EXAMINING FLUENCY PRACTICES: AN INTERACTIONAL STUDY OF STUTTERING

BY

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DISSERTATION

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ABSTRACT

The current study integrates situated theories of communication and communication disorders approaches to examine the impact of stuttering on the functional communication system managing stuttering. Adults who self-identified as persons who stutter and their familiar communication partners were recruited for this study. Following an ethnographic approach to data collection, participants were videotaped during an interactive barrier game adapted from Hengst (2001, 2003); Hengst, Duff, and Dettmer (2010); and Clark (1992), and interviewed after the barrier game to discuss their goals, actions and interactions during the game. The data obtained from each conversation pair (either an adult who stutters and their familiar communication partner, or a normally fluent adult and their familiar communication partner) during the barrier game and interview sessions consisted of: (1) video recordings of the barrier game (24 trials across four sessions), (2) on-line data kept during the barrier sessions including card placement accuracy, and participant responses during interviews, and (3) video recordings of interview sessions (one session for each participant).

The barrier game and interview sessions from five adults who stutter (AWS) and five normally fluent adults with a familiar communication partner of the own choosing were coded and transcribed combining methods used in situated theories of communication and communication disorders to highlight patterns of collaboration and disfluencies. Data analysis was designed to assess group- and (participant pair) activity- based performance. Group based analysis consisted of collaborative effort (consisting of accuracy of card placements, time needed to complete trials, number of interactional turns used, number of words exchanged, number of gestures used, number of card placement sequences per trial), and patterns of disfluencies. The activity based analysis looked at the development and use of card labels to examine how initiating referencing expressions stabilize and simplify across trials.

Overall, the number of disfluencies was higher in adults who stutter than normally fluent adults. The number of disfluencies was also higher in the first trials of the first session than subsequent sessions and trials. However, the proportion of other disfluencies was higher than stuttering-like disfluencies for adults who stutter. Similarly, normally fluent adults also had a higher proportion of other disfluencies compared to stuttering-like disfluencies. There were no group differences in collaborative effort and learning. Also, fluency breakdowns were not observed to negatively impact the production and use of target card labels. The AWS pairs were

observed to establish, stabilize and simplify initiating referencing expressions in a similar manner to pairs not managing stuttering.

Findings from this research investigation suggest that the functional communication system managing stuttering may be strategically managing speech disruptions and successfully accommodating deviations. These findings may have implications on how we study and interpret the disorder. Essentially, the results from this study point to the potential of this integrated approach, combining the situated theories of communication and communication disorders approaches to investigate stuttering, that shifts the focus away from individual productions and isolated moments of fluency breakdowns to the functional communication system, to examine and interpret how stuttering may impact communication in real world within a research setting.

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PREFACE

My own experiences with stuttering have been both personal and academic. As a person who stutters, I am curious to learn more about a disorder that has shaped my life. Over the past few years, I have come to realize that my experience with stuttering though unique, is a common thread I share with many of the pioneering researchers in the field of communication disorders. These include Wendell Johnson and Charles Van Riper who have shaped the field and how we view the disorder. I was once asked the question as to whether the way stuttering has been described in research and texts accurately or fully portrays what I do during those moments of fluency breakdowns. As I have reflected on that question, I have come to understand that my experiences with the disorder reach far beyond the moments of fluency breakdown, typically described as repetitions, blocks or prolongations. Stuttering also shapes my perceptions of myself as a speaker, my feelings about communicating with others, as well as patterns of interactions that others have with me. These far reaching experiences have influenced how I view the disorder and my research questions. As a researcher, I am interested in the impact of stuttering beyond the moments of fluency breakdowns and the person who stutters. I am interested in the impact of stuttering on communication from the perspective of the speaker and listener during social interactions.

An integrated approach to the study of stuttering

The goal of my research is to understand the impact of stuttering on real world communication by integrating research on the psychological and experiential aspects of stuttering, research on behavioral and related physiological aspects of stuttering, and situated communication theories and research approaches. This theoretical integration shifts the units of stuttering research beyond the individual who stutters and moments of fluency breakdown to encompass communication systems (person who stutter and their communication partners), and their interactions prior to, during and after fluency breakdowns. Essentially, my research brings a novel perspective with reflexivity to the study of stuttering by focusing on the functional communication system managing fluency breakdowns as the unit of analysis. As a situated term, the “management” of stuttering within a functional communication system does not indicate a valence: positive versus negative experiences, or successful versus unsuccessful attempts. To understand the phenomenon of stuttering in the world, this hybrid approach combines the situated theories of communication and communication disorder approaches to capture the dynamic and collaborative aspects of communication and complexities of communicative behavior and practices in dynamic contexts in stuttering. By situating stuttering within social interactions, the current study is designed to investigate interactional aspects of the disorder that may be difficult with methodologies that are focused only on the person who stutters and disfluencies. The central focus of this study is the functional communication system which includes the collaborations between adults with developmental stuttering and their familiar communication partners within a social context, using a barrier game activity, an adaptation of a collaborative referencing activity used in Hengst (2001, 2003) with adults who experienced disruptions in communication specifically those with moderate to severe aphasia. A situated theory of communication approach to the study of stuttering, allows me to systematically investigate the social aspects of the disorder and examine the phenomenon of stuttering within the continuum of speech production and communication that is not abstracted away from context, while the communication disorder approach lends itself to defining and identifying stuttering. This hybrid design allows us to interpret the phenomenon of stuttering through comprehensive lens.

Chapter 1 looks at the history of stuttering research and pioneers in the field of communication disorders that have shaped how stuttering has been researched and regarded. The personal experiences and perspectives of these researchers, including Wendell Johnson, Charles Van Riper and Joseph Sheehan, have guided their research questions. Many of these researchers were psychologists who used the psychological approach in investigating stuttering. Self-perception of people who stutter has not only been an important component in research but also in treating the disorder.

Chapter 2 provides an overview of the behavioral and biological approaches in stuttering research. The behavioral approach to stuttering has defined and identified the disorder by its symptoms or overt physiological characteristics, primarily the moments of fluency breakdown, whereas, the biological approach to stuttering research attempts to uncover the underlying link(s) between stuttering behaviors and biology (for example, genetics and neurology). Stuttering is often viewed as a multifactorial disorder, and multifaceted models of stuttering that includes behavioral, biological and social aspects of the disorder attempt to capture this complexity. Beyond the behavioral and biological components, stuttering is a disorder that has social consequences for the person who stutters and as well as for the communication partner. (Note: In the present study, the terms stuttering and developmental stuttering are used interchangeably).

Chapter 3 provides a brief review of situated theories of communication focusing specifically on research that combines the psychological and experiential approaches, and shifts the unit of analysis to the functional communication system. Grounded in situated theories of communication including Gumperz's theory of contextualization, the chapter advocates approaching stuttering from a situated theories of communication perspective, in essence putting stuttering in context, to systematically examine the disorder. Situated perspectives focus on the flexibility and distribution of communicative success with the function system. In the barrier game adapted from the works of Clark (1992, 1994), Hengst (2001, 2003), and Hengst, Frame, Neuman-Stritzel and Gannaway (2005), this perspective shifts our focus to the functional communication system managing stuttering.

Chapter 4 presents the research design, a hybrid methodology combining the situated theories of communication and communication disorders approaches to the study of stuttering by shifting attention to the on-going management of fluency and communicative goals. The personal experience was given precedence when recruiting participants who stutter. Following an ethnographic approach to data collection, participants were videotaped during the barrier game, and interviewed after the barrier tasks to discuss their goals, actions and interactions when they were engaged during the activity. The transcription and coding integrated the situated discourse analysis and communication disorders approaches. Both group based- and participant pair/activity-based data analyses were included conducted in the study. The group-based analysis consisted of the accuracy of card placements, time needed to complete trials, number of turns/words/gestures used per trial, number of card placement sequences per trial and number of disfluencies including stuttering-like and other disfluencies). The activity-based analysis was focused on the development and use of target card labels.

Chapter 5 reports results from five target participant pairs managing stuttering and five comparison pairs who were not managing stuttering. Overall, the number of disfluencies was higher for adults who stutter compared to their normally fluent peers. For both groups, the number of disfluencies was observed to be higher during the first trials of the first session than subsequent sessions. Also, for both groups the proportion of stuttering-like disfluencies was higher than other disfluencies. There were no group differences in measures of collaborative effort and learning. Participant pairs managing stuttering performed similarly to participant pairs not managing stuttering in the accuracy of card placement, interaction time needed to complete trials, number of turns/words/gestures used per trial and number of card placement sequences per trial. Pairs managing stuttering were observed to establish, stabilize and simplify initiating referencing expressions similarly to comparison pairs.

Chapter 6 reflects on the results of the study. The results of this study indicate that functional communication systems managing stuttering is strategically managing moments of fluency breakdowns and successfully adapting to deviations and disruptions that occur, despite experiencing a higher frequency of fluency breakdowns than the functional communication systems not managing stuttering. Fundamentally, the experience of stuttering is shared by communication partners, and moments of fluency breakdown are managed by multiple parties (in varying degrees). The results also point to the advantage of an integrated approach, combining the psychological, experiential, behavioral, and situated perspectives to the study of a disorder that is multifaceted and complex.

CHAPTER 1

PSYCHOLOGICAL AND EXPERIENTIAL APPROACHES TO STUTTERING

Many of the prominent early researchers in stuttering stuttered themselves. Prompted by personal experiences they contributed greatly to the rich history of stuttering research, and to the knowledge and understanding of developmental stuttering, a disorder that typically emerges in early childhood and may persist into adulthood. Numerous names come to mind including Wendell Johnson, Charles Van Riper, Joseph Sheehan and many more. Their personal stories, struggles and experiences are a testament to the impact of stuttering on their lives. Perhaps more than any other field, stuttering research has been populated by individuals who have been personally affected by the disorder they are investigating. Their personal and often life-long struggles and experiences with the disorder have shaped their contributions to stuttering research and spawned a rich area of intervention that are still used today. Many of the early researchers were also psychologists who were also influenced by the zeitgeist of their era.

Psychological and Experience

In his book *Because I Stutter,* Wendell Johnson (1930) describes his personal experience and ambitions, "I am a stutterer. An awkward tongue has molded my life -- and I have only one life to live [. . .] I shall try therefore, to tell what it means to stutter [. . .] to describe the influence that stuttering has had on the development of my personality, my ambitions, my fundamental attitudes towards life" (pp. 1-2). Johnson's search for a cure led him to a career in speech-language pathology where he was researcher and participant all-in-one. Johnson designed and conducted experiments on himself, even changing the hand he used, restricting his own speech and engaging in public speaking voluntarily as part of his quest for a cure (Williams, 1992). He is also credited with the *Diagnosogenic Theory*, a now classic theory of stuttering that accounted for stuttering as sociogenetic. Johnson's theory was based on the notion that the stuttering label could lead to actual stuttering (Ambrose & Yairi, 2002). The diagnosis of stuttering including parental labeling, abnormal focus on disfluencies and inappropriate treatment of a child exhibiting normal disfluencies would reinforce these normal disfluencies, turning them into abnormal disfluencies, or stuttering (Bloodstein & Bernstein Ratner, 2008). According to Johnson's theory, it was parental diagnosis of their children and their children's speech that needed to be altered. Packman and Attansio (2004) propose that Johnson's view of stuttering was motivated by the prevailing thought in psychology in the early 20th century (that cultural and social factors are crucial in determining human behavior), his association with the General Semantics movement, and the work of linguists Sapir and Whorf.

Another prominent researcher and person who stutters, Charles Van Riper, pioneered an alternate approach to treating stuttering based on his own experiences of stuttering. He forged a new treatment that was not focused on eliminating but instead focused on modifying moments of fluency breakdown. He advocated teaching people who stutter to use their fears and blocks to overcome their stuttering (Van Riper, 1937). His earlier experience with another person who stuttered had helped shape this view on stuttering therapy. In his letter to the National Stuttering Foundation, Van Riper (1991) recounts the meeting:

> The basic idea that led to my living a very successful and happy life came to me while hitch-hiking my way home from Rhinelander, Wisconsin, where I had spent a month as the hired man on a farm, pretending to be a deaf mute because my stuttering was so severe and grotesque I could not get any other employment. I had hoped thereby to be able to live without talking, but after a month I couldn't bear it any longer and left to return to a home where I felt I would not be welcome.
>
> After walking several miles I sat under a tree to rest near a field where a man was plowing. Soon an old man in a Model-T Ford pulled up beside me and he got out to talk with the farmer. I noticed that he had an odd way of speaking with many little hesitations but didn't think it was stuttering. When they finished their conversation, I accosted the old man with the thumb gesture for hitch-hiking and he told me to get in the car.
>
> Then of course came the inevitable question: "What's your name, son, and where are you going?" Oh, how I stuttered when I tried to tell him with gasping, facial contortions and body jerks! And then the old bugger started laughing outrageously. I could have killed him! Seeing my anger, he said, "Take it easy, son. Take it easy. I'm not laughing at your stuttering. I've been a stutterer all my life and I used to jump around and make faces like you do but I'm too old and tired to fight myself now so I just let the words leak out. And they do!"
>
> Well, that hit me hard. All my life I'd been trying to talk without stuttering and avoiding it and hiding it whenever I could and all that had happened was that I got worse. That old man was telling me that what I should have been seeking was a way of stuttering that would be tolerable both to others and myself, that it was possible to stutter so easily and effortlessly that it wouldn't matter, that I could stutter and be fluent anyway. The insight that I should learn how to stutter hit me like a bolt of lightning. I wouldn't just wait until I was too old and too tired to stutter hard.

> Well, that's the message I'd like to pass on to my friends of the tangled tongue. Merely accepting one's stuttering is not enough; speaking out is not enough.
> Learn how to stutter! (Van Riper, 1991, para. 4-7).

Van Riper's therapy technique commonly known as *stuttering modification* represented a shift in how stuttering was viewed. The Van Riper technique which focused on modifying moments of fluency breakdown, confronting their fears about and desensitization them to these moments, and teaching them to modify the moments into easy disfluencies that would fit within the flow of interaction, is still widely used today.

Psychological Approaches

Other contemporary perspectives with Johnson's and Van Riper's views of stuttering were based on the psychoanalytic approach, a branch of psychology, advocated by Sigmund Freud (Bloodstein & Bernstein Ratner, 2008). Psychoanalysis, influenced research on and treatment for stuttering, and peaked interests in the personality, emotional and psychological aspects of the disorder (Bloodstein & Bernstein Ratner, 2008). Psychoanalysts regarded stuttering as a neurotic disorder caused by unfulfilled and unresolved infantile psychosexual needs reflected as a speech disturbance, and advocated psychotherapy to resolve the inner conflict in people who stutter (Bloodstein & Bernstein Ratner, 2008; Glauber, 1958). Psychotherapy is just one of many treatments that have been prescribed for stuttering[1].

The psychological approach to stuttering research and treatment continued into the late 20th century. Joseph Sheehan, another prominent researcher in stuttering, was a psychologist whose work was focused on the experience of the person who stutters. He declared that stuttering was linked to problems "in the social presentation of the self" (Sheehan, 1983, para. 2). As a person who stutters, he had keen insight into the disorder, "stuttering is a lonesome kind of experience. Possibly you haven't seen too many stutterers and those you have seen you have avoided like the plague. Just as there may be people who know you or have seen you or even heard you who don't realize that you stutter, so those who have a speech handicap similar to

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[1] Other prescribed treatments may be viewed as bizarre by contemporary standards. For example, in ancient Greece, Demosthenes, climbed up hills with lead strapped to his chest and put pebbles in his mouth to cure himself from stuttering (Bobrick, 1995). Other ancient treatments included blistering and searing the tongue, and even bloodletting (Bobrick, 1995). In one Native American tribe, treatment included recitation of "I give my stuttering to you" and spitting through a piece of wood with a hole in it to remove the 'spirit' in their throat (Bobrick, 1995, p. 20). In the 19th century Dieffenbach, a German physician, believed that stuttering was caused by spasms of the glottis and could be treated by making a surgical cut in the tongue (Rieber & Wollock, 1977).

yours may conceal it" (Sheehan, 1997, para. 10). He also compared stuttering to a jungle, where the path of entry to the jungle is less important than conditions for survival (Sheehan, 1970, p. 31). Sheehan proposed that the onset factors for the disorder were less important than "the struggle for the survival of the ability to communicate" (Sheehan, 1970, p. 31). He is perhaps most recognized for his Iceberg analogy of stuttering grounded in the Avoidance-Approach Conflict theory. In his "Message to Stutterers", Sheehan (1997) presents his analogy and theory:

> Your stuttering is like an iceberg. The part above the surface, what people see and hear, is really the smaller part. By far the larger is the part underneath the shame, the fear, the guilt, all those other feelings that we have when we try to speak a simple sentence and can't.
>
> Like me, you've probably tried to keep as much of that iceberg under the surface as possible. You've tried to cover up, to keep up a pretense as a fluent speaker despite long blocks and pauses too painful for you or your listener to ignore. You get tired of this phony role. Even when your crutches work you don't feel very good about them. When your tricks fail, you feel even worse. Even so, you probably don't realize how much cover up and avoidance keep you in the vicious circle of stuttering.
>
> In psychological and speech laboratories we've uncovered evidence that stuttering is a conflict, a special kind of conflict between going forward and holding back - an "approach-avoidance" conflict. You want to speak but are torn by a competing urge to hold back because of fear. For you as for other stutterers, your fear has many sources and levels. The most immediate and pressing fear is of stuttering itself and this is probably secondary to whatever caused you to stutter in the first place (para. 3-5).

For Sheehan, who regarded stuttering as the result of the struggle to move forward with and hold back from speaking, the appropriate therapy was the acceptance of one's own stuttering, and overcoming the fear and avoidance of moments of fluency breakdown (Yairi & Seery, 2011).

Perceptions of Stuttering and People who Stutter

Due to the personal experiences of researchers who stuttered themselves, the notion of self-perception has been an important issue in stuttering research and treatment. Individuals who stutter typically describe a feeling of loss of control during instances of stuttering followed by feelings of anger, guilt, shame, and feeling limited by their stuttering or the possibility of stuttering (Daniels & Gabel, 2004; Van Riper, 1982). Higher levels of anxiety, apprehension, depression and lower self-perceptions of competency in social or speaking situations (e.g. group discussions) and interactions have also been found in those who stutter (Ardila et al., 1994;

Blood, Blood, Tellis, & Gabel, 2001; Bray, Kehle, Lawless, & Theodore, 2003). In a study of adolescents, Bray, Kehle, Lawless and Theodore (2003) reported lower perceived speaking ability in adolescents who stutter compared to those who do not. Bray and colleagues recruited 21 adolescents (16 males and 5 females) who stutter for the study. Matched controls were selected based on age, sex, grade level and academic achievement by speech-language pathologists (SLP) and teachers. All participants who stuttered were receiving therapy for their stuttering, and diagnosed with moderate to severe severity by SLPs, and exhibited disfluencies that are categorized as stuttering-like disfluencies (SLD) (Yairi & Ambrose, 1992) consisting of part-word repetitions, sound and syllable prolongations and blocks. For the measure of confidence on speaking, an abbreviated Self-Efficacy Scaling for Adolescents who Sutter (Manning, 1994) was used to assess speaking confidence in social, family and academic situations. The Self-Efficacy for Academic Tasks (Baum & Owen, 1988) and the Reynolds Adolescent Depression Scale (Reynolds, 1986) were used to evaluate the level of confidence for academic tasks and depression respectively. The results indicate that adolescents who stutter demonstrate lower scores for speaking confidence than their matched peers who do not stutter. However, there were no differences in the Academic Task and Adolescent Depression between adolescents who do and do not stutter in the study, which is in contrast to reports of academic difficulties and depression as a consequence of stuttering (Ardila et al., 1994; Hugh-Jones & Smith, 1999). These differences suggest that although people who stutter generally find speaking to be difficult, the experience of stuttering is heterogeneous and influenced by other variables that impact attitudes and perceptions of the disorder. One limitation of the study is the small sample size compared to previous studies that found differences between people who stutter. In addition, adolescents who stutter in this study were receiving therapy at the time of the study which may affect their perceptions of and attitudes towards stuttering.

