please explain:

4. How do you think your speech was during today's session?
   Rating out of 7 (1 is the worst, 7 is the best): 1 2 3 4 5 6 7
   Please explain:

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