Not surprisingly, most individuals who stutter develop coping strategies including circumlocution, word substitution, avoidance of difficult words and speaking situations, and even limiting their speech output (Bloodstein & Bernstein Ratner, 2008; Guitar, 2006; Packman, Hand, Cream, & Onslow, 2001). In general, these strategies have been observed to result in a decrease in willingness to initiate or participate in social interaction and communication as a result of greater levels of anxiety and fear of communication and social interaction related to speaking. Some forms of therapy include changing perceptions and attitudes of the person who stutters. In addition to reducing the overt manifestations of stuttering using methods such as cancellation and pull-out techniques and decreasing muscular tension, these treatment procedures such as the Van Riperian approach advocate self-acceptance by promoting desensitization to fluency breakdowns and acceptance of stuttering (Blomgren et al., 2005; Craig & Andrews, 1985). In contrast, other forms of therapy are not focused on the self-perception of people who stutter. Instead techniques such as fluency shaping, which are aimed at teaching individuals who stutter how to speak more fluently by replacing disfluent speech with fluent speech, work under the assumption that once an individual is able to speak fluently, negative emotions and attitudes, and anxiety that are associated with stuttering will be automatically removed (Blomgren, Roy, Callister, & Merrill, 2005).

Pharmacological treatments for stuttering which typically use antianxiety and antipsychotic drugs operate under a similar assumption. Although some drugs such as haloperidone, olanzapine, and risperidone have been somewhat effective in reducing the overt symptoms of stuttering, their effects on the emotions of people who stutter have been inconclusive (Maguire, Riley, Franklin & Gottschalk, 2000; Murray, Kelly, Campbell & Stefanik, 1977; Stager et al., 2005). Although Stager and colleagues (2005) reported a decrease in anxiety related to speaking with increased fluency, this was also accompanied by an increase of generalized anxiety (that was not associated with speaking). Additionally, the side effects of these drugs including feelings of dizziness and being drugged, and dystonic movement remain an issue (Maguire, Riley, Franklin & Gottschalk, 2000; Murray, Kelly, Campbell & Stefanik, 1977; Stager et al., 2005). In general, the mechanisms of action of these recent pharmacological treatments are focused on the central nervous system.

In addition to negative self-perception, listeners (generally, individuals who do not stutter) may also view people who stutter negatively. One study in particular found significant differences in how people who stutter viewed themselves, and how they were viewed by others (Kalinowski, Lerman & Watt, 1987). Kalinowski and colleagues (1987) sent questionnaires to 200 randomly selected adult males who stutter (from a membership list from a national speech assistance organization) and 275 randomly selected normally fluent adults (NFA) (from a list of computer generated random telephone numbers across the state of Connecticut). In order to insure a naïve participant pool, participants who were speech language pathologists and members of the American Speech-Language and Hearing Association were excluded from the participant pool. The NFA group was evenly divided between male and female participants. A total of 91 and 138 (usable) questionnaires were returned by adults who stutter (AWS) and NFA respectively. The questionnaires consisted of two sections, the first included questions on self-perception and the second section consisted of questions on perception of others. The instructions to AWS for the perception of self were "Below you will see some rating scales each with nine points. I would like you to evaluate YOURSELF, as you typically are, on each of these scales. Please circle the number on the scale that best describes yourself, on each scale" (p. 329). For the perception of others section, the instructions were "Below you will see some rating scales each with nine points. I would like you to evaluate a typical, NORMAL ADULT MALE SPEAKER, someone who has normal speaking capacities when talking. On the scales provided below circle the number on the scale which identifies what YOU THINK are the traits of a NORMAL speaker" (p. 329). The instructions provided to the NFA group were identical for the self-perception section. However, for the section on the perception of others, NORMAL ADULT MALE SPEAKER was replaced with ADULT MALE STUTTERER, and NORMAL was replaced with STUTTERER. The questionnaires consisted of 25 semantic differential questions (e.g., open-guarded, nervous-calm, withdrawn-outgoing, avoiding-approaching, inflexible-flexible, etc.). The results point to differences in how AWS and NFA view people who do and do not stutter. The NFA participants viewed those who stutter to be guarded, nervous, self-conscious, tense, sensitive, hesitant, introverted, and insecure. In contrast, AWS judged those who are normally fluent to be open, calm, bold, relaxed, composed, daring, extroverted and secure. Despite differences in how they perceived others, the self-perceptions of AWS and NFA did not differ. The authors propose that self-perceptions were similar between the two groups because AWS were able to disassociate all or part of the stuttering behavior from the self. There were several limitations to the study. Firstly, participants were not provided with a definition of stuttering or asked if they had previous contact with people who stutter. Although SLPs were excluded from the study, NFA participants who responded to the survey may still have contact with individuals who stutter (including family members and friends) which may affect their perception of AWS. Another limitation of the study is recruitment criteria for AWS which is biased, as only male AWS were recruited. These limitations may affect the results as the perception of self and others may differ between men and women. Also, participants were not asked to rate their stuttering severity. Stuttering severity may impact how people who stutter view themselves and are viewed by others. Finally, the experiences of people who stutter are diverse and thus, the results of one study cannot be generalized to the entire population of people who stutter.

Surprisingly, negative perceptions of people who stutter may also be pervasive in those who are familiar with or related to individuals who stutter and those who are informed about the disorder including professionals in the field (Doody, Kalinowski, Armson & Stuart, 1993; Kalinowski, Armson, Stuart & Lerman, 1993). Negative perceptions are also affected by stuttering severity as greater stuttering severity is typically correlated with decreased ratings of speaker competence and listener comfort (Susca & Healey, 2001). Normally fluent listeners have been observed to react to stuttering with elevated emotional and physiological responses indicating shock or discomfort. Guntupalli and colleagues (2006, 2007) reported increased skin conductance and decreased heart rate similar to those observed during the startle or threat responses in listeners' during moments of fluency breakdown but not during periods of fluent speech. Listeners were also more likely to avert their gaze away from AWS even during periods of fluent speech (Bowers, Crawcourt, Saltuklaroglu & Kalinowski, 2010; Rosenberg & Curtiss, 1954).

Current research tells us that as stuttering progresses across a speakers' lifetime, social anxiety often follows suit (Ezrati-Vincour & Levin, 2004; Tran, Blumgart & Craig, 2011). Not surprisingly, negative moods and attitudes of people who stutter are strongly correlated with and elevated during speaking and social situations. These negative emotions are also positively correlated with stuttering severity (Miller & Watson, 1992). Also, unsurprisingly, these negative emotions do not go unnoticed among the communication partners of the person who stutters; listeners also judge speakers who stutter to be more anxious and depressed than speakers who do not stutter (Costa, 1983; Craig, 1990).

Summary

Stuttering is a complex disorder that has far reaching consequences beyond the moments of fluency breakdown that shape the experience of a person who stutters. Although early stuttering research has been guided by contemporary views of the researchers involved, the underlying thread of early stuttering research has been the experiential perspective, that is, the personal experience of a person who stutters. Early researchers subscribed to the notion that stuttering is an experience, a mindset and cultural category; Wendell Johnson was of the belief that disfluencies are not stuttering until labeled as such. Personal experiences have defined and guided early stuttering research. How early researchers viewed, studied and treated stuttering was intertwined with their personal experiences and contemporary psychological perspectives. These psychological approaches to stuttering have pushed us to consider the personal experiences of the disorder, perceptions and attitudes of people who stutter and those around them, and the power of social dynamics in stuttering.

The equivocal findings of these studies on how people who stutter view themselves, and how they are viewed by others suggest that severity is in the mind of the speaker and listener which makes objective measurements challenging. Likewise, these disparities also illustrate the diversity of experiences among people who stutter and their attitudes towards communication, hence, the personal and experiential must be inherent in how stuttering is defined, identified, studied and interpreted. The experiential differences are also likely to surface in research designed to study the behavior of people who stutter and the nature of the disorder. The experience of the person who stutters remains an integral part of stuttering, and as such must remain a fundamental component of how we view and approach its study.

My own study has been informed by these approaches in two key ways; first, in participant selection, and second, in using interviews to ascertain the experience of the person who stutters. The next chapter explores another approach to the study of stuttering that is focused on the behavioral and biological patterns of the disorder.

CHAPTER 2

BEHAVIORAL AND BIOLOGICAL APPROACHES TO STUTTERING

Although much is known about developmental stuttering, it is a disorder that has defied a unified explanation. Numerous lines of research including the behavioral and biological that have shaped how we define and identify stuttering are presented. This chapter will discuss: (1) the behavioral approaches to defining and identifying stuttering, (2) behavioral research on stuttering, (3) biological research on stuttering, and (4) multifaceted models of stuttering that includes behavioral, biological and social aspects of the disorder.

Behavioral Approaches: Defining and identifying stuttering

Traditionally, the behavioral approach to stuttering has defined and identified the disorder by its symptoms or overt physiological characteristics, more specifically, the moments of fluency breakdown experienced by the person who stutters. For example, Wingate (1964) defines stuttering as "(a) Disruption in the fluency of verbal expression, which is (b) characterized by involuntary, audible or silent, repetitions or prolongations in the utterance of short speech elements, namely: sounds, syllables, and words of one syllable. These disruptions (c) usually occur frequently or are marked in character and (d) are not readily controllable". Similarly, Van Riper (1982) defines stuttering as "… when the forward flow of speech is interrupted by a motorically disrupted sound, syllable, or word, or by the speaker's reactions thereto". The heterogeneity of overt physiological characteristics (in terms of the types and frequency of disfluencies and secondary behaviors) that accompany fluency breakdowns and how they are described have resulted in differences in how these characteristics, particularly disfluencies, are managed in research.

Yairi and Ambrose's (1992) pilot investigation to establish a protocol for the longitudinal study of children who stutter (CWS) represents one prominent approach to characterizing and measuring disfluencies. A total of 27 children under the age of five (19 males and 8 females) who had been stuttering for less than a year were recruited and evaluated over a period of two years. The criteria for stuttering were based on overt behaviors including stuttering severity of mild or more, and a minimum of 3% stuttering-like disfluencies (SLD) during conversational speech, parent report of stuttering and assessment by two speech-language pathologists. After initial contact, treatment was offered to all children although only 18 children agreed to treatment (lasting between 5 to 12 sessions) which consisted of modeling slow speech. To study the developmental trends of stuttering, the authors divided disfluencies into two main categories: stuttering-like disfluencies and other disfluencies. Stuttering-like disfluencies (SLD) consist of part-word repetitions, single-syllable word repetitions, disrhythmic pronation which are prolongations, blocks, and tense pauses comprising audible tense vocalization between words. Other disfluencies (OD) consist of polysyllabic word repetitions, phrase repetitions, interjections, and revision-incomplete phrases. The study reported a decreasing trend of SLD over the period of the study regardless of whether the participants were in treatment or if they persisted in or recovered from stuttering. This suggests that over the course of development the overt characteristics of stuttering, that is, disfluencies are likely to vary. However, the use of SLD and OD in research has attracted controversy. Wingate (2001) questioned the inclusion of single-syllable word repetitions arguing that SLD: (1) is not representative of the disfluencies displayed by people who stutter as they also occur frequently in those who are normally fluent, and (2) the structure of single-syllable word repetitions which includes the whole unit of utterance is disparate from the structure of disfluencies observed in people who stutter which are repetitions "of brief elements-something less than a complete syllable" (p. 382). Wingate also argues that part-word repetitions, and sound and syllable repetitions are "inadequate descriptors of stutter. A stutter does not involve just any part of a word. One of the basic facts of stuttering is that it involves word-initial position-correctly, syllable-initial position" (p. 383). He advocates isolating behaviors that "are not comfortably assessed as stuttering" for further identification and "if that cannot be achieved, then those certain behaviors will have to remain in identification limbo" (p. 383). These contentions evince the difficulty in labeling behaviors that have been used to define and identify stuttering.

Alfonso (1991) proposes that "until the distinction between fluent, disfluent, and dysfluent speech is better understood, the adult stutterer's judgment in the classification of him- or herself as a stutterer and in the fluency-dysfluency distinction of his or her speech should be encouraged" (p. 232). This may be a crucial element in defining and identifying stuttering as research indicates that fluency in people who stutter, which may be perceptually similar to their normally fluent counterpart, is fundamentally disparate in their kinematic and physiological correlates. In a study of movement variability using the spatiotemporal index (STI), Smith and Kleinow (2000) found that adults who stutter (AWS, *n*=8) displayed more timing and spatial variability in the movement of their lower lip even when they were fluent compared to control participants (*n*=8), although they may still operate within the normal range. Self-reports were used to screen for speech, language, hearing and neurological disorders although it was unclear how stuttering was defined or how AWS were identified. Participants who stutter were administered the Stuttering Severity Index (SSI; Riley, 1986) to evaluate stuttering severity. The task employed in the study consisted of asking participants to say "Buy Bobby a puppy" at three different rates, their habitual, slow and fast rates of speech. The movement and timing of the lips for AWS were recorded using a 3D motion capture camera system, while participants' vocalizations were audio recorded and evaluated by three researchers (including the author) for disfluencies. Utterances containing "sound, syllable, word or phrase repetitions, sound prolongations, inappropriate pauses, rewording and aberrant prosody" were excluded from the analysis (p. 552). Results indicate that the lip movements of AWS were most different from their normally fluent peers at the habitual speaking rates. At the slow speaking rates, movement and timing of the lower lip were most similar between the two groups. These observations suggest that perceptual differences between AWS and NFA may not be an appropriate method of distinguishing people who do and do not stutter.

Behavioral research that links to the biological also indicates differences between people who do and do not stutter. A functional magnetic resonance imaging (fMRI) study by Preibisch and colleagues (2003) which recruited 16 AWS and 16 normally fluent adults (NFA) found differences in activation of the right frontal operculum (RFO) during a reading task (reading aloud of 78 short sentences) where participants who stutter were perceptually fluent. Activation of the RFO (Broca's right hemisphere homologue) was only observed in AWS but not NFA and positively correlated with stuttering severity. Participants who were assessed with less severe stuttering by a SLP at the start of the study were found to activate the RFO to a greater degree than those who were diagnosed with more severe stuttering. These studies by Smith and Kleinow (2000), and Preibisch and colleagues (2003) support Alfonso's (1991) stance on self-identification based on personal experience in the diagnosis of stuttering.

In general, the overt/behavioral approach to defining and identifying stuttering remains prominent. Perhaps Bloodstein and Bernstein Ratner (2008) best express the zeitgeist of stuttering research, "the best definition we appear to be able to offer at present is: whatever is perceived as stuttering by a reliable observer who has relatively good agreement with others…stuttering is an abstract construct, whose nature is informed indirectly by these types of behavior count, but is not limited to them" (p. 9). These moments of fluency breakdown are also commonly used to measure stuttering severity (Riley, 1980; Zebrowski, 1994). However, it is important to note that despite the fact that fluency breakdowns have been used as a defining characteristic of stuttering, normally fluent speakers may also experience fluency breakdowns, although they typically occur at considerably lower frequencies and shorter durations in normally fluent speakers (Ambrose & Yairi, 1995; Boey, Wuyts, Van de Heyning, De Bodt & Heylen, 2007). In other words, moments of fluency breakdowns and fluency are not discrete entities embodied by persons who stutters or normally fluent individuals. In fact, Starkweather and Givens-Ackerman (1997, p. 19) suggest that "stuttering is not the opposite of fluency", instead they proposed that stuttering and fluency are conditions or states that exist at different ends of the same speech continuum[2].

Similarly, secondary or accessory behaviors that accompany fluency breakdowns are just as varied. Secondary behaviors are physical concomitants that may appear to be performed automatically and unconsciously by individuals who stutter. Physical concomitants vary widely across individuals and may include eye blinking, head jerking, teeth grinding and a host of others that occur during fluency breakdowns typically indicate greater stuttering severity (Yairi & Ambrose, 2005). Additionally, introspective concomitants which may be present prior to and after fluency breakdowns that typically include feelings of frustration, feelings of muscular tension and emotional reactions may also be present (Bloodstein & Bernstein Ratner, 2008). People who stutter often report feelings of anxiety prior to a fluency breakdown, frustration at the effort to speak, and embarrassment after moments of fluency breakdown.

The definition of stuttering remains a challenging issue in stuttering research, and ultimately affects how participants are identified and selected. In most studies, the selection criteria for inclusion are not explicitly stated, although the severity of stuttering based on the frequency and type of disfluencies is almost always reported. However, the methods of assessing severity may vary between studies. While some studies report the percent syllable stuttered without the inclusion of physical concomitants (e.g., Giraud et al., 2008; Neumann et al., 2005; Preibisch et al., 2003), others (e.g., Choo, Chang, Zengin-Bolatkale, Ambrose &

[2] Starkweather's concept of stuttering is similar to Bloodstein's (1970) Continuity hypothesis. Bloodstein proposed that instead of distinguishing between stuttering and normal disfluencies (or "nonfluency"), more descriptive labels such as part-word repetition, word repetition, sound prolongation and forcing that stresses the overt characteristics should be used.

Loucks, 2012; Smith & Kleinow, 2000; Watkins, Smith, Davis & Howell, 2008) may use inventories or measurements that include physical concomitants in their ratings of severity such as the *Stuttering Severity Index* (SSI) (Riley, 1994, 2009) and *Illinois Clinician Stuttering Severity Scale* (ICSSS; see Appendix A) (Yairi & Ambrose, 2005). The ICSSS, which includes scores for frequency (0 = less than three SLD, 6 = more than 20 SLDs) and duration (0 s = none, more than 2 s = 6) of stuttering, along with tension (0 = none, 6 = excessive) and secondary behaviors (0 = none, 1= severe, frequent and painful to look at) associated with the disorder, draws from Darley and Spriesterbach's (1978) stutterer's self-ratings to reactions to speech situations, and Riley's *Stuttering Prediction Instrument* (1981) (Yairi & Ambrose, 2005). The severity rating consists of the average of the frequency, duration and tension scores added to the score for the secondary behavior. To evaluate reliability of the ICSSS ratings, Yairi and Ambrose randomly selected ten videotapes of participants to reanalyze, the mean difference in rating was 0.17 which indicates very high reliability.

In the present study, the experiential approach was given precedence in the identification and selection of participants. Self-identification was used as the criteria for inclusion in the target group (see Alfonso, 1991). Additionally, this study followed Yairi and Ambrose's approach to evaluating stuttering severity by using the ICSSS scores which include ratings for physical concomitants. Also, disfluencies were analyzed using the system proposed by Yairi and Ambrose (1992) and divided into two categories according to their occurrence and frequency: stuttering-like disfluencies (SLD) which are more characteristic in individuals who stutter consisting of part-word repetition, single-syllable words repetition and dysrhythmic phonation (including blocks and prolongations); and other-disfluences (OD) which are more typical in normally fluent speakers consisting of phrase repetition, revision and interjection (Yairi & Ambrose, 1992).

Overall, how stuttering has been defined and identified remains a challenge in studying the disorder. Various studies have approached the issue in numerous ways, some are focused on the overt symptoms of the stuttering, relying on measures of disfluencies to define the disorder and to identify those who stutter, while others take a more experiential approach and are guided by self-identification as a means of identification.

Behavioral Research on Stuttering

Behavioral paradigms in stuttering research devoted to uncovering differences between people who do and do not stutter provide evidence of differences between the two groups.

Focused on overt symptoms of stuttering, these research investigations which have mainly centered on personality and emotions, and speech and language skills, evaluate and analyze the measurable components of the disorder.

Personality and emotions. Research into the link between personality, emotion and stuttering has been around since the 1920's. Personality and emotion have been cited as a by-product, cause and/or aggravating factor in the disorder. Generally, investigations exploring personality and emotion report lower personality adjustment and more negative emotions in those who stutter.

Temperament has been discussed as a factor that maintains or exacerbates stuttering although the results have been ambivalent. Children who stutter have been observed to be more impulsive, less able to regulate their emotions and attention, and less adaptable (Anderson, Pellowksi, Conture, & Kelly, 2003; Eggers, De Nil, & Van den Bergh, 2010; Embrechts, Ebben, Franke, & van de Poel, 2000; Karass et al., 2006). Interestingly, in a study of children between 3 to 5 years old, Johnson, Walden, Conture and Karass (2010) reported no difference in the display of positive emotion but a significant difference in the display of negative emotion between CWS and typically developing children (TDC) using knowledge of display rules (KDR) and disappointing gift (DG) paradigms. Both CWS (n=16) and TDC (n=16) participants did not report any hearing, neurological, developmental, academic, intellectual, or emotional problems. Also, none of the children had received treatment for stuttering or any other communication disorders, or were receiving treatment at the time of the study. The criteria for stuttering was 3% SLD in conversational speech and at least a mild severity score on the SSI (Riley, 1994) while the criteria for TDC was a maximum of 2% SLD in conversational speech and a severity of less than mild on the SSI (Riley, 1994). The study included two visits about one to two weeks apart. During the first section of the study using the KDR procedure, children were told four stories with accompanying illustrations of sequential, related pictures for the first three stories, and asked to identify the emotion of the main character by pointing to a sad or happy emoticon. Then, the experimenter presented the main character of the story with a missing face and informed the child that "the motive of the story was to avoid making the secondary character feel bad and to not hurt his or her feelings. The experimenter then asked the participant to identify what the main character's facial expression should look like (i.e., whether the character should display a happy or sad face on the outside in order to avoid hurting the secondary character's feelings). After responding, the participant was asked to explain the facial expression that he or she selected as well as to indicate how the secondary character felt about the main character's facial expression" (p. 1482). For the second visit (DG procedure), participants were first asked to select two "really cool gifts" and two "really yucky gifts". In the first section of the study, participants were first presented with a "really cool gift" after playing with the experimenter. Then in the second section, participants were presented with a "really yucky gift" after playing the experimenter. In between the gift presentation sections, children engaged in a five min unstructured play conversation with their parent. Results suggest that there were no differences in the positive expressive behavior (e.g., smiling, giggling, laughing) between CWS and TDC after receiving desired gifts. However, CWS displayed more negative behaviors (e.g., grimace, frown, groaning, sighing) than TDC after receiving an undesired gift. Interestingly, CWS exhibited fewer disfluencies (SLD and OD) after receiving the undesired gifts. In contrast, no differences were found in the number of disfluencies for the desired and undesired gifts for TDC. The authors suggest that CWS may find it more challenging to regulate their speech and expressive behavior concurrently than TDC. These observations also suggest that emotion and behavior are integral components of stuttering that affect social communication, and more research into the dynamics of how these components are intertwined is warranted.

In adults, Guitar (2003) reported greater reactive temperament in AWS than in NFA as indicated by the magnitude of their startle response, but Alm and Risberg (2007) failed to find a difference between adults who did and did not stutter in their startle amplitude and startle response latency. Guitar (2003) recruited 14 AWS who self-identified as persons who stutter (all of whom displayed physical concomitants) and 14 matched NFA. Stuttering severity was measured using the SSI (Riley, 1984), ten participants were rated as mild, one as moderate and three as severe. Participants had normal hearing. To assess the temperament, Guitar used the Taylor-Johnson Temperament Analysis (Taylor & Morrison, 1996), a self-administered test with 180 items to measure dimensions of personality traits (nervous versus composed, depressive versus lighthearted, active-social versus quiet, expressive-responsive versus inhibited, sympathetic versus indifferent, subjective versus objective, dominant versus submissive, hostile versus tolerant, and self-disciplined versus impulsive). Participants were told that the purpose of the study was to test their hearing. The startle stimuli were ten bursts of white noise that was delivered to both ears via a headphone. Two electromyographic (EMG) electrodes were placed below the right eye to capture the startle responses. Although no differences were found between AWS and NFA in the overall temperament scores, individual analyses of the subdimensions suggest that AWS were more nervous (defined as “tense, high-strung, apprehensive” as well as “excitable”, p. 237) than NFA. Also, AWS (*M* = 552 arbitrary analog-to-digital units) showed more reactivity to the startle stimuli than NFA (*M* = 372 arbitrary analog-to-digital units) for all ten stimuli bursts.

Alm and Risberg (2007) recruited a larger number of participants comprising of 32 AWS and 28 matched NFA. Participants who stutter self-identified as such. The authors also used the *Diagnostic and Statistical Manual of Mental Disorders* (DSM)-IV-TR diagnostic criteria (American Psychiatric Association, 2000) as a citerion for AWS. In contrast to Guitar (2003), Alm and Risberg used the behavioral activation system (BAS) scale (Carver & White, 1994), a self-report questionnaire that evaluates ‘‘proneness to engage in goal-directed efforts and to experience positive feelings’’(p. 13) and the Karolinska Scale of Personality (KSP) psychic anxiety scale (Schalling, Asberg, Edman, & Oreland, 1987) to assess temperament and anxiety. Alm and Risberg also collected data on the biochemicals associated with muscular activity and stress including levels of calcium, magnesium and prolactin. The startle stimuli were pulses of white noise that was delivered with increasing volume. The major differences between the Guitar study were that the startle stimuli that was delivered with a background of continuous and low volume white noise and participants were told the purpose of the investigation was to measure auditory reflexes. Specifically participants were told “The response we measure cannot be influenced by will, so you do not have to do anything but to sit and watch a video with nature sceneries, with open eyes. There will be a continuous low background noise’’ (Alm & Risberg, 2007, p. 15). An EMG electrode was placed under each eye to capture the startle responses. No differences were found between AWS and NFA in their startle responses. Additionally, differences were found in the levels of calcium, magnesium and prolactin between groups. However, AWS were found to be more anxious than NFA on the anxiety scale. The differences between the Guitar (2003), and Alm and Risberg (2007) studies may be due to stimuli presentation. In the Guitar (2003) study, the stimuli were presented without a background noise whereas in the Alm and Risberg (2007) study, the stimuli were presented with a continuous background noise and participants were also watching a video. This is particularly crucial when research suggest that individuals who stutter are less easily distracted (Savelkoul, Zebrowski, Feldstein & Cole-Harding, 2007; see section on Interaction with communication partners). The reduced distractibility of AWS (as they were focused on the video and continuous white noise) may mean a smaller startle response compared to Guitar's study where no other stimuli were presented except for the bursts of startle stimuli.

The association between anxiety and stuttering has also been widely researched. In general, individuals who stutter have been observed to display elevated anxiety particularly during speech situations including public speaking, and social interactions (Blumgart, Tran, & Craig, 2010). Miller and Watson (1992) also reported elevated negative moods and attitudes during speech and social situations particularly in AWS who stutter more severely. Other studies also report greater anxious mood, phobic anxiety, and negative moods related to interpersonal sensitivity in people who stutter (Ezrati-Vincour & Levin, 2004; Tran, Blumgart, & Craig, 2011). Research examining the link between neuroticism and stuttering has yielded ambivalent results. While some studies report that AWS were more neurotic, introverted, more prone to psychological distress, negative emotions, more reserved and independent than NFA (Iverach et al., 2010) others did not (Hedge, 1972; Thomas, 1976). In general, increased stuttering is linked to high stress and high anxiety situations while reductions in stress and anxiety typically result in reduced stuttering (Craig & Tran, 2006). Research consistently reports that stuttering episodes are reduced or absent when speaking alone and affected by the situation, size and make-up of the audience (Bloodstein & Bernstein Ratner, 2008; Dalton & Hardcastle, 1989; Mahr & Torosian, 1999).

Speech and language skills. The interaction between speech motor coordination and language processing is a widely explored topic in stuttering particularly in CWS. Although research in children has yielded ambivalent results, it is widely accepted that there is a complex interaction between stuttering and language.

In a study of CWS between five and nine years of age, Byrd and Cooper (1989) reported delayed expressive but not receptive skills. In contrast, studies conducted at the University of Illinois found precocious language skills in younger CWS between two to three years old, who scored near or above the normative expectations (Watkins, Yairi, & Ambrose, 1999). However, older children between four to five years of age who were eventually identified with persistent stuttering scored below the normative expectations (Yairi, Ambrose, Paden, & Throneburg, 1996). Investigations into lexical skills have also been inconclusive. While Watkins, Yairi and

Ambrose (1999) reported average or above average skills in 2 to 5 year-old CWS, Silverman and Bernstein Ratner (2002) reported poorer lexical skills in CWS of the same age group. In adults, Newman and Bernstein Ratner (2007) reported lexical processing deficits in AWS as reflected in greater naming errors and slower reaction times when compared to their normally fluent counterparts. Syntactic complexity may also be a contributing factor in fluency breakdown. Numerous studies report greater frequency of stuttering with increased syntactic complexity in both CWS and AWS (Bernstein Ratner & Sih, 1987; Gaines, Runyan, & Meyers, 1991). Increased syntactic complexity is also associated with decreased motor stability (Kleinow & Smith, 2000). Interestingly, during spontaneous speech CWS and AWS have been observed to use syntactically simpler sentences compared to their typically fluent peers (Anderson & Conture, 2004; Wall, 1980). In contrast, Logan (2003) failed to find a relationship between stuttering and syntactic complexity although in his study AWS were slower in initiating speech.

Stuttering may also be co-morbid with other disorders including phonological disorders (Blood, Ridenour, Qualls, & Hammer, 2003; McKinnon, McLeod, & Reilly, 2007; St. Louis, Murray & Ashworth, 1991; Willams & Silverman, 1968). Around 30% of CWS have a co-occurring phonological disorder (Conture, Louko, & Edwards, 1993). Children who stutter with co-occurring phonological disorder also display more disfluencies than those without concomitant phonological disorders (Yaruss & Conture, 1996). Interestingly, children who recovered from stuttering had comparable phonological skills to TDC while children who persisted in stuttering displayed poorer phonological skills (Paden & Yairi, 1996). In contrast, Weber-Fox, Spruill, Spencer and Smith (2008) did not find differences in phonological awareness between CWS and TDC, although increasing syllable length was associated with poorer performance in both groups. Smith, Sadagopan, Walsh and Weber-Fox (2010) also decreased stability of the speech motor system with increased phonological complexity. Interestingly, AWS showed greater gains in speech motor stability and fluency with increased practice or repetitions compared to NFA. This phenomenon of adaptation where greater fluency is achieved with repeated oral readings of the same text is commonly seen in AWS (Johnson & Knott, 1937; Max & Baldwin, 2010; Max, Caruso, & Vandevenne, 1997). Other linguistic factors have also been implicated in stuttering. Typically, fluency breakdowns occurs on words at the start of sentences, content words compared to function words, words that start with consonants, and longer words (Brown, 1945; Bloodstein & Bernstein Ratner, 2008). However, CWS are more likely to stutter on function instead of content words and more on words that were not linguistically complex compared to adults who stutter (Bloodstein, 1974; Bloodstein & Grossman, 1981, Dworzynski, Howell, & Natke, 2003).

The fundamental premise of the behavioral approach to stuttering is that it is a measurable disorder (e.g., studies that examine linguistic complexity and use in people who stutter). These measurable elements or overt symptoms of stuttering distinguish people who stutter from those who do not. This approach sought to offer an objective means of characterizing behaviors that are not dependent on the limitations of the perceptual and introspective research paradigms. Behavioral research has focused on identifying behaviors and behavioral patterns that would clearly define and identify the disorder, and differentiate it from other speech disorders, and also from similar behaviors in normally fluent speakers. Studies using this approach suggest that people who stutter including children can be differentiated from those who do not stutter in their speech and language skills. For example, Silverman and Bernstein Ratner (2002) reported poorer lexical skills in CWS compared to TDC. However, this behavioral approach to examining linguistic, speech and language skills in stuttering has yielded equivocal results. In contrast to Silverman and Bernstein Ratner (2002), Watkins, Yairi and Ambrose (1999) found average or above average skills in CWS. These differences may be a corollary of the complexity of interactions, and environment that shapes our communication which is not easily measured.

In order to investigate stuttering as well as the impact of fluency breakdown on the functional communication system managing stuttering, my research investigation adopts the behavioral approach to capture the measurable differences between people who do and do not stutter. Specifically from this approach, my study will borrow methods to evaluate stuttering severity and analysis of disfluencies, not just in people who stutter but also in their communication partners.

Biological Research on Stuttering

The biological approach to stuttering research works under the assumption that behavioral characteristics of the disorder have an underlying biological basis. The research paradigms used in this approach attempt to link the overt symptoms or measurable differences to biological deficits or anomalies that may be present in people who stutter.

Sensory motor control. Research on the sensory-motor aspect of stuttering is based on the notion that stuttering results from the breakdown of the speech motor system or inadequate resources dedicated to the sensory motor processing. Investigations into the speech motor system of AWS suggest atypical and reduced speech motor coordination and stability, even during moments of fluent speech. Differences between AWS and NFA are evident during central auditory processing. Salmelin et al. (1998) reported impaired auditory feedback in AWS who did not distinguish between silent (reading silently and reading with mouth movement but no sound) and spoken (reading aloud and chorus reading) tasks by activating the right auditory cortex during a silent task. Studies also report reversed activation during speech processing; AWS initiated motor programming prior to articulatory coding, activating the left motor cortex prior to the left inferior frontal region (Biermann-Ruben, Salmelin, & Schnitzler, 2005; Salmelin, Schnitzler, Schmitz, & Freund, 2000).

Research also suggests that AWS and NFA differ in their fine and gross bimanual and oral motor coordination. Forster and Webster (2001) reported slower or reduced manual coordination in AWS (*n*=24) compared to adults who recovered from stuttering (*n*=24) and their normally fluent peers (*n*=24) during sequential finger tapping and bimanual crank tasks. Self-reports were used as criteria for participant selections. Participants were also asked to rate their own stuttering severity and administered the Perception of Stuttering Inventory (PSI; Woolf, 1967). During the sequential finger tapping task, participants were asked to reproduce sequences of finger tapping movements displayed to them. For the bimanual crank task, participants were required move a dot on a computer screen through a track by moving two crank handles similar to manipulating an “Etch-a-Sketch” board, with and without visual feedback. Adults who stutter were slower in their sequential finger movements than adults who recovered and NFA. However, no differences were found between adults who recovered and NFA. For the bimanual crank task, AWS were 40% less accurate than adults who recovered from stuttering and NFA when visual feedback was not provided. When visual feedback was provided, no significant differences were found between AWS and the other groups in their accuracy. Overall, AWS generated more crank movements in the wrong direction in both the visual and no visual feedback conditions compared to adults who recovered from stuttering and NFA. The results of the bimanual crank task suggest that under certain conditions (e.g., with visual feedback) AWS are able to compensate and perform within the normal range. Similarly, Max, Caruso and Gracco (2003) reported longer durations of movements in addition to lower peak velocities and longer peak latencies in finger coordination tasks with and without concurrent speech production for AWS. Additionally, AWS may also have poorer visuomotor coordination. When asked to track a random object using a mouse, AWS were slower and less accurate compared to their fluent counterparts (Jones, White, Lawson, & Anderson, 2002).

Adults who stutter also display deficits in sensorimotor control. Hampton and Weber-Fox (2008) reported lower accuracy at detecting target tones and slower reactions times in AWS compared to their fluent peers (Hampton & Weber-Fox, 2008). Although these deficits have not been reported in CWS (Kaganovich, Hampton, & Weber-Fox, 2010). Children who stutter and typically developing four and five year olds did not differ in their P1 and N1 cortical potentials which measure sensitivity to frequency, duration, complexity and intensity of sounds. This observation suggests that anomalies associated with advanced stuttering may be the result of prolonged exposure to the disorder.

Genetics. Based on the research that has documented that stuttering occurs at a greater rate among individuals with family members who stutter, it is now widely accepted that there is genetic component to stuttering (Kidd, 1977; Yairi, Ambrose, & Cox, 1996). The link between heredity and stuttering has been proposed since the 1930s (Bloodstein & Bernstein Ratner, 2008). Studies conducted by Bryngelson and Rutherford in 1937; Bryngelson in 1939; Wepman in 1939; and West, Nelson, and Berry in 1939 indicate a higher incidence of stuttering in individuals with a family history of stuttering compared to normally fluent individuals (as cited in Bloodstein & Bernstein Ratner, 2008). In general, the incidence of stuttering is thought to be around 5% (Månsson, 2000) while the prevalence of stuttering is thought to be around 1% (Bloodstein & Bernstein Ratner, 2008). Recent studies also suggest a higher prevalence of stuttering in those with a family history. In studies by Ambrose, Yairi and Cox (1993), Buck, Lees & Cook (2002), Månsson (2000), Viswanath, Lee and Chakraborty (2004), 67 to 84% of participants who stutter reported a familial history of stuttering. In addition to family history, sex is also a risk factor. Research suggests that males with a family history of stuttering are more likely to develop stuttering than females with a family history (Buck, Lees, & Cook, 2002). Male relatives of females who stutter also faced higher risks of stuttering than female relatives of males who stutter (Yairi & Ambrose, 2005). Overall, males are more likely to stutter than females (Andrews, Morris-Yates, Howie, & Martin, 1991; Ooki, 2005).

Studies based on twins, pedigree and molecular genetics have presented strong evidence for a genetic predisposition to stuttering. The degree of concordance is higher in identical than fraternal twins who stutter, meaning that the probability of both twins stuttering is higher in identical twins who share similar genetic material than fraternal twins who do not (Andrews Morris-Yates, Howie, & Martin, 1991; Felsenfeld, Zhu, Statham, Neale, & Martin, 2000; Ooki, 2005). Recent linkage studies have identified variations in genes that are linked to stuttering. Early research into heredity and stuttering suggests that the prevalence of stuttering appears to be higher in twins than in the general population (Berry, 1937, 1938; Nelson, Hunter, & Walter, 1945). Although no genes underlying stuttering have been identified, a number of studies have found evidence of linkage[3] on chromosomes 1, 2, 3, 5, 7, 9, 10, 12, 13, 16, and 18 (Riaz et al., 2005; Shugart et al., 2004; Suresh et al., 2006; Wittke-Thompson et al., 2007). Additionally, Suresh et al. (2006) reported a stronger linkage signal on chromosome 7 in males and chromosome 21 in females. In a more recent study, gene mutations linked to skeletal, cardiac, and ocular disorders were also identified in individuals who stutter (Kang et al., 2010).

Persistence in and recovery from stuttering also appears to run in families. Using genetic analysis of family pedigree, Ambrose, Cox and Yairi (1997) examined the patterns of persistence and recovery from stuttering in 1,403 relatives (immediate and extended) of 66 (17 females, 47 males) children between two to eight years of age who persisted in stuttering, recovered late and early from stuttering. The criteria for CWS included a stuttering severity rating of at least 2 (mild stuttering) on an 8-point scale of (0 = normally fluent speech, 1 = borderline normal disfluency/very mild stuttering, 7 = very severe stuttering) by SLP and parent reports, and at least 3% of stuttering-like disfluencies (SLD; part-word repetitions, single syllable word repetitions, blocks and prolongations) during conversational speech. The criteria for recovery included a stuttering severity rating of less than 1 (very mild stuttering) on the 8-point scale that used to confirm severity in CWS, parental perception and SLP judgment stuttering cessation and a maximum of 4% SLD during conversational speech. Additionally, to confirm the status of persistence or recovery, children were evaluated every six months for two years, and annually after the second year. Out of 66 children, a third were identified to be persistent in stuttering, another third to be children who recovered within 18 months after stuttering onset (early recoverers), while the remaining children were those who recovered between 18 to 36 months

[3] Linkage is the tendency of genes to be inherited together due to their proximity on the chromosome.

after onset (late recoverers). Ambrose and colleagues reported that children in the study tended to have a higher proportion of relatives with similar recovery status as themselves, meaning that children who persisted were more likely to have relatives who also persisted in stuttering while those who recovered were more likely to have relatives who also recovered from stuttering. The study also indicates that sex and recovery from stuttering are correlated, females who stutter were more likely to recover from stuttering than males. The authors suggest that the sex ratio in stuttering may be an indicator of the genetic factor in recovery from stuttering, which may also be influenced by environmental variables. Further, Ambrose et al. (1997) suggests that the "nature and role of environmental factors remains an important issue and it is imperative that future research continue in attempting their identification; it is these factors that may be more readily modified to assist recovery, reduce symptoms, and aid in adjustment" (p. 587). These genetic studies suggest that more systematic research into the socio-environmental factors that may shape stuttering is needed for a disorder that plays out in social contexts.

Neurophysiology and anatomy. Early electroencephalography (EEG) studies suggested that stuttering was the result of a lack of cerebral dominance (Orton, 1928; Travis, 1978). Although recent studies have not substantiated the hypothesis, these investigations indicate that stuttering is associated with atypical neuroanatomy and function. In general, anomalous patterns of activation in stuttering include over-activity of the cortical and subcortical areas related to motor processing, reduced activation in the regions associated with auditory processing and atypical lateralization during speech processing (Brown, Ingham, Ingham, Laird, & Fox, 2005). During speech production, regions of the brain including the primary motor cortex (M1), supplementary motor area (SMA) and frontal operculum feature increased activation in the right hemisphere (Braun et al., 1997; Brown et al., 2005; De Nil, Kroll, & Houle, 2001; Fox et al., 1996; Giraud et al., 2008; Preibisch et al., 2003). Adults who stutter also show reduced functional connectivity between the left *pars opercularis* (POP) which is part of Broca'a area and the left premotor area but increased connectivity between the right POP and left hemisphere inferior frontal gyrus, and bilaterally in the precentral gyrus, middle temporal gyrus, supplementary motor area and cingulate gyrus (Chang, Horwitz, Ostuni, Reynolds, & Ludlow, 2011). Several studies reported a normalization of activation, that is, a reduction in right hemisphere activation but increased left hemisphere activity following fluency treatments (De Nil, Kroll, Lafaille, & Houle, 2003; Giraud et al., 2008; Neumann et al., 2005).

Neuroimaging studies have also reported atypical structure in stuttering including increased white matter (WM) in the superior temporal gyrus, inferior temporal gyrus and middle frontal gyrus of the right hemisphere which fall within close proximity to the matter tracts that connect the auditory processing and semantic retrieval regions with other language areas in AWS (Beal, Gracco, Lafaille, & De Nil, 2007; Jäncke, Haggi, & Steinmetz, 2004). Stuttering is also associated with lower WM integrity in the premotor cortex and corpus callosum although the overall corpus callosum area is larger in AWS (Choo et al., 2011; Cykowski, Fox, Ingham, Ingham, & Robin, 2010; Watkins, Smith, Davis, & Howell, 2008). Reduced WM integrity in the left arcuate fasiculus which links Broca's and Wernicke's regions was also observed in AWS but limited to children who persisted in stuttering (Chang, Erickson, Ambrose, Hasegawa-Johnson, & Ludlow, 2008; Dronkers & Larsen, 2001; Sommer, Koch, Paulus, Weiller, & Buchel, 2002). Regions associated with speech comprehension and processing including the planum temporale and Heschl's gyrus were larger in the right hemisphere or more symmetrical in AWS compared to NFA (Foundas et al., 2001, 2003; Jäncke et al., 2004; Strub, Black, & Naeser, 1987). Structural imaging of CWS also found decreased WM integrity in left hemisphere region of the brain overlapping the oral-facial motor areas (Chang et al., 2008).

The biological approach is based on the principle that stuttering is a family of behavioral characteristics that manifest from an underlying impairment in motor processing. In other words, stuttering is the symptom of an underlying biological disorder. For example, biological research suggests a genetic component in stuttering. Ambrose, Cox and Yairi (1997) reported that persistence and recovery tend to run in families, children who persist in stuttering or recovered tended to have relatives who similarly persisted in or recovered from stuttering. Equivalently, neuroimaging studies point to differences in brain activation patterns between AWS and NFA, and even between AWS who were mild or severe in their stuttering (Preibisch et al., 2003). These same studies that point to a strong biological component for the disorder, also suggest that other factors may also shape how (and if) the disorder is manifested, as not all children with a family history of recovery recover themselves and not all AWS stutter in the same manner. Consequently, although the behavioral approach to the study of stuttering has greatly informed our understanding of stuttering, the complexity and characteristics of the disorder and how it interacts with other variables requires a more comprehensive approach to understanding stuttering.

Fluency and impacts of stuttering on fluency. The focus on overt manifestations of stuttering in behavioral and biological research has also influenced the concept of fluency. Hedge (1978) views stutter-free speech as synonymous with fluent speech. Here, fluent speech and stuttering are placed at diametric ends of the speech production continuum in stuttering. Fluency is also viewed as a skill of speech production that is possessed by both people who do and do not stutter with considerable differences in the degree of skill across and between the two groups (Starkweather, 1997). This skill is measured in terms of speech production and rated on the continuity of syllables and words, rate of delivery, duration of pauses, coarticulation and effort. Of these, the most prominent and commonly used dimension may be effort, in particular muscular effort or exertion necessary to produce speech. The measurement of effort is primarily subjective, based on the speaker's and/or clinician's perceptions although electromyography (EMG) can been used to measure muscle movement not evident to the naked eye (Healey, Trautman & Susca, 2004; Ingham, Warner, Byrd, & Cotton, 2006; van Lieshout, Starkweather, Hulstijn, & Peter, 1995).

Overall, stuttering results in decreased fluency, that is less continuity of syllables and words. Disfluencies including pauses, hesitations, interjections and repetitions are typically more disruptive and prominent in individuals who stutter than in those who do not stutter as they occur more frequently and last for a longer duration (Ambrose & Yairi, 1995; Boey et al., 2007). In addition to affecting the continuity of speech, disfluencies may also act to slow down the overall speech rate and interrupt the flow of communication. Numerous studies have reported slower speech rate in people who stutter even during fluent speech (Bloodstein & Bernstein Ratner, 2008; Bosshardt, 1990; Hall, Amir, & Yairi, 1999). Interestingly, a reduction in speech rate has been advocated in some therapy techniques and found to be effective in reducing stuttering (Onslow, Costa, Andrews, Harrison, & Packman, 1996; O'Brian, Onslow, Cream, & Packman, 2003; Runyan & Runyan, 1986).

Even in the absence of overt disfluencies, the fluent speech of individuals who stutter is also affected by fluency breakdown. Adams and Runyan (1981) suggest the "stutterers' fluency…is likely to be flawed…This means of course that clinically we must direct our therapeutic intervention not just toward a patient's stuttering, but toward tenuous fluency as well…include in our clinical programs procedures that will strengthen stutterers' fluency, make it less tenuous, or ideally, make it indistinguishable from normal" (pp. 210-212). Adams and

Runyan (1981) define tenuous fluency as speech that includes imprecise articulation, low vocal intensity, atypical speaking rate and rhythm, and tension which are evident to listeners despite being stutter-free. Kleinow and Smith's (2000) study substantiated this definition. They found that even during the perceptually fluent speech that was free of stuttering, AWS feature reduced speech motor stability as demonstrated by the spatiotemporal index (STI). The STI which measures timing and movement stability indicates that the lower lip movements of AWS were more variable than the lip movements of NFA even after repeated performance.

Stuttering may also impact the fluent speech of individuals who stutter beyond the mechanics of speech production. Research suggests that there is a correlation between stuttering and language use. Adults who stutter have been reported to utilize less complex language compared to their fluent peers. Spencer, Packman, Onslow and Ferguson (2009) used a sociolinguistic approach, specifically Systematic Functional Linguistic analysis (which provides a method to describe features of language use such choice of wording and structure of utterances) to the study how AWS use language. In this study, the selection criteria for participants who stutter was "a history of stuttering since early childhood" and no history of fluency treatment although two AWS who had received treatment for their stuttering were also recruited. In their study, speech samples (continuous 5 min monologue) from AWS (*n*=10) were found to be less linguistically complex than those of their normally fluent peers (*n*=10) and likely to negatively impact communicative effectiveness, verbal expression, and ultimately, social interactions. A limitation of the study was the inclusion of participants who had received treatment for their stuttering which may affect linguistic complexity. In fact in earlier studies, Spencer and colleagues (2003, 2005) reported on the influence of treatment on linguistic modality. Although, people who stutter were reported to display a reduction in the use of linguistic modality, a resource for expressing interpersonal meaning (e.g. think, believe, possibly) which facilities and mediates interaction, this trend was reversed after therapy with increased fluency. These observations suggest the inclusion of participants with a history of stuttering may influence the results of Spencer et al.'s (2009) study. Additionally, stuttering was not explicitly defined by the authors and although the percent syllable stuttered (% SS) was reported for each AWS, and it is not known if these included all types of disfluencies or only those that are categorized as SLD which are often regarded as more severe. Further, the % SS of four AWS (between 1.5-2.5%) is typically considered within the normal range (very mild to mild stuttering). These % SS scores may have well been comparable or within the range of % SS of their matched normally fluent adults. Thus, if the claim of the study is that fluency breakdowns affect linguistic complexity, the inclusion of AWS with % SS that are within the normal range is a critical issue.

It is also important to note that these studies were based on monologues or telephone conversations where there is no communication partner, or the communication partner is not physically present. Further studies will need to be performed to ascertain if this trend of reduced linguistic complexity can be generalized to social interactions where people who stutter are able to take full advantage of the multimodality of communication when the communication partner is physically present. The present study takes on this challenge by looking at the collaborative effort including language use of people who stutter and their communication partners during face-to-face interactions. The overt manifestation of the disorder or fluency breakdowns is the most salient feature of stuttering. Research indicates that the influence of fluency breakdowns are not isolated or confined to the duration of the breakdown itself but beyond. Fluency breakdowns influence how people who stutter communicate resulting in reduced linguistic complexity and modality.

Multifaceted Models of Stuttering

There is not a working model or theory of stuttering that has integrated all observations and knowledge about the disorder into a unified and comprehensive framework. Generally, theoretical accounts of stuttering are varied and focused on different aspects of the disorder. Often these theories are focused on a narrow aspect of stuttering and confined to a single perspective such as physiology, psychology or linguistics but not the interactional nature of speech production. However, a number of multidimensional theories and models include a social component and attempt to capture the variability in social communication and complex interactions that may contribute to stuttering including the *Demands and Capacities Model* which suggests that fluency breakdown results when the demands for fluency exceeds the capacity for fluent speech (Starkweather & Givens-Ackerman, 1997), *Breakdown Hypothesis* which proposes that fluency breakdown is due to a momentary failure speech production coordination (Bloodstein & Bernstein Ratner, 2008), *Dynamic Multifactorial Model* which integrates multiple factors and suggests that the disorder is the result of multiple etiologies (Smith & Kelly, 1997), and *Communication-Emotional Model of Stuttering* which suggest that distal, proximal and exacerbating contributors such as genetics, emotions, and speech planning and production processes contribute to fluency breakdowns (Conture et al., 2006). These multidimensional models of stuttering attempt to capture the complexity of stuttering and highlight its dynamicity. These perspectives support the view that stuttering is a disorder that is influenced by various components including social aspects that are intertwined and cannot be reduced to a single entity, and as such must be viewed with comprehensive lens.

Social aspects and consequences of stuttering. Beyond the speaker, stuttering also affects the communication partner. Research suggests that moments of fluency breakdown influences memory of the listener and interaction between people who stutter and their communication partners.

Impact on listeners' recall. Fluency breakdown may also negatively influence listeners' recall. Listeners' exhibited poorer recall of information when there were disfluencies present (Cyprus, Hezel, Rossi, & Adams, 1984; Hulit, 1976; Sander, 1965). Panico and Healey (2009) reported that even mild stuttering, around 5% frequency negatively affected listeners' recall ability, and that this negative effect was even more pronounced when stuttering occurred on words with high content information. In Panico and Healey's study to examine the influence of fluency breakdown on listener recall, comprehension and mental effort, 60 adult listeners (30 males and 30 females) who reported no extensive contact with people who stutter were randomly assigned to listen to four narratives or expository topics with different frequencies of stuttering, 0% (no stuttering), 5%, 10% and 15%. The reading samples were provided by an adult male who stutters who was able to insert disfluencies (part-word repetitions, whole-word repetitions, and prolongations) on demand in predetermined locations of supplied texts. After listening to the speaking samples by the speaker who stutters, listeners were asked to recount what they heard and their responses were audio-recorded for analysis. Following the recall task, listeners were given a set of eight content questions based on the speaking sample and asked to provide responses to each of them. Finally, listeners were asked to rate their perceived mental effort while listening to the samples. Panico and Healy reported lower recall in listeners when the samples had a higher number of disfluencies regardless of whether the speech sample was a narrative or expository text. However, the number of disfluencies was less likely to impact the number of correct responses when listeners were familiar with the topic. Listeners reported requiring great mental effort when listening to speaking samples with a higher number of disfluencies but lower mental effort when listeners were familiar with the topic. Overall, regardless of the number of disfluencies, listeners were able to comprehend and recall the speaking samples, particularly when the topics were familiar to them, although in varying degrees. These observations are in contrast to a study by Fraundorf and Watson (2011) examining memory associated with listening to a story. Their study reported that fillers or interjections, which are considered disfluencies in stuttering research, facilitate recall. The study by Fraundorf and Watson used three short stories from Alice in Wonderland that was memorized and retold by a female speaker to maintain natural delivery, and spliced with commonly used fillers such as *Uh* and *Um,* or coughs prior to new plot points. Fillers were observed to facilitate recall while coughs had the opposite effect. The studies by Panico and Healy (2009), and Fraundorf and Watson (2011) suggest that disfluencies have an impact on recall although the results are ambivalent. The difference in findings between the two studies may be related to the types of disfluencies inserted into the speech sample; interjections in the Fraundorf and Watson study; and part-word repetitions, whole-word repetitions, and prolongation (categorized as OD and SLD respectively by Yairi and Ambrose, 1992) in the Panico and Healey study. Collectively, these studies suggest that disfluencies that are considered SLD may be more likely to negatively impact recall than those categorized as OD.

Interaction with communication partners. In children, the presence of stuttering has also been observed to influence their interaction with their parents and peers. Meyers and Freeman (1985a) reported that mothers of CWS were more likely to interrupt their child than mothers of TDC. They were also more likely to interrupt their CWS during stuttering than during fluent speech. Also, normally fluent peer playmates were more likely to make negative or derogatory statements when interacting with CWS. In another study, Meyers and Freeman (1985b) observed that both parents of CWS and TDC increased their speech rate when talking to CWS. However, in a study to examine the impact of stuttering on temporal reciprocity in communication, Savelkoul, Zebrowski, Feldstein and Cole-Harding (2007) reported that CWS and their parents showed more coordination in their interpersonal timing than TDC-parent dyads. The study recruited ten CWS and ten age- and sex-matched TDC and one an adult (who was either a mother, father or a parental-figure). The criteria for stuttering in the target group were based on parental report and the presence of at least 3% disfluency (SLD consisting of sound-syllable repetitions, sound prolongations) in conversational speech. A personality inventory was also administered, no differences were found between CWS and TDC and their parents on the family relations, withdrawal and social skills measurements. All three sessions of the study, which consisted of semi-structured play activity were conducted at the participants' homes and videotaped. During sessions, the child and one parent were seated across from each other, provided with "Playdoh" (to play with if they wanted to) and instructed to talked about anything that interested them for about 20 min. The conversations were analyzed using an automatic vocal transaction analyzer (AVTA) that quantifies different vocal states (vocalization, individual pause, joint pause, and simultaneous speech) of each communication partner. Results indicate that CWS and their parent were more likely to show mutual accommodation than TDC and their parent. When comparing mothers and fathers, CWS were observed to be more influenced by the temporal features of their father than mother. These observations suggest that CWS and their parents were more influenced by the temporal patterns of their communication partners than their matched counterpart. Savelkoul et al. (2007) propose that the increased temporal coordination or mutual accommodation between CWS and their parent allows them to better manage interactions. Additionally, the authors also suggest that CWS' accommodation to temporal patterns of their communication partners may be related to their (in)sensitivity to internal and external stimuli, and reduced distractibility. Children who stutter are thought to be atypically vigilant, less easily distracted and less adaptable to changes than those who do not stutter (Anderson, Pellowski, Conture, & Kelly, 2003). Further studies are needed to ascertain if this pattern of increased mutual accommodation is also present between AWS and their communication partners, and between people who stutter and unfamiliar communication partners.

Research points to the impact of fluency disorders beyond the person who stutters. Moments of fluency breakdown have been observed to have a negative effect on listeners' recall and mental effort. However, psycholinguistic research suggests the opposite, instead, disfluencies specifically, interjections are thought to aid recall. Research in stuttering also demonstrate the impact of fluency breakdown on interpersonal communication. Children who stutter and their communication partners have been observed to show increased mutual accommodation that may be a corollary of the temperament of CWS or a compensatory mechanism to facilitate communication.

Summary

The behavioral and biological approaches have grown hand in hand with the perceptual approaches to the study of stuttering but where the interanimation is the strongest is when the behavioral definition of stuttering is adopted. Some studies adopt this approach, for example, the study by Savelkoul and colleagues (2007), designed to investigate the impact of stuttering on interpersonal timing, used parental reports and the presence of at least 3% SLD as a criteria for stuttering, but other studies do not attempt a definition. For example, a study designed to examine how AWS and NFA view themselves and people who are normally fluent or stutter by Kalinowski, Lerman and Watt, (1987) did not include an operational definition of stuttering or an evaluation of disfluencies or stuttering severity. Instead, target AWS participants were selected from a membership list of national speech organization. This criterion makes it plausible that individuals who have recovered from stuttering may be selected as target participants. This is plausibly an issue as those who stutter mildly may view themselves differently from people who stutter severely.

Generally, the behavioral and biological approaches have mainly focused on the speaker, that is, the individual who stutters. In contrast, there has been less focus on the impact of stuttering on the dynamics of the speaker-recipient interaction particularly in adults. The aim of my research study is to close that gap, to gain a more comprehensive understanding of stuttering by investigating the functional communication system managing stuttering, by integrating the behavioral, and experiential approaches to the study of stuttering. My study uses the operational tool adopted from the behavioral approach to measure disfluencies in AWS, and also adopts the situated theories of communication approach that extends the operational tool to all participants in the study including those who do not stutter. Specifically, my study adopts Yairi and Ambrose's (1992) approach to analyzing disfluencies by separating the various types of disfluencies into two main categories: SLD and OD, while the experiential component in stuttering is given precedence in the recruitment and selection of participants, the criterion for stuttering was self-identification as a person who stutters. In the present study, the term stuttering is used to define the disorder, while fluency breakdown is used to define moments of disfluencies to better reflect the shared management and experience of communication partners during interactions.

CHAPTER 3
SITUATING STUTTERING IN INTERACTION

Despite the fact that disfluencies in speech are a hallmark of stuttering, individuals who stutter also experience periods of fluent speech, and during interactions these periods of fluency and also fluency breakdown are experienced, shared and managed by communication partners within the functional communication system. The experience of stuttering is a considerable component of the disorder and situated theories of communication allow me to investigate the experiences of people who stutter. Taking a situated perspective and situating stuttering in interactions and investigating how individuals who stutter orchestrate their success in communication around/with their moments of disfluency within the functional communication system will give us further insights into a multifactorial disorder that plays out in social settings. The present study is grounded in the theoretical perspectives of Hengst (2001, 2003), Hengst et al. (2010), and Clark (1992), and their clinical and experimental research approaches to study the functional communication system and communicative practices of communication partners managing stuttering. This chapter will discuss (1) approaches to situated communication, (2) rethinking repetition, (3) the barrier task activity and (4) the current study.

Approaches to situated communication

Over the last century there have been many researchers in multiple disciplines who have turned to situated perspectives to understand human behaviors including social interaction and communication in everyday contexts. Some of the most active lines of research have grown out of developmental and cultural psychology (e.g., Cole, Wertsch, and Scollon), linguistic and cultural anthropology (e.g., Hymes and Kendon), sociology, and writing studies and literacy theory (e.g., Prior). The underlying thread of these perspectives is the study of action in context.

Within any arena of language, the primary goal of its participants is to accomplish some social process such as problem solving and learning (Clark, 1996). To accomplish this social process communication partners adopt a common frame to interpret utterances and actions (Kendon, 1992, p. 326). Clark (1992) refers to this common frame, or intersubjective knowledge that includes mutual beliefs and suppositions, as common ground. In other words, the situation or context is not another component of interaction that is disparate from action. Wertsch (1991) asserts that even when an action is performed in isolation, it is intrinsically social and largely carried out with the help of tools including language and computers (p. 15). Cole (1996) proposes that action and context of the social process are inseparable parts of a unified process. By adopting a situated perspective the common ground of the social process that is inextricable from action becomes visible.

Broadly, situated perspectives are marked by collapsing boundaries between: text and context, to focus on contextualizing practices (Duranti & Goodwin, 1992); verbal and non-verbal behaviors, to focus on multimodalities; and, isolated behaviors and meaningful activities, to focus on the flexibility and distribution of communicative success within functional systems. In this section, we will briefly discuss each of these key issues.

Contextualizing. Contextualization "refers to speakers' and listeners' use of verbal and nonverbal signs to relate what is said at any one time and in any one place to knowledge acquired through past experience, in order to retrieve the presuppositions they must rely on to maintain conversational involvement and assess what is intended" (Gumperz, 1992, p. 230). Auer (1992) proposes that contextualization" comprises all activities by participants which make relevant, maintain, revise, cancel … any aspect of context which, in turn, is responsible for the interpretation if an utterance in its particular locus of occurrence" (p. 4). In addition, contextualization cues such as prosody, tempo, stress and intonation are used by communication partners to highlight and interpret interactions (Gumperz, 1992). Contextualization promotes interpretation and meaning making in social interaction that is based on shared knowledge.

Cole (1996) proposes that context includes both what surrounds (e.g. setting) and weaves together (e.g. culture) social processes. Context emerges from the interaction between communication partners and highlights what is relevant for the interaction (Auer, 1996). It is dynamic and interactional, and reconstructed continuously across interactions and activities of communication partners (Auer, 1996; Günther, 2008). Context includes the speech event, speech act, setting and language which are inextricable from the action or utterances that unfold during the social process (Goodwin & Duranti, 1992; Hymes, 1974). In short, context influences how actions and utterances are interpreted and understood in any social process (Kendon, 1992).

Multimodality. Communication is fundamentally multimodal. It includes the interaction of various modalities such as text and talk. For example, communication in a group collaborating on a project may include written notes, drawings and diagrams which culminate in a written document that is reviewed through a series of oral and written exchanges (Prior, 2009, p. 18; Prior & Hengst, 2010, p. 10). Essentially, text and utterances are multimodal as they involve both inner (e.g. thoughts and feelings) and outer semiotics (e.g. talk and writing) (Prior, 2009, p. 24). Although language may dominate, communication is not confined to this one dimension. Language use is often fully embodied and often strategically interanimated with gestures, facial expressions, postures and other nonverbal action. Even though nonlinguistic action such as pointing has received less attention it is an equally essential resource in interactions. Accordingly, to study interactions we must account for the multimodality in communication.

Individuals often gesture with their hands, move their bodies and direct their eyes in ways that contribute to the interaction (Goodwin, 2000a, 2000b). Gestures that accompany speech can be used to emphasize a word, formulate a thought, represent an object, show a spatial relationship and illustrate bodily action (Becvar, Hollan, & Hutchins, 2005; Knapp & Hall, 2010; Haviland, 2000). Alač and Hutchins (2004) postulate that gestures are a feature of cognition. Gestures function as cognitive artifacts that can be used to represent abstract concepts that support thinking, collaboration and communication. They also suggest that in addition to meaning making, gestures function to align disparate pieces of information into larger schematic units. Gestures are resources in communication that can be reconstructed, repurposed, referred back to and stabilized over time (Goodwin, 2000c).

Functional communication system. In cases of brain injury that result in disruptions in communication particularly speech disruptions, the functional communication system is reorganized and existing resources that are left intact may be marshaled to mitigate effects of the assault. Various components of the functional system work as a single entity that coordinates communication. Since communication is multimodal, resources that are spared can compensate for major losses in various dimensions.

For example in individuals with aphasia, other nonlinguistic resources are able to compensate for speech deficits. Hengst et al. (2010) described three individuals with aphasia who successfully narrated their stories despite deficits in their speech disruptions. They narrated their stories successfully by using language together with other modalities including gestures, postures, nonlinguistic vocalizations, intonations and even singing. Although communication appears to be dominated by speech, these observations tell us that other nonlinguistic modalities are an inextricable part of the functional communication system.

To study language use and cognition, essentially the functional communication system, Wertsch (1991) argues that the appropriate unit of analysis must be "individual(s)-acting-with-meditational-means" (p. 12). Mediational means are tools and language that shape action in fundamental ways (Wertsch, 1991, p. 12). Thus, any study of interaction must focus on action, individuals and meditational means together, that is, the functional system. Hymes (1974) speaking model provides a meaningful way to look at functional communication systems. According to Hymes' speaking model there are eight inextricable aspects that must be included: setting or scene, participants, ends, act sequence, key, instrumentalities, norms and genres (pp. 45-62). These various aspects of discourse inextricably contribute to the functional system. For example, the physical settings where speakers and recipients meet influence the norms or social rules that govern their behavior. Behavior and goals of an informal setting (e.g. birthday party) are different from behaviors and goals of a formal setting (e.g. conference). Similarly, the key or tone of the speech act, and instrumentalities such as the styles of speech at birthday parties and conferences are very different. Also, the kind of speech act or genre for birthday parties and conferences are disparate as well. In order to make sense of moments of talk, all these aspects of the speaking model must be attended to.

Rethinking Stuttering Research

Taking a situated approach to the study of communication shifts our attention away from isolated behaviors, or moments of disfluencies, to the ongoing management of fluency to meet situated communicative activities and goals. Situated perspectives do not impose a predetermined valence on the moments of stuttering by assigning it as a measure of disability, a sign of underlying impairment or breakdown in communication. A situated perspective offers another approach to evaluating stuttering by viewing it as a social phenomenon, a perspective that is supported by the fact that the frequency of stuttering is affected by the situation, size and make-up of the audience (Bloodstein & Bernstein Ratner, 2008; Dalton & Hardcastle, 1989; Mahr & Torosian, 1999). This social perspective is also supported by the fact that stuttering is frequently absent when speaking alone (Dalton & Hardcastle, 1989). Individuals who stutter also report greater frequency of stuttering in more stressful social situations such as speaking to strangers and large crowds. Generally, they also report greater amounts of stress in social situations than their normally fluent counterparts (Bloodstein & Bernstein Ratner, 2008). By situating stuttering, moments of stuttering, secondary behaviors that may be present, and fluent and disfluent utterances emerge as inextricable components of a single process, that is, the functional communication system.

This perspective also redefines stuttering as a social phenomenon. Stuttering is the experience that is shared by the speaker and listener within the functional communication system. The current study uses this definition of stuttering, and borrows from the situated theories of communication approach to examine the functional communication system managing stuttering, and experiences of people who stutter and their communication partners during a collaborative referencing activity. Grounded in the sociocultural and clinical work of Hengst (2001, 2003) and Hengst et al. (2010), this study considers the experience of the person who stutter and their communication partners as a crucial component of a disorder that is shaped by social contexts.

Rethinking repetition. Certain patterns occur frequently in communication. Repetition is one of those patterns. It is ubiquitous and functional in everyday behavior and communication (Johnstone, 1994; Schegloff, 1979; Tannen, 2007). Rituals, and religious and social activities are often imbued with repeated behaviors and mantras (Roberts, 1988). Repetition is also pervasive in the developmental process of infants and children. Babbling and rhythmic motor stereotypes which constitute the repetition of sounds (e.g., ba-ba-ba, da-da) and body movements (e.g., clapping, grasping) are considered essential components in the development of speech and motor control (Gallahue & Ozmun, 2005; Iverson, 2010). In the adult-children interaction, repetition of activities in story-telling, rituals and rhymes provides children with opportunities for exploring regularities in their environment, learning, and comprehension of the significance and meaning of social activities (Cook, 1994; Wood, 1986).

Within the classroom, repetition is an often used teaching strategy particularly in language learning. It has been proven to improve pronunciation, lexical and grammatical accuracy for all levels of proficiency (Lynch & Maclean, 2000). Repetition is also "the beginning of learning by heart" (Cook, 1994). Karpicke and Roediger (2008) reported better long-term retention of information with repetition. In their study of foreign language learning of vocabulary word pairs in Swahili and English (e.g., mashua–boat), students who were engaged in repeated study and testing of the word pairs outperformed students who were not engaged in repetition of the material by more than four standard deviations. This may be due to the fact that repetition plays a crucial role in refreshing and consolidating information, allowing that information to be retrieved more easily and quickly (Cicognani, 2000). Research also suggests that cognitively, repetition enhances the speed and efficiency of cognitive skills, and processing capacity (Schneider & Chien, 2003; Trofimovich & Gatbonton, 2006).

Repetition is also an essential component in the acquisition of expert performance in sports, arts and sciences. At all levels, practice and training which are essentially systematic repeated performances of an activity have emerged as important predictors of performance (Lee, Swanson & Hall, 1991; Lehmann & Ericsson, 1997). Repeated engagements or practice may also result in changes in the brain. Bengtsson and colleagues (2005) reported changes in the corpus callosum which mediates activities of the right and left sides of the brain in professional concert pianists but not in non-musicians who served as controls. This neuroanatomical change brought about by repeated engagement is cited as the key component in the difference in performance ability between the two groups. In another study by Hyde et al. (2009), changes in the brain were reported after only 15 months of musical training in the motor and auditory regions of the brain in children. These changes were correlated with improvements in both behavioral motor and auditory skills in children with repeated engagement.

Repetition is not only pervasive in conversation but thrives in it as well (Norrick, 1987). Situated theories of communication regard repetition as a major resource in communication that contributes to the meaning of the interaction by serving a number of functions (Hengst, Duff & Dettmer, 2010; Johnstone, 1994). Broadly, repetition can serve numerous functions in production, comprehension, connection, interaction and coherence (Tannen, 2007). More specifically, repetition can signal participation and acceptance of the communication partner by promoting participatory listenership and ratifying listenership. Repetition is also an effective and commonly used resource in humor. It may also signal appreciation and savoring. Repeating an utterance can stall or slow a conversation to an appropriate speed, allowing the speaker to hold the floor while formulating the next utterance. By repeating and elaborating utterances, speakers can emphasize and amplify the importance of an element or utterance. Additionally, coherence and synchrony between communication partners can be achieved or sustained through repetition of an item or format by creating and maintaining mutual attention to an on-going event, and promoting interpersonal involvement. Repeating a structure or format eliminates the need to formulate a whole new utterance and increases the processing time available to plan the next utterance and consequently, facilitates fluency and speech production by decreasing processing effort.

Repetition comes in various forms. Self-repetitions refer to same speaker repetitions while allo-, second-speaker or other-repetition refers to cases where a speaker repeats what someone else has said (Norrick, 1987). Repetitions can range from exact to paraphrase (Tannen, 2007). In exact or verbatim repetition, the utterance is reiterated exactly without variation while paraphrased repetitions are non-exact and vary in some form from the original (Johnstone, 1994). Temporally, repetition can be delayed or immediate (Tannen, 2007). Delayed repetition is characterized by the presence of some intervening linguistic material between the source and repetition. However, when the repetition is immediate, there is no intervening material between the source and repetition. Another facet of repetition that has received less attention is intentional and unintentional (Aitchinson, 1994). Intentional repetition refers to the conscious use of repetitions within a function while unintentional repetition is characterized by repetitions that are unconsciously used. For example, perseveration and palilalia which are associated with language and/or cognitive problems are considered unintentional repetitions (Killmer, 2010).

Redefining fluency. Fluency can be described in various ways. How it defined and measured has made a significant impact in the practices of those fields. The Oxford dictionary (2011) describes fluency as *the quality or condition of being fluent; in particular, the ability to speak or write a foreign language*; *the ability to express oneself easily and articulately*; and *gracefulness and ease of movement or style.*

Although fluency is typically regarded as synonymous with the absence of stuttering in communication disorders, it has been defined differently in other fields. In second language learning, fluency is used to describe language performance and often regarded as synonymous with oral proficiency and effectiveness in language use (Brumfit, 1984; Wood, 2001). In literacy, fluency is associated not only with oral proficiency but also reading. Reading fluency refers to efficient and effective word recognition skills that contribute to the meaning of a text. Similar to language learning, fluency in reading is also associated with speed, accuracy and effort (Pikulski & Chard, 2005). Fluency is also associated with behavior. Binder (1996) suggests that the combination of accuracy and speed which allows an individual to function efficiently and effectively should be labeled behavioral fluency. In general, most definitions of fluency are focused on the speaker. However, Lennon (1990) proposes that fluency is an element that must include the listener. He defines fluency as the ability of a speaker to direct the listener's attention to the message.

In situated theories of communication, fluency in speech production and communicative competence are not regarded as synonymous although communicative competence may include a dimension of speech production. Hymes (1972) proposed that communicative competence goes beyond linguistic mastery or fluent speech; it must include the ability to accomplish a range of speech acts and the capacity to participate in various speech events. In addition, the appropriate communicative conduct must accompany attitudes, values and motivations related to features and uses of language in order to achieve communicative competency. Ability in a narrow aspect of language use, for example, mastery of vocabulary and phrases, without appropriate knowledge of sociocultural rules of discourse and interaction does not result in competency. In other words, linguistic competency must be accompanied by proficiency in the social rules of language that permits an individual to engage in various speech acts and by a social/individual willingness to communicate in a situation. Hymes (1974) also points out that the ideals of fluency encompass different characteristics in disparate communities. The concept of fluency must then be "part of ethnography. Knowledge of them is of course indispensable background to the study of actual abilities"(Hymes, 1974, p. 46). In other words, situated perspectives must inform our definitions of fluency. Hymes' S-P-E-A-K-I-N-G model places importance on the interactions between the speakers, scene and setting, tone, genre, in the analysis of discourse, fluency and disfluencies. According to Hymes, the components of speech includes the setting which refers "to the time and place of a speech act, and in general, to the physical circumstances" and the scene which is the "psychological setting" or "cultural definition of the occasion" (p. 55). The scene may also encompass the context of the interaction. The "P" or participants in Hymes' model includes communication partners in the interaction. The "E" refers to ends of goals of the interactions and the "A" is the act sequence, or sequence of events that unfolds. The "K" is the key or "tone, manner or spirit in which an act is done" (p. 57). The "I" is for intrumentalities are the styles or forms of speech that are used while the "N" refers to the norms of interpretation or social rules or interpretations of the reactions and actions of communication partners. Finally, the "G" refers to genre or categories of speech. Hymes' model lends to the study of stuttering a schema or framework that can be applied to any level of analysis for the disorder.

The Barrier Task as Activity

The barrier game is a collaborative referencing protocol, which foregrounds the interaction between participants, and originally used by Clark (1992) to study the process of definite referencing in communication partners. The present study adopts the theoretical perspectives of the experimental approach of Clark (1992), and the sociocultural approach and clinical focus of Hengst (2001, 2003) and Hengst et al. (2010).

The barrier task studies by Clark and Wilkes-Gibbs (1986; 1992) involved two participants, one designated the director and the other as matcher. Separated by an opaque barrier, each partner was given a set of 12 tangram cards with geometric shapes. The director's cards were prearranged in two rows of six while the matcher's cards were arranged in a random sequence. The director's duty was to get the matcher to arrange her cards in exactly the same sequence by describing the cards sequentially. The task was performed six times in each session, over six sessions. Clark and Wilkes-Gibb (1986) found a reduction in collaborative effort, and more concise referential descriptions over time. The process of collaboration shortened in each successive session. In fact, participants' performance improved not only across trial but also within each trial. In other words, the process of mutual acceptance (of card labels) which was played out in the conversation between the speaker and listener as a series of steps shortened with each trial. These observations also suggest that the accumulation of common ground or shared knowledge minimizes the collaborative effort required to describe and identify the cards. In other words, efficiency was gained as a result of a common perspective (pp. 116-123).

Hengst (2001, 2003) and Hengst et al. (2010) used the barrier game to study the ongoing reorganization of functional communicative systems managing aphasia. In her studies, individuals with aphasia were partnered with familiar communication partners in a modified version of Clark's barrier game. Instead of a full barrier that obstructed the view of each other, a low barrier that allows partners to see each other but not their partner's cards was used. Hengst used pictures that were familiar to the participants and tangrams cards in her 2003 study, and Hengst et al. (2010) used only familiar pictures their study. Similar to Clark and Wilkes-Gibbs (1992), Hengst reported successful collaborative referencing in individuals with aphasia and their partners in both studies. The dramatic decrease in overall effort was reflected in the shorter duration of trials, decrease in number of turns, words and nonverbal gestures across trials. The minimized collaborative effort observed across trials in individuals with aphasia who face speech deficits tell us that interpretations, meaning making and collaborative referencing are not dependent on words alone. Instead meaning making and referencing are informed by the context, and are multimodal. In the Hengst (2001, 2003), and Hengst et al. (2010) studies with aphasia, it is clear that context cannot be separated from action as participants undertook the task and engaged in other behaviors (e.g., joking) that did not appear in Clark and Wilkes-Gibbs' design. Context which is inextricable from the interaction foregrounds other resources including gestures and facial expression that have been left intact in individuals with aphasia. The functional communication system is multimodal, accordingly deficits in one modality such as language need not be detrimental to communication. Other resources can be garnered for successful communication. In addition, the success of individuals with aphasia in Hengst's studies was also due to their common ground. The redesigned barrier game which was played by familiar communication partners instead of strangers brought together shared histories and personal goals. In other words, the common ground between the players was an essential component in their success in the game. This common ground was foregrounded in the barrier game not only because players were familiar with each other but also by the playing cards which included familiar pictures. The common ground between players facilitated success in the game by allowing partners to draw on a wide-range of resources that would not have been available between strangers.

In her 2010 study, Hengst and colleagues using the modified version of the game investigated conversational repetition of referential labels through repeated engagement in the barrier game in patients with aphasia. Across ten sessions, the barrier protocol successfully supported conversational repetition of labels for the tangram cards. In fact, despite mild anomic aphasia, Dave, the participant in the study and his game partner, Melissa were observed to reference the cards frequently. Dave and Melissa averaged an impressive 202.2 referencing expressions per session. Both players worked together to generate consistent, specific and meaningful labels and frequently repeated their own referencing expressions or their partner's. Once a meaningful label was agreed upon for a target cards, it was consistently reused by both parties in later trials and sessions. As evidenced in the work of Hengst, the barrier game is a goal-directed activity that supports repeated engagements of a specific material. The barrier game redesigned by Hengst (2001, 2003) and Hengst et al. (2010) promotes repeated engagements for the construction of successful communication.

The barrier task has also been used to study functional communication systems managing amnesia. Duff (2005); Duff, Hengst, Tranel, and Cohen (2006, 2008); and Duff, Gupta, Hengst, Tranel, and Cohen (2011) used the barrier task to study functional communication systems managing amnesia. Using Hengst's (2003) and Hengst et al.'s (2010) barrier task set up with two modifications to the protocol (tangram cards were used instead of familiar pictures and target participants with amnesia were directors for all trials instead of alternating being director and matcher), each individual with amnesia was partnered with a familiar individual for the game. Although there was a reduction in the number of turns and words across trials, individuals with amnesia and their partners required more time to complete game than comparison pairs not managing amnesia. In fact, the familiar partners of individuals with amnesia exerted greater effort to manage the game and make it accessible for their partners with amnesia than partners of individuals without amnesia. In other words, partners without amnesia exerted greater effort to maintain common ground between themselves and their partners with amnesia. Despite deficits in their memory, individuals with amnesia were able to successfully play the barrier game. Similar to individuals with aphasia, shared history or common ground was the key to success. This was evident in the reduction of words and turns across trials and sessions. One of the striking findings in amnesic patients was related to the use of definite referencing expressions. Despite managing amnesia, these patients displayed robust learning during the barrier game; supported by their non-declarative or procedural memory systems, their use of referencing expressions stabilized and simplified across trials (Duff, Hengst, Tranel, & Cohen, 2006; Duff, Gupta, Hengst, Tranel, & Cohen, 2011). In these studies amnesic pairs demonstrated an increase in their use of definite references across trials similar to their comparison pairs. Duff and colleagues (2011) propose that "declarative-memory system creates relational representations of relations among the constituent elements of experience. These representations include information about the co-occurrences of people, places, and objects along with the spatial, temporal, and interactional relations among them, as well as representations of higher-order relationships among various events. Thus, these relational representations provide the larger record of people's experiences over time" (p. 672). Fundamentally, grounded in shared histories and knowledge, the functional system managing amnesia is able to orchestrate resources to support successful collaborations.

In terms of stuttering, the barrier game provides meaningful opportunities through repeated engagements for the construction of successful strategies of communication while managing stuttering. Through repeated engagements individuals who stutter can learn to orchestrate resources to promote successful communication in a real-life functional communication system provided by the barrier game. By pairing the individual who stutters with a familiar communication partner, the barrier game may provide even more robust opportunities for promoting effective management of multimodal communicative resources in managing stuttering.

Barrier task in the study of stuttering. The barrier game in the study of stuttering is grounded in the theoretical and clinical approaches of Hengst (2001, 2003) and Hengst et al. (2010). This approach shifts the unit of analysis beyond the person who stutters and production of disfluencies, a perspective advocated by Wertsch (1991) who argues that the units of analysis must be "linked in some way with specific cultural, historical, or institutional factors". Utterances are governed by personal knowledge, experiences and voices, and thus, cannot be analyzed in isolation without regard to other dimensions of discourse that may have impacted the conversation either directly or indirectly (Scribner, 1997; Wertsch, 1991). In stuttering, this means that the fluency breakdowns and essentially, communicative practices of the person who stutter must be analyzed within the functional communication system considering the context, and interaction between communication partners.

The Current Study

Grounded in the sociocultural and clinical approaches of Hengst (2001, 2003), Hengst et al. (2010), and experimental approach of Clark (1992), the present study uses a hybrid methodology, combining the situated theories of communication and communication disorders approaches, to examine the functional communication system managing stuttering. A group of adults who self-identified as persons who stutter (adults who stutter; AWS) and their familiar communication partners were compared with a group of adults who self-identified as not having any communication disorders (normally fluent adults; NFA) and their familiar communication partners were recruited for the study. Specifically, the study was designed to explore the impact of fluency breakdown on collaborative effort and learning. Following an ethnographic approach to data collection, participants were videotaped during an interactive barrier game, and interviewed after the barrier tasks to discuss their goals, actions and interactions during the game.

The current research study is to my knowledge the first to use the barrier task protocol by Hengst (2001, 2003) and Hengst et al. (2010) to the study of stuttering. Hengst's theoretical framework and approach to the study of aphasia using this collaborative referencing activity offers a new window and perspective into data collection, analysis and interpretation of key observations and emerging themes in stuttering. This approach shifts attention from the traditional communication disorders perspective of stuttering to the functional communication system. In other words, the unit of analysis which typically centers on the person who stutters and disfluencies, is broadened to encompass the interactions of communication partners, and shared experiences and management of fluency breakdowns.

Generally, the literature on stuttering suggests that AWS would have difficulties in activities that require speaking. First, past studies have reported a greater number of disfluencies in AWS than NFA, this pattern is also expected in the barrier task. Overall, AWS were expected to have a higher number of disfluencies than NFA, and a greater proportion of SLD than OD while NFA were expected to have more OD than SLD. The higher number of disfluencies in AWS is expected to negatively impact their communication partner's recall. Second, based on findings from behavioral, biological, and perceptual studies, AWS participants were predicted to have more difficulty than NFA in social interactions, and speaking tasks due to anomalies in their speech motor control, speech and language abilities, in addition to negative attitudes and emotions related to speaking. In the barrier task, these differences were expected to result in greater collaborative effort related to more time needed to complete trials, increased number of interactional turns used, more words exchanged, more gestures used, increased number of card placement sequences per trial for participant pairs managing stuttering compared to pairs not managing stuttering although no differences were expected between groups in the accuracy of card placements. Third, behavioral research suggests that with increasing familiarity and adaptation to tasks, there will be a reduction in the number of fluency breakdowns in AWS. In the barrier task, the number of disfluencies was expected to decrease across sessions and trials for AWS (and also NFA), and accordingly, result in a reduction in collaborative effort (less time needed to complete trials, less number of interactional turns/words/gestures used) is also expected. Similarly, in the collaborative model proposed by Clark (1992), communication partners are expected to minimize collaborative effort from the beginning to the end of an activity. In the barrier task, this would result in a reduction in collaborative effort in both the AWS and NFA groups. However, when comparing across groups, collaborative effort is still predicted to be greater in the AWS groups due to a higher number of disfluencies and the presence of coping strategies. Finally, in this paradigm, the literature on stuttering also predicts that participants who stutter are more likely to have difficulty developing and using target card labels due to circumlocution, and word/sound avoidance. Although the initiating referencing expressions for each card placement sequence may stabilize and simplify across the barrier sessions and trials for AWS pairs, this is expected to be achieved with greater effort and time compared to NFA pairs. In contrast, the work by Duff, Hengst, Tranel, and Cohen (2006); and Duff, Gupta, Hengst, Tranel, and Cohen (2011) on amnesic pairs would predict that pairs managing stuttering will successfully develop and use initiating referencing expressions. Overall, greater variability in the measures of collaborative effort is expected within the AWS group than NFA group as a consequence of the disparities in stuttering severity between AWS pairs.

The situated discourse approach to analysis is focused on both speech and non-speech resources during interactions, and measures of learning in the functional communication system managing and not managing stuttering while the communication disorders approach to the analysis of stuttering, is focused on the number and type of disfluencies. Specifically, the analysis is designed to compare: (1) collaborative effort and learning, (2) patterns of disfluencies, and (3) the development and use of initiating referencing expressions between groups managing and not managing stuttering.

The data collection and analysis were guided by three main questions:

1) Do participant pairs managing and not managing stuttering demonstrate similar patterns of collaborative learning (as measured by comparing group performance for accuracy of card placements; time and number of turns/words/gestures used to complete trials)?
2) How do patterns of disfluencies compare across groups? What are the overall patterns of disfluencies (number of disfluencies, and proportion of stuttering-like disfluencies to other disfluencies)? Also, how does the pattern of disfluences (total number of disfluencies as a function of words uttered) compare within group?
3) Do participant pairs managing stuttering display similar patterns in developing and using target card labels during sessions as comparison pairs? If so, does the use of these labels on initiating referencing expressions for each card placement sequence stabilize and simplify across trials. In other words, do participant pairs managing stuttering display similar levels of confidence as reflected in the development and use of initiating referencing expressions as comparison pairs?

CHAPTER 4

METHODS

This study employed a hybrid research design that supported the analysis of group performance as well as situated discourse analysis of specific participants. Data were collected from adults who stutter (who self-identified as persons who stutter) and their familiar communication partners, and matched comparison pairs. Following an ethnographic approach to data collection all sessions (four barrier game sessions, and one semi-structured interview session after the barrier tasks where participants discussed their goals, actions and interactions when they were engaged during the activity) were videotaped. Data obtained consisted of video recording of the barrier game and interview sessions, researcher notes and individual communicative history and evaluation. Data analysis was performed on measures of collaborative effort and learning and initiating referencing expressions. Also, the number and types of disfluencies were identified and analyzed according to the communication disorder approach. The present study also yielded a rich amount of data for future analyses including: how participants use non-verbal communication (e.g., gestures, facial expressions) during the barrier game; qualitative analysis of the interviews to uncover the patterns, and themes around the experience of stuttering; the impact of fluency breakdowns on conversational repetition (self/other, immediate/delayed, and paraphrase/verbatim repetitions); and the influence of modality of response (verbal versus written) on the production of target card labels. This chapter details the participant pairs, the data collection procedures and the data analysis procedures.

Participant Pairs

A total of 14 participant pairs were recruited for this study. Each pair consisted of a target participant (either a person who stutters, or a matched comparison), and a familiar communication partner of their choosing. All participants were right-handed adults, native English speakers, with adequate hearing and normal or corrected to normal vision. Participants reported typical developmental histories, without any cognitive, psychological or communication disorders with the exception of stuttering in the target group. Participants were ethnically diverse consisting of African-Americans (*n*=6), Asian-Americans (*n*=4), European-Americans (*n*=14) and East-Asians (*n*=4). In the target group, all adults who stutter (AWS) self-identified as a person who stutters and reported a history of persistent developmental stuttering that began between 3 to 7 years of age. None of the normally fluent adults (NFA) and familiar communication partners (FCP) reported a history of stuttering or self-identified as a person who stutters.

All inclusion/exclusion criteria for participation in the study were based on self-reports from participants through a screening interview conducted over the telephone or in person (see Appendix B). In addition to questions on history of cognitive, communication (including stuttering) and psychological disorders, the screening interview was also used to confirm stuttering in target participants. Participants were compensated $10 per session for their participation. Written permission for participation in the study was obtained from all participants (see Appendix C for consent forms) prior to the first barrier game session. Participants were recruited in a number of ways including through the Speech and Hearing Science (SHS) Speech-Language Pathology Clinic (e.g., clients who had signed waivers and given permission to be contacted about research opportunities), and advertisements and flyers in public places (e.g., SHS departmental and other University of Illinois community bulletin boards) (See Appendix D).

The recruitment process started with AWS participants who self-identified as a person who stutters. This was confirmed by the interviewer during the screening interview. Next, AWS participants who were recruited were asked to identify a FCP to participate in the study with them. Subsequently, the NFA (comparison participants) were recruited specifically to match age, educational background, self-declared ethnic status, dominant language and sex of each AWS participant. Comparison participants were also asked to identify a FCP to participate in the study with them. All familiar communication partners were selected by the AWS or NFA themselves. Similar to AWS and NFA participants, FCP participants met the general criteria for all participants but did not need to match their AWS or NFA communication partners on age, educational background, self-declared ethnic status, dominant language or sex.

Group profile. To support comparison of performance by AWS and NFA, two groups of participant pairs consisting of seven AWS, seven NFA and their FCP were recruited for the study. However, for the final analysis only five AWS and five NFA pairs were included. Four pairs were excluded due to non-native English proficiency or attrition. One AWS and his FCP (both males), and their matched NFA and FCP (also both males) reported struggling with card labels due to their level of English proficiency. Another pair of target participant consisting of an AWS and his FCP (one male and one female) was excluded due to the presence of Attention

Deficit Hyperactivity Disorder (ADHD) in the AWS participant, no matched comparison pair was recruited for this pair. Finally, a NFA pair (one male and one female) was excluded as their matched target pair (an AWS and his FCP) withdrew after the first session due to relocation.

The number of AWS participants included the final analysis which consisted of four AWS males and one AWS female reflects the sex ratio in stuttering. Table 1 displays the general characteristics of AWS and their FCP. Age of AWS participants ranged from 19 to 32 years (*M* = 22.8, *SD* = 5.26). When asked to rate their own stuttering severity, one AWS rated his stuttering severity as moderate, three AWS rated their stuttering as mild, and one AWS reported no stuttering except when stressed. At the time of participation, all AWS participants were enrolled in college, and had received at least 14 years of formal education (*M* = 15.2, *SD* = 1.10). Communication partners of AWS consisted of three males and two females who are normally fluent adults. Age of the FCP participants ranged from 18 to 29 years (*M* = 22, *SD* = 4.18). At the time of the study, all FCP participants were enrolled in or had graduated from college with at least 14 years of formal education (*M* =15.4, *SD* = 0.89). All AWS participants selected friends they have known for at least 1year (range=1 to 7 years, *M* = 4.8, *SD* = 1.48) as their FCP. The *Illinois Clinician Stuttering Severity Scale* (ICSSS; see Appendix A), a commonly used measurement of stuttering severity, developed at the University of Illinois by Yairi and Ambrose (2005) was used to assess stuttering severity in all participants. The ICSSS based on spontaneous conversation samples indicates that three AWS presented mild severity, and two presented moderate severity, while all five FCP presented normal severity. Participants were also administered the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass, Kaplan & Barresi, 2001) to screen their language abilities in the four modalities (auditory comprehension, spoken language, reading and writing), and fluency of motor speech production on oral non-verbal tasks, speech tasks, and in discourse. Participants presented normal performance in all modalities and fluency of motor speech production.

The selected comparison participants consisted of five NFA (four males and one female) and five FCP (two males and three females). Table 2 displays the general characteristics of NFA participants and their FCP. Both NFA and FCP participants were also normally fluent adults. Age of NFA and FCP participants ranged from 20 to 28 years (*M* = 22.8, *SD* = 5.26), and 19 to 32 years (*M* = 24, *SD* =5), respectively. At the time of the study, all NFA and their FCP were enrolled in college as undergraduate or graduate students, and reported at least 14 years of formal education (M = 15.2, SD = 1.10; FCP: M = 16.8, SD = 3.03). All NFA participants selected friends they have known for at least a year (range= 1 to 5 years, M = 2.5, SD = 1.66) as their FCP. All NFA and their FCP presented normal severity on the ICSSS. Participants also presented normal performance in all modalities and fluency of motor speech production in the BDAE examination. The profiles for participant pairs are summarized below:

Profile of participant pairs. The profile of each participant pair including their relationship to each other, length of acquaintance, sex, age, ethnicity and formal education attainment is presented in this section. For participants who stutter, their reported age of stuttering onset, self-report of stuttering severity and history of fluency therapy are also included.

Carol and Girl (target pair). Carol is a 20-year-old, female European-American who identifies as a person who stutters and reports a history of stuttering in her family. During the interview with Carol, she reported that she began stuttering at around three years old, but has never been diagnosed by a SLP or received therapy for her stuttering. She rates her own stuttering severity as mild with occasional repetitions, prolongations, blocks and tension. During the evaluation, Carol displayed mild to no stuttering, as documented by her score of 0 on the ICSSS. Carol selected Girl as her FCP. Carol and Girl are undergraduates in the same major who communicate and see each other at least a few times a week, and have known each other for about a year. Girl is a normally fluent, 20-year-old female Asian-American, who also reports being conversational in Korean. During the evaluation, Girl displayed no stuttering, and documented by her score of 0 on the ICSSS. Both Carol and Girl presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. Both participants were never impaired in their articulation nor presented paraphasia, and successfully repeated all items in the repetition subtests during the evaluation. They also scored all items correct on the auditory comprehension, naming, reading and writing subtests.

Tebow and Cameron (target pair). Tebow is a 19-year-old, African-American male undergraduate student who identifies as a person who stutters. During the interview, he reported that he began stuttering at around five years of age and has a family history of stuttering. Tebow also reported that he received therapy for his stuttering between five to nine years of age. Although Tebow self-identifies as a person who stutters, he reports that his speech is mainly fluent with mild disfluencies, mainly repetitions, when stressed. During the interview, Tebow presented mild stuttering, documented with his score of 1 on the ICSSS. Tebow selected

Cameron, a friend he had known since high school, as his FCP. Cameron is a normally fluent, 18-year-old male African-American who attends the same university as Tebow. They both live in the same college dormitory and see each other daily. During the interview, Cameron presented no stuttering, and documented a score of 0 on the ICSSS. Both Tebow and Cameron presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. They were never impaired in articulation or presented paraphasia, and successfully repeated all items in the repetition subtests. Tebow scored all items correct on the auditory comprehension, naming, and reading subtests but had one incorrect response in the writing subtest. Cameron scored all items correct on the auditory comprehension, naming, reading and writing subtests.

Tom and Pat (target pair). Tom is a 21-year-old, male European-American who self-identifies as a person who stutters. He reported that his stuttering began at seven years old but did not report a family history of stuttering. He also reported that he began receiving therapy for his stuttering in the 4th grade, which continued until high school. Tom was receiving therapy for his stuttering at the time of the study and reports his stuttering severity as mild with occasional blocks and tension. During the evaluation he displayed moderate stuttering, and documented with a score of 3.66 on the ICSSS. Tom selected Pat as his FCP. Pat is a normally fluent, 21-year old, male European-American. Both Tom and Pat are senior undergraduate students who are fraternity brothers, and friends who have known each other for four years. Both participants are occupants in the same fraternity house and communicate with each other on a daily basis. During the interview, Pat presented no stuttering, and documented a score of 0 on the ICSSS. Both Tom and Pat presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. Neither Tom nor Pat was impaired in articulation or presented paraphasia and successfully repeated all items in the repetition subtests. Tom scored all items correct on the auditory comprehension, naming, reading and writing subtests. Pat scored all items correct on the auditory comprehension, naming, and reading subtests but had one incorrect response in the writing subtest.

Xavier and Olof (target pair). Xavier is a 22-year-old, male Asian-American who self-identifies as a person who stutters. He reported that he started stuttering at five years of age, but did not report a family history of stuttering. He reported receiving therapy for his stuttering at the ages of eight, thirteen and nineteen. Xavier reports his stuttering severity as moderate with repetitions, prolongations, blocks and tension. During the interview, Xavier presented moderate to severe stuttering, and documented with a score of 5 on the ICSSS. Xavier selected Olof as his FCP. Olof is a normally fluent, 21-year -old, male European-American. Xavier and Olof are friends who have known each other for nine years, since middle school. Both participants are senior undergraduate students in the same college and communicate with each other on a daily basis. During the evaluation, Olof did not present any stuttering, and documented a score of 0 on the ICSSS. Both Xavier and Olof presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. Neither participant was impaired in articulation or presented paraphasia, and successfully repeated all items in the repetition subtests. Xavier scored all items correct on the naming, reading and writing subtests. In the auditory comprehension subtest, Xavier had one incorrect response. Olof scored all items correct on the auditory comprehension, naming, reading and writing subtests.

Noj and Tina (target pair). Noj is a 32-year-old male European-American, who self identifies as a person who stutters. He reported that he began stuttering at four years old but did not report a family history of stuttering. Noj also reported receiving stuttering therapy at age 12 and rates his stuttering as mild with mainly prolongations and blocks. During the evaluation, he presented very mild stuttering and documented a score of 0.33 on the ICSSS. Noj who is an undergraduate in college selected Tina as his FCP. Tina is a normally fluent, 29-year-old female European-American who is a college graduate. Noj and Tina are friends who have known each other for about a year, move in the same circle of friends and communicate with each other a few times a week. During the evaluation, Tina presented no stuttering, and documented with a score of 0 on the ICSSS. Both Noj and Tina presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. Neither participant was impaired in articulation or presented paraphasia, and successfully repeated all items in the repetition subtests. Noj and Tina scored all items correct on the auditory comprehensions, naming, reading and writing subtests.

Chelsea and Mary (comparison pair for Carol and Girl). Chelsea is a normally fluent, 22-year-old, female European-American graduate student. Chelsea selected Mary as her FCP. Mary is a normally fluent 23-year-old, female European-American who is also a graduate student in the same program as Chelsea. Chelsea and Mary are friends who have known each other for about a year and communicate with each other almost daily. Both Chelsea and Mary presented no stuttering during their evaluations, and individually documented a score on 0 on the ICSSS. Both Chelsea and Mary presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. They were never impaired in articulation nor presented paraphasia, and successfully repeated all items in the repetition subtests. Both participants also scored all items correct on the auditory comprehension, naming, reading and writing subtests.

Stella and Danny (comparison pair for Tebow and Cameron). Stella is a 21-year-old male African-American who is normally fluent. Stella selected Danny, a 25-year-old male African-American who is also normally fluent as his FCP. Danny also reported being conversational in Igbo. Stella and Danny are friends who have known each other for three years and move in the same circle of friends. They are both undergraduate students in the same college and communicate with each other at least a few times a week. During the evaluation, Stella presented mild stuttering, and documented with a score of 0.33 on the ICSSS. Danny presented no stuttering during the evaluation, and documented with a score of 0 on the ICSSS. Both Stella and Danny presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. Neither participant was impaired in articulation or presented paraphasia and successfully repeated all items in the repetition subtests. Stella scored all items correct on the repetition, auditory comprehension, naming, and reading subtests with an incorrect response in the writing subtest. Danny scored all items correct on the repetition, auditory comprehension, naming, reading and writing subtests.

Heywood and Andy (comparison pair for Tom and Pat). Heywood is a 21-year-old, male European-American who is normally fluent. He selected Andy, a 21-year-old male European-American who is normally fluent, as his FCP. Heywood and Andy are friends and roommates who have known each other for over two years and communicate with each other on a daily basis. Heywood and Andy are both senior undergraduate students in the same program in college. During the evaluation, Heywood presented no stuttering and documented a score of 0 on the ICSSS. Similarly, Andy also presented no stuttering and documented a score of 0 on the ICSSS during his evaluation. Both Heywood and Andy presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. Neither participant was impaired in articulation or presented paraphasia, and successfully repeated all items in the repetition subtests. Heywood and Andy scored all items correct on the repetition, auditory comprehension, naming, reading and writing subtests.

Derrick & Gretchen (comparison pair for Xavier and Olof). Derrick is a 20-year-old male Asian-American, who is normally fluent. He selected Gretchen, a 19-year-old Asian-American female, who is also normally fluent as his FCP. Derrick and Gretchen are friends who attend the same university. They have known each other for a year and communicate with each other on a daily basis. Both participants reported being bilingual English-Tamil speakers. During the interview, Derrick presented no stuttering and documented with a score of 0 on the ICSSS. Gretchen also presented no stuttering during the evaluation, and documented with a score of 0 on the ICSSS. Both Derrick & Gretchen presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. Neither participant was impaired in articulation or presented paraphasia, and successfully repeated all items in the repetition subtests. Derrick and Gretchen scored all items correct on the auditory comprehension, naming, reading and writing subtests.

Special K and Dead Lift Diva (comparison pair for Noj and Tina). Special K is a normally fluent, 28-year-old male European-American. He selected Dead Lift Diva, also a normally fluent 32-year-old, female European-American as his FCP. Special K and Dead Lift Diva are friends who have known each other for over five years who communicate with each other weekly. They are both graduate students in the same university who share common interests. During the evaluation, Special K presented mild stuttering, and documented with a score of 0.33 on the ICSSS. Dead Lift Diva's presented no stuttering during her evaluation and documented with a score of 0 on the ICSSS. Both Special K and Dead Lift Diva presented seven plus words, normal speech melody, normal range of syntax and prosody in the BDAE fluency subtests. Neither participant was impaired in articulation or presented paraphasia, and successfully repeated all items in the repetition subtests. Both participants scored all items correct on the repetition, auditory comprehension, naming, reading and writing subtests.

Data Collection Procedures

To support close discourse analysis of communicative interaction, all sessions were videotaped and transcribed. All participant pairs completed five data collection sessions consisting of four barrier game sessions and one interview session. All barrier game and interview sessions for each participant pair were completed within three weeks of the first session. In addition, on-line researcher notes were taken by the researcher during barrier task sessions to determine accuracy of card placements at the end of each trial and agreed-upon target card labels at the end of each session. Researcher notes kept during interview sessions included participant responses on how they played the game, and their speech patterns during the barrier sessions.

The data obtained from each conversation pair (AWS and FCP; NFA and FCP) during barrier game and interview sessions comprised of: (1) video recordings of the barrier game (24 trials across four sessions), (2) on-line data kept during the barrier sessions including card placement accuracy, and participant responses during interviews, (3) video recordings of interview sessions (one session for each participant). All barrier game and interview sessions were conducted at the Speech Language Pathology Clinic and video recorded with the recording system at the clinic.

Barrier Game Sessions

Materials for the barrier game. During the barrier game, participant pairs were seated across a table facing each other with a low barrier placed between them. Following the protocol used by Hengst (2003, p. 78), the present study utilized a partial barrier instead of the full barrier employed by Clark and Wilkes-Gibbs (1992, p. 186). The low barrier allowed participants to see each other's faces and gestures, and other non-verbal behaviors that contribute to face-to-face interactions. Although participants were able to see each other's faces and gestures, they were not able to see the numbered board on the other side of the barrier. Identical boards numbered from 1 to 12 were placed on each side of the barrier in front of each participant. Figure 1 shows the setup of the barrier game. At the start of each session, each participant in the conversation pair were given a set of 12 different tangram cards identical to those used by Duff (2005, p. 69) and Hengst (2003, p. 81). Figure 2 shows the tangram used in the study.

Protocol for the barrier game. All barrier game sessions were videotaped. Each barrier game session consisted of three parts: a) set-up time, b) barrier game play, and c) final interview. The set-up took approximately 15 minutes during which the researcher reviewed goals of the study, instructions for the barrier game (see Appendix E), and results from previous trials (after the first trial of Session 1) and the agenda for the current session (e.g., who will be the director and matcher for each of the six barrier game trials). Before participant pairs played the barrier game, they were told:

"I want you to play this matching game; we're going to call it the barrier game. Each session you will play the game six times. And, I will record you playing the game together. It should be fun, kind of like Solitaire or a puzzle. I will teach you how to play the game, it is very easy and there are very few rules. You each have a playing board in front of you. The two boards are identical. They each have 12 spots on them, 6 in the first row and 6 in the second row. Each spot is numbered 1 through 12. You each have a set of 12 pictures. Both sets are identical. To play this game, one person is the director and one person is the matcher. You will take turns being the director and the matcher. The director starts with his/her picture cards already on the playing board. Then the director tells the matcher which picture card to put in each numbered spot, starting with spot 1, then spot 2, spot 3, through spot 12. At the end, we check to see if the matcher's board looks like the director's board. However, to make sure that the matcher doesn't just look at the order of cards on the director's board, I will put this barrier between you. Now, can you see each other okay? There is only one rule in this game and that is that you can't move or look around the barrier. Other than that, anything goes! Be creative! You can use the cards in any way that you want to. You can use gestures, facial expressions, and you can both talk as much as you want to. The only thing you can't do is move the barrier and look at the order of the cards on the director's playing board."

Investigators left the room and watched the barrier game through a one-way mirror in the adjacent observation room during the game play sessions. Participants notified investigators when they were done with each trial. The duration of each trial was recorded. After each trial, the investigator returned to the room to check the accuracy of card placements on the matcher's board, reported the number of correct card placements to the pair, set up cards for the next trial, reviewed the instructions for the game (if needed) and answered any questions participants had. The accuracy of card placements was determined by the number of cards on the matchers' board that was in the exact location on the directors' board. The maximum number of correct card placements for each trial was 12. During the game play portion that took between 10-45 minutes, depending on how quickly the trials were completed, the pair completed six barrier game trials.

At the end of each session after completion of all six trials, the researcher conducted a brief interview during which the researcher showed the pair the cards used during the game, and asked them what their agreed-upon-target labels (ATL) were for each of the 12 cards. Protocol for the interview was adopted from Duff (2005, p. 68) and Hengst, Duff and Dettmer (2010, p. 892) where participants were asked to report their labels for the tangram cards, and participant responses were recorded as their agreed-upon target label. Additionally, at the end of each session, participants were provided with a form with pictures of the tangram cards and asked to write down their labels for the cards (see Appendix F). This written procedure is novel to this study, and was conducted to determine whether the modality of response (verbal versus written) would influence the generation of target card labels particularly for participants who stutter who are thought to avoid certain sounds that may be difficult to produce (Martens & Engel, 1986).

Unlike the previous studies by Hengst (2003, p. 80) and Duff (2005, p. 64) where the target participant with aphasia or amnesia was assigned the role of director across all trials for the first sessions (Hengst, 2003) or for all sessions (Duff, 2005), in the present study target participants with stuttering and their partners alternated being director and matcher across all trials and sessions. This was done to capture the alternating roles and responsibilities of communication partners as they shift between speaker and listener in establishing common ground during social interactions (Clark, 1992, p. 252), and also to put AWS participants at ease to optimize success during the barrier game. In the present study, the AWS or NFA participants were the designated director in the first trial of all sessions but alternated roles with their FCP in subsequent trials in all sessions. Each session consisted of six trials in which each partner took on the role of director a total of three times and matcher a total of three times. Each barrier game session took between 15-45 minutes depending on the speed of participant pairs. For each participant pair, there were a total of 24 trials across four sessions. For each group (AWS or NFA), there were a total of 192 game trials.

Interview session. After all four barrier game sessions were complete, participant pairs were interviewed to discuss their performance in the game and participated in formal speech and language tests. Each interview session took around 90 minutes and consisted of two sections: a) semi-structured joint interview with both communication partners; and b) individual communicative history and evaluation.

Joint interview session. The initial portion of the interview session used a stimulated-elicitation procedure adapted from Hengst (2003, p. 290) to elicit a discussion of participants' performance and communication during the barrier game sessions. The interview took between 30-45 minutes and consisted of four major parts (See Appendix G). During the first part of the interview participants were asked to respond to general questions about the game (e.g. What do you think about the barrier game?). During the second part of the interview participants were asked to recount how they came up with labels for the tangram cards, state the labels they used for the cards during the game, their perception of the level of difficulty or ease of the game, and other comments or thoughts they might have on the game itself. In the third part of the interview, participants were asked to compare their communication practices during the barrier game to their typical communication practices outside the barrier game sessions, and discuss their fluency and disfluency during and outside the barrier sessions (e.g. How did your fluency or disfluency during the game compare to your everyday communication?). In the final set of questions, participants were asked to discuss how they worked together during those sessions. Specifically, they were asked to discuss their goals, if and how their goal(s) changed during the game, why they described the cards the way they did, how they decided on the labels for the cards, and their perceived successes or issues during the game. To prompt their recall participants were shown brief video clips of their barrier task sessions. Participants were also encouraged to discuss or comment on any aspect of the barrier game and their performance throughout the interview.

***Individual communicative history and evaluation*.** The joint interview was followed by a 45-60 minute individual evaluation with each participant during which they completed a case history, and speech and language assessments. The case history form included questions on speech and hearing problems, vision, history of stuttering and stuttering therapy (Appendix H). All participants were also administered the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass, Kaplan, & Barresi, 2001) to evaluate their fluency, auditory comprehension, spoken language, reading and writing abilities. A ten minute spontaneous speech sample was also elicited from questions by the interviewer (see Appendix I for potential questions) and a reading of the Rainbow Passage (see Appendix J) was also collected. The spontaneous speech sample was used to determine the stuttering severity (of AWS participants) using the ICSSS (Yairi & Ambrose, 2005) (see Appendix A).

Data Analysis Procedures: Transcribing and Coding the Barrier Task Sessions

The barrier game and interview sessions were coded and transcribed combining methods used in situated approaches to studies of communication and communication disorders to highlight emerging patterns of collaboration and disfluencies. Planned group analyses included comparing measures of collaborative learning, and disfluencies within and across sessions. Measures of collaborative learning consisted of accuracy of card placements, the time needed to complete a trial, and number of turns required to complete a card sequence number of words exchanged, and number of gestures used. The disfluency analysis consisted of the number and types of stuttering within- and between-groups across trials and sessions. The initiating referencing expressions were also identified for each card placement sequence. For the purposes of this dissertation, only orally produced data will be analyzed.

Transcribing videos of sessions. The transcription procedure followed conventions utilized by Hengst (2003) ensuring sensitivity to multichannel and concurrent actions of all participants. For the present study, this system of transcription supported both qualitative and quantitative evaluation of the data. The discourse was transcribed in format that "de-emphasizes turn-by-turn talk" (Hengst, 2001; p. 88). Figure 3 displays the transcription format. The transcript was delineated into segments that follow utterances and actions of speakers across time. This format traced the ongoing contributions of all participants during the interaction and ensured that their (concurrent) contributions to the discourse were added to the transcript appropriately. Each speaker was placed within his or her own line in the transcript. Speech and non-speech vocalizations attributed to specific speakers were located within his or her line while gestures and card placements were placed at the bottom of the segments. Temporal alignment between (speech and non-speech) actions and speakers were preserved in the transcript. Simultaneous speech and actions were placed at the same point in the transcript.

Transcribing talk and gestures. A total of three passes (audio, video and consensus) using conventions that integrated both the interactional sociolinguistic and communication disorders approaches were required by the transcription protocol (see Hengst, Duff, & Dettmer, 2010). During the first pass all audible utterances, sounds and pause time were included in the transcript. After the audio pass was completed, transcribers watched videos of the sessions, added gestures and card placement sequences to the transcript. During the video pass, corrections (if any) were also made to the transcript. Finally, during the consensus pass, the original transcriber along with a consensus transcriber viewed the entire video recording together to review accuracy of the transcription and coding until a consensus was reached, and generated a final version of the transcript. Unintelligible utterances were marked with XXXX in the transcripts. Corrections and additions (if any) to the consensus transcripts were also made at this point. The time needed to complete transcription for each barrier game session was approximately nine hours (five hours for the audio pass, three hours for the video pass and one for the consensus pass). The time needed to complete transcription for each interview session was approximately six hours (three hours for audio, two hours for video and one hour for consensus). In total, the transcription process took about 480 hours for 40 barrier game and 20 interview sessions across ten participant pairs. (See Appendix K for transcription codes).

Coding disfluencies in talk. Disfluencies were coded according to the commonly used convention in communication disorders. Disfluencies were separated into two main categories, stuttering-like disfluencies (SLD) and other disfluencies (OD), according to the system use by Yairi and Ambrose (1992). Disfluencies categorized as SLD consisted of part-word repetition (PW), single-syllable word repetition (WW), blocks (BL) and prolongations (PO). The next category of disfluencies, OD, included multi-syllabic repetition (ML), phrase repetitions (P), revisions (R) and interjections (I). Table 3 lists the different types of disfluencies. Within the body of the transcript, specific codes (see Appendix K) were used to identify utterances with disfluencies. Figure 4 displays examples of different types of disfluencies coded in a transcript. Codes for disfluencies were not mutually exclusive. For example, if a part-word repetition was also prolonged, the utterance was included in both the part-word repetition and prolongation counts. Similarly, words containing disfluencies were also included in the word counts. A total number of 1,157 disfluencies were coded across 240 trials for ten participant pairs.

***Identifying card placement sequence (CPS) boundaries*.** Each trial was separated into discrete card placement sequences (CPS) designed to identify and place a target card on the correct location on the matcher's board. Once a CPS was initiated, the communication partners were assumed to be acting within that card placement sequence until the correct placement of the card on the numbered board was achieved or the pair decided to skip this sequence. Accordingly, a CPS may contain side-talk about other cards as well as non-task related topics. Each card placement sequence was marked by *CPS* and followed by a number indicating the card placement sequence number. Figure 5 displays an example of card placement sequences boundaries in a transcript. For example, the first card placement sequence was coded as *CPS1*. Within this sequence, when a card was selected, it was marked with an *S*, followed by a + or – sign for correct or incorrect selection respectively and the card number (e.g. *S+/2*) (see Appendix K). When the card was placed on the board it was denoted with a *P* followed by a + or – sign for correct or incorrect placements and the number on the board where the card was placed (e.g. *P+/1*). In some cases where a turn bridged more than one CPS, priority was given to the card label. For example, a description which included target labels for two cards (*jet* and *house*) in a single turn - *jet crashes into a house* - was coded as a single card placement sequence, *CPS2*.

Additionally, when conversation pairs are engaged in a discussion of previously placed cards, after all cards had been matched on both sides of the board, the card placement sequence was coded as a repair card placement sequence (RCPS). All interactions (verbal and non-verbal actions) during a barrier game session were placed within CPS or RCPS. Essentially, all (verbal and non-verbal) resources used by communication partners, supported by the barrier game activity, were placed within a CPS or RCPS. All turns in a trial were coded within a CPS or RCPS. A total of 2,766 CPS and 10 RCPS were coded across 240 trials for ten participant pairs.

Scoring performance on the barrier task. Both qualitative and quantitative measures of basic performance, collaborative effort and learning, and referencing were analyzed. These included: (1) basic performance including the accuracy of card placements, (2) initiating of referencing expressions per CPS, and (3) overt collaborative effort needed to complete a card sequence based on the duration of each trial, number of interactional turns, total number of words exchanged, and number of meaningful gestures used.

Accuracy of card placements. The accuracy or number of correct card placements were determined by the number of cards on the director's and matcher's boards that matched at the end of the trial. For each trial, the maximum number of correct card placements was 12. For each session, the maximum total number of correct card placements was 72. All participant pairs correctly placed their cards across all trials and sessions.

Initiating referential expressions. For each card placement, across all trials and sessions, the initiating referential expressions were coded and classified into one of eight categories according: description, elementary, episodic, provisional, installment, placeholder, proxy and other, according to the operational definitions used by Hengst (2003; p. 837). Initiating referencing expressions or noun phrases (as referred to by Clark, 1992) are assumed to reflect the interactional display of common ground. Clark argues that these different types of references not only do the work of labeling the target card, but also display the level of confidence or certainty the director has that a particular label will be readily understood by the matcher. Streamlined definite expressions such as elementary expressions indicate greater confidence that the label will be understood by the matcher, whereas descriptive expressions reflect the lowest level of confidence. These displays of confidence reflected in the use of referencing expressions may be implicit and disparate from participants' self-reports of confidence in their fluency or disfluency during the barrier game (see Interview section). The eight categories of initiating referencing expressions are presented in increasing levels of confidence below. f confidence below.

Description. Initiating referencing expressions with an indefinite article were coded as descriptions. An initiating referencing expression was coded as a description even when an article was not included if the referencing expression was used for the first time in the barrier game activity. Participants typically categorized (e.g., *It looks like a really big figure with like the square head on top*) or described the tangrams as resembling something (e.g., *number twelve is another guy in a boat*). Participants also attributed characteristics or qualities to the tangrams (e.g., *... like a house with the really tall chimney*) or described actions (e.g., *Ok, the second once looks like a person skating*). Descriptive initiating referencing expressions mainly occurred during the first few trials of the first session.

Provisional/Self-corrected. Definite references generated, and then significantly amended and/or replaced without prompting by one speaker were coded as provisional. The original referencing expressions and self-correction are produced in more than one intonational group (e.g., *The first one is the boat, the canoe*).

Episodic. This definite reference is produced by a single speaker in multiple intonational groups. In the referencing expressions which includes nouns and modifiers, subsequent intonational groups modify the previous tone group (e.g., *...kind of like if he was like Muslim, like praying to Mecca*). Acceptance of the referential expression may be explicit or implicated.

Placeholder. This definite reference may be distributed across director and matcher. This definite expression initiated by director with a placeholder may be completed by the director or matcher (e.g., *Uhm…eight is like the cheetah or like the you know, like it's more like, you know, it's a cheetah*). Fillers and pauses were the most commonly observed placeholder expressions in this study. Placeholders became less common in the later trials and sessions.

Proxy. This referencing expression is marked by a change in speakers. Definite references which were initiated by one speaker (often the director), followed by a pause, then completed by the matcher were coded as proxy. In this referencing expression, grammatical construction and intonational contour were maintained across the multiple speakers (e.g., ***O**: Uh the house with the... **X**: the smokestack*).

Installment. This definite reference is jointly produced by multiple speakers in multiple intonational groups. Noun and modifiers are generated by the director with explicit acceptance by the matcher at each installment (***D****: Six is the shorter boat* ***S:*** *Shorter boat, cool* ***D****: with…without the guy in it* ***S****: yeah*).

Elementary. This definite reference includes nouns and modifiers, and is uttered in a single intonational group by a single speaker (e.g., *The fourth one is the UPS guy*). Although elementary referencing expressions were the most widely used referential expression, they were less common in earlier trials compared to later trials and sessions. They were also marked by fewer words compared to the other types of referencing expressions.

Other. Initiating references that were mainly non-verbal actions were coded into this category (e.g., *It's like a dude on the ground like* <u>*this**</u>; the asterisk indicates that the speaker bent his upper torso towards his feet while being seated).

Coding for overt collaborative effort. Collaborative effort required to complete each trial was determined by the time need to complete each trial, number of turns required to complete a card sequence, number of words exchanged, and number of gestures used.

Time needed to complete each trial. The duration of each trial or the time needed to complete a trial was defined as the amount of time required by the conversation pair to match all cards on both sides of the barrier. The start of a trial was designated as the point when the investigator said "You can begin when you are ready, have fun and let me know when you are done" or equivalent. Whereas, the end of the trial was denoted as the point when participants verbally (e.g., *Done)* or non-verbally (e.g., lifting both hands or thumbs up) indicated that they had completed the task.

Number of interactional turns per trial. A turn was defined as utterances produced by one speaker and included verbal and/or non-verbal (e.g., sighing, nods) actions. The completion of a turn was denoted by a change in speaker. Accordingly, when one speaker began an utterance that was completed by another speaker, it counted as two turns. Backchannel responses were also included in turn counts. Turn counts consisted of turns that were and were not attended to. Participants used more turns in earlier than later trials and sessions. A total of 6,564 turns were recorded across 240 trials for ten participant pairs.

Number of words per trial. To capture the amount of verbal space and effort, words were broadly defined, with little weight placed on the morphology or syntax of the utterance. Words where disfluencies occurred were also included in the word counts. For example, *Uhm* was coded as an interjection and also included in the counts of the number of words exchanged. For disfluencies that included repetitions, the units of repetition did not add to the total number of words exchanged. For example, *ma-ma-matcher* was counted as a single word although there were two repetition units. For phrase repetitions, word counts only included those that made up the original phrase. For example, *we will-we will* was counted as two words not four. A higher number of words exchanged reflected greater collaborative effort. There was a decline in the number of words used across sessions and trials. A total of 22,946 words were coded for ten pairs of participants across 240 trials.

Number of meaningful gestures per trial. Gestures were defined as non-speech (audible and inaudible) actions that were used in isolation or in combination with speech that significantly contributed to the interaction and referencing expressions. Significant gestures and iconic gestures including postures and movements that functioned as word substitutions (e.g., holding up index finger to indicate one), provided judgments including acceptance or rejection (e.g., nods), and described target card or placement (e.g., pointing to card) were included in the counts. Significant audible actions (e.g., singing) that contributed to interaction and referencing expressions were also included. Actions that were salient but that did not contribute to the interaction or referencing expressions (e.g., drinking water) were not included in the counts. There were more gestures in earlier trials and sessions than in the later trials and sessions. A total of 163 gestures were coded for ten pairs of participants across 240 trials.

Reliability of Coding. Inter- and intra-judge reliability were performed for the number of turns, words, gestures, disfluencies and coding of initiating referencing expressions. Another investigator who was trained in the transcription and coding system served as the inter-reliability judge. Ten percent of the data or 24 trials were randomly selected for reliability analysis. The data were divided into three sections: beginning (Trials 1-6 from Session 1, and Trials 1-2 from Session 2 from all participants), middle (Trials 3-6 from Session 2, and Trials 1-3 from Session 3 form all participants) and end (Trial 4-6 from Session 3, and Trials 1-6 from Session 4 from all participants). Eight trials were randomly selected from each section of the data. Selected transcripts included at least two trials from each of the ten participant pairs. Inter-rater reliability was high for turn, word, gesture, and disfluency counts. Similarly, inter-rater reliability was high for initiating referencing coding. Cronbach's Alpha (1951) for turns, words, gestures, disfluencies and initiating referencing coding were 0.99, 1.00, 1.00, 1.00 and 0.99 respectively. There was also high intra-rater reliability for words, turns, gestures, disfluencies, and coding for the initiating referencing expressions. Cronbach's Alpha for turns, words, gestures, disfluencies and initiating referencing coding were 0.99, 0.88, 1.00, 1.00 and 0.98 respectively.

Data Analysis: Comparing Performance of Groups

Group performance of collaborative effort across was compared using a generalized linear model (GLM) which offers an approach to study patterns of variation that are not normally distributed. For each measure of collaborative effort or response (e.g., time needed to complete trials), the group comparison was based on 120 trials/data points across 5 participant pairs in each target and comparison group. For this study, a GLM assuming a Poisson distribution with a log link function, which is typically used to model the frequency of an event within a defined period, was employed for non-normally distributed data. The resources used during the barrier game that did not follow a normal distribution (number of interactional turns used, number of words exchanged, and number of meaningful gestures) was fitted with a Poisson distribution. Data for the time needed to complete a barrier game session was normally distributed, and analyzed using an identity link. A Poisson distribution was also used to compare the number of disfluencies (which was not normally distributed) between groups.

A significant amount of data was collected for this study. However, the current study only focused on the measures of collaborative effort and learning, number and types of disfluencies, and development and use of initiating referencing expressions.

Table 1.

General characteristics of target pairs consisting of adults who stutter and their familiar communication partners who are normally fluent. The characteristics listed includes participant number, pseudonym, relationship to each other, length of acquaintance, sex, age, handedness, ethnicity, age of stuttering onset, self-report of stuttering severity, history of fluency therapy and formal education attainment.

Adults who Stutter and their Familiar Communication Partners

Participant Pair Number	Participant Pseudonym *	Relationship	Length of Acquaintance (years)	Sex	Age	Handedness	Self-declared Ethnicity	Age of Stuttering Onset (years)	Self-report of Stuttering Severity	History of Fluency Therapy	Formal Education (years)
1A	**Carol**	Friend	1	**F**	**20**	**R**	**EU**	**3**	**Mild**	**No**	**16**
	Girl			F	20	R	AS	-		No	15
2A	**Tebow**	Friend	5	**M**	**19**	**R**	**AA**	**5**	**None**	**Yes**	**14**
	Cameron			M	18	R	AA	-		No	14
3A	**Tom**	Friend	4	**M**	**21**	**R**	**EU**	**7**	**Mild**	**Yes**	**16**
	Pat			M	21	R	EU	-		No	16
4A	**Xavier**	Friend	9	**M**	**22**	**R**	**AS**	**5**	**Moderate**	**Yes**	**16**
	Olof			M	22	R	EU	-		No	16
5A	**Noj**	Friend	1	**M**	**32**	**R**	**EU**	**4**	**Mild**	**Yes**	**14**
	Tina			F	29	R	EU	-		No	16
		M	4.2		**22.8**			**4.8**			**15.2**
					22			-			15.4
		SD	3.42		**5.26**			**1.48**			**1.10**
					4.18			-			0.89

Note: *Pseudonyms of adults who stutter are bolded. AA= African-American, AS=Asian-American, EU=European-American, F=female, M=male, and R=right.

Table 2.

General characteristics of the normally fluent adult (comparison) participants and their familiar communication partners. The table includes participant number, pseudonym, relationship to each other, length of acquaintance, sex, age, handedness, self-declared ethnicity, and formal education attainment. The pseudonyms of comparison participants are bolded.

Normally Fluent Adults and their Familiar Communication Partners

Participant Pair Number	Participant Pseudonym*	Relationship	Length of Acquaintance (years)	Sex	Age	Handedness	Self-declared Ethnicity	Formal Education (years)
1B	**Chelsea**	Friend	1	**F**	**22**	**R**	**EU**	**16**
	Mary			F	23	R	EU	16
2B	**Stella**	**Friend**	3	**M**	21	**R**	**AA**	**16**
	Danny			M	25	R	AA	16
4B	**Heywood**	Friend	2.5	**M**	**21**	**R**	**EU**	**16**
	Andy			M	21	R	EU	16
4B	**Derrick**	Friend	1	**M**	20	**R**	AS	**14**
	Gretchen			F	19	R	AS	14
5B	**Special K**	Friend	5	**M**	28	**R**	**EU**	**20**
	Dead Lift Diva			F	32	R	EU	22
	M		2.5		**22.8**			**15.2**
					24			16.8
	SD		1.66		**5.26**			**1.10**
					5.00			3.03

Note: *Pseudonyms of normally fluent adults (comparison participants) are bolded. AA= African-American, AS=Asian-American, EU=European-American, F=female, M=male, and R=right.

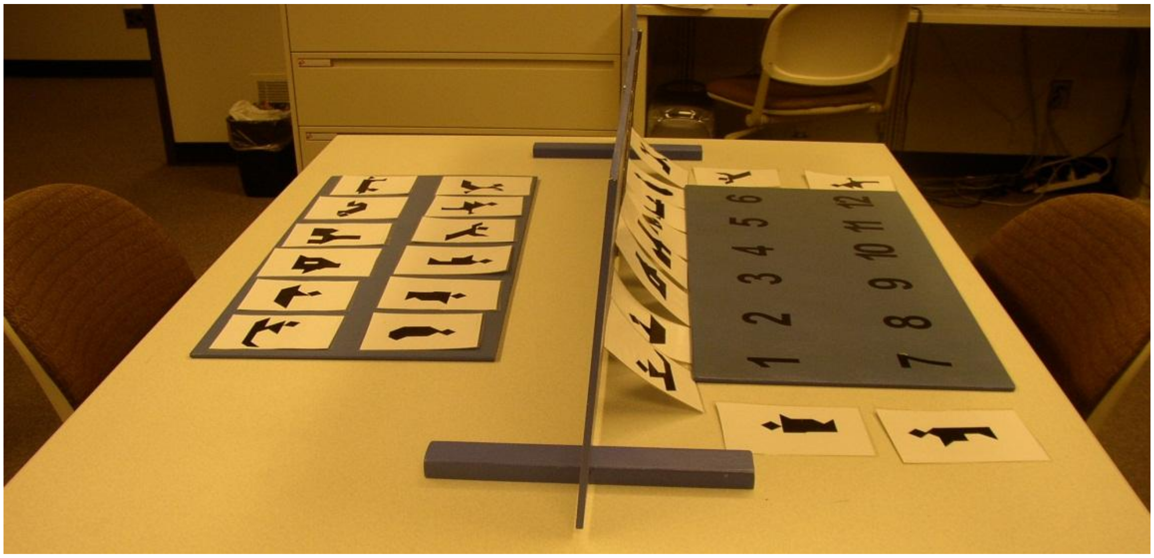

Figure 1. Setup for the barrier game. At the start of each barrier game trials, the directors' cards were laid down on the numbered board. The director and matcher were able to see each other over the barrier but not each other's numbered board.

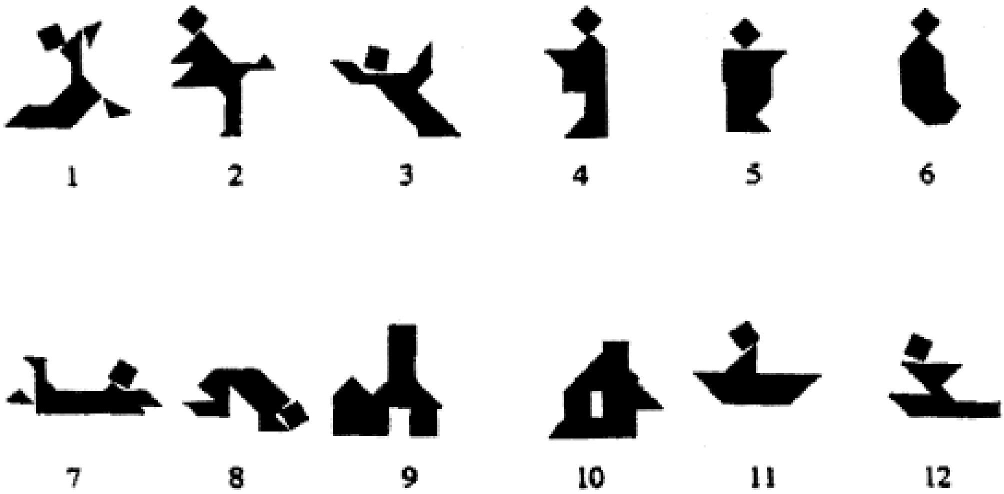

Figure 2. Tangrams used in the study were identical to those used by Duff (2005, p. 69) and Hengst, (2003, p. 81).

D: Actually where was I thinking of Jim yesterday? Oh! Well,
S: Cause he's awesome?
A:

D: no, I saw a post ([I1] uhm) in the metal group about a guy up in Chicago who's trying
S:
A:

D: to get his like garage band to be part of this *ridiculously awful thing called a **Uproar
S:
A:
*rolls eyes **frowns

Figure 3. The discourse was transcribed in format that "de-emphasizes turn-by-turn talk" identical to the system used by Hengst (2003, pp. 88-90). D stands for Dead Lift Diva (familiar communication partner), S for Special K (normally fluent adult) and A for Ai Leen (investigator). Each line for each speaker was present throughout the whole transcript. All actions including gestures were temporally aligned in the transcript. Non-speech actions attributed to participants were indicated by asterisks and their descriptions located at the bottom of the each segment. For example, the single and double asterisks (*) in Dead Lift Diva's line indicates that she rolled her eyes during the utterance of *ridiculously* and frowned during *Uproar*.

Table 3.

The table below which lists the different categories and examples of disfluencies is adapted from Yairi and Seery (2010).

Types of disfluencies		Codes	Examples
Stuttering-like Disfluencies (SLD)	Part-word repetition	PW	Bu-bu-but
	Single-syllable-word repetition	SS	And-and
	Whole-word repetition	WW	Within-within-within
	Blocks	BL	L----ike
	Prolongation	PO	Mo—mmy
Other disfluencies (OD)	Multisyllabic word repetition	ML	Busi-busi-business
	Phrase repetition	P	I like to – I like to…
	Revision	R	It was, I mean…
	Interjection	I	Uhm, well, er

A: So tell me more about your switching *([PW1] **fr**om) you know from *psych to
T:
*moves left and right hands towards the left side of the torso and then to the left side

---

A: yeah!
T: for grad school? ([I1] Um) well for the most part I just didn't really know

---

A:
T: *([^BL.1.] **wh**at) I wanted to do after school. ([I1] Um) so I went ([^BL.1.] to) the career
*sticks bottom jaw out

A: * *mhm
T: center last year and I was learning about grad school stuff and ([I1] uh)
*nods

Figure 4. Examples of different types of disfluencies coded in a transcript. *([PW1] **fr**om) indicates that 'fr' was repeated once during the utterance of *from*. ([I1] Um) indicates an interjection. ([^BL.1.] **wh**at) denotes that the disfluency was an audible block which lasted for 1 second occurring on the 'wh' sound of *what*.

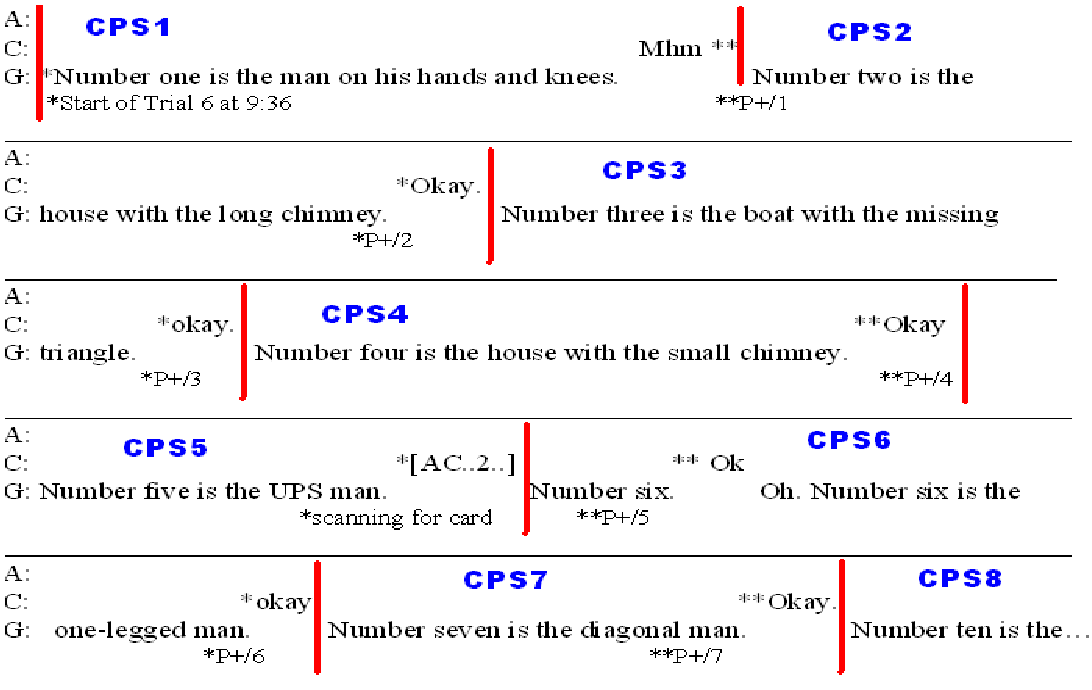

Figure 5. Card placement sequences (CPS) during a barrier trial for Carol (C) and Girl (G). The trial was divided into discrete card placement sequences. Once a CPS was initiated, the communication partners were assumed to be acting within that card placement sequence until the correct placement of the card on the numbered board was achieved or the pair decided to skip this sequence. The start of the trial was marked by a single asterisk. In this case, the trial started at 9 min 36 sec into the session. In this trial, Girl was the designated director and Carol, the matcher. Each card placement sequence was marked by *CPS* and followed by a number indicating the number of the sequence of card placement. A card place during the CPS was denoted with a *P* followed by a + or – sign for correct or incorrect placements and the number on the board where the card was placed. For example, the first card placement sequence during the trial was marked as CPS1, and the P+/1 code indicates the card was correctly placed.

CHAPTER 5

RESULTS

This study using a barrier task activity was designed to answer specific questions about communicative practices and stuttering using both the situated theories and communication and communication disorders approaches. All ten participants pairs attended the five data collection sessions as scheduled and engaged well with both the barrier game and the interview sessions. The results are organized here around the three research questions: (1) Do participant pairs managing and not managing stuttering demonstrate similar patterns of collaborative effort and learning, (2) How do patterns of disfluencies compare across groups?, and (3) Do participant pairs managing stuttering develop and use specific card labels during sessions as comparison pairs?

Collaborative Effort and Learning

Collaborative effort and learning between target and comparison groups were compared by evaluating differences in the accuracy of card placements, time needed to complete each trial, number of interactional turns used per trial, number of words used per trial, number of meaningful gestures used per trial, and number of card placement sequence per trial.

Accuracy of card placements. As expected there were no differences in the accuracy of card placements between groups. As predicted, all pairs completed all trials of the task, and did so with high accuracy. For each trial, participant pairs placed 12 different cards. A total of 288 cards were placed across 24 trials by each participant pair. All participant pairs in both groups achieved 100% accuracy in card placements across all trials and sessions (AWS achieved 288 correct card placements; NFA achieved 288 correct card placements).

Time needed to complete each trial. Contrary to prediction, there was no group difference in the time it took to complete trials across four sessions and 24 trials (model: y = 46.40 + 7.36*time, z = 0.97, $p = 0.33$). Across four sessions consisting of 24 trials, target and comparison groups took an average of 53.43 s ($SD = 57.81$) and 51.60 s ($SD = 57.19$) to complete trials, respectively. The average time for each trial for all four sessions is shown in Table 4. Figure 6 is a line graph displaying the average time needed to complete each trial across all four sessions, both groups showed a similar pattern of getting faster in the barrier game across sessions and trials. Although the first session of the first trial took the longest time to complete, with AWS group averaging 303.20 s ($SD = 127.88$) while the comparison group averaging

312.00 s (*SD* = 117.71), the time needed to complete trials was significantly reduced by the second session. The target group showed a more dramatic decrease in the time needed to complete trials from the first session to the last session than the comparison group. Closer inspection of the data indicates greater variability in time needed to complete trials for the AWS group than NFA group for session 1. However, this difference in variability between groups is reduced in subsequent sessions. Overall, the AWS group showed a dramatic decrease of 108.40% in the time needed to complete trials while the comparison group showed a decrease of 84.68% in time. For AWS participant pairs, the average time need to complete each trial for sessions 1, 2, 3 and 4 were 111.30 s (*SD* = 108.36), 37.77 s (*SD* = 15.77), 31.50 s (*SD* = 10.94), and 33.33 s (*SD* = 8.70) respectively. For NFA participant pairs, the average time needed to complete each trial for sessions 1, 2, 3 and 4 were 82.43 s (*SD* = 68.65), 38.67 s (*SD* = 17.69), 31.40 s (*SD* = 10.23), and 33.10 s (*SD* = 17.04) respectively. Additionally, the average time of the shortest recorded trial was slightly longer for the AWS groups (*M* = 28.8 s, *SD* = 17.4) than for the comparison group (*M* = 25.8 s, *SD* = 9.18).

Number of interactional turns used per trial. Contrary to prediction, there were no group differences in the number of interactional turns used per trial (model: y = 3.32 - 0.012*turns, z = -0.25, *p* = 0.80). As predicted, the comparison group followed the expected pattern of using fewer turns across trials. However, contrary to expectation, the target pairs also followed the pattern of using fewer turns across trials. Table 5 shows the average number of interaction turn across sessions and trials. Figure 7 is a line graph showing the average number of turns used, there was a dramatic decrease in turns after the first trial of the first session for both groups. Both AWS (*M* = 80.00, *SD* = 45.35) and comparisons (66.60, *SD* = 25.56) used the highest number of turns in the first trial of the first session. The lowest average number of interactional turns used per trial for AWS was 21.76 (*SD* = 3.23) for the first trial of the second session, and 21.40 (*SD* = 5.27) for NFA for the second trial of the third session. For AWS, the average number of interactional turns used per trial for sessions 1, 2, 3 and 4 were 37.13 (*SD* = 26.65), 23.03 (*SD* = 2.41), 25 (*SD* = 2.08), and 23.19 (*SD* = 2.05), respectively. For NFA, the average number of interactional turns used per trial during sessions 1, 2, 3 and 4 were 35.8 (S.D. = 18.60), 25.27 (*SD* = 3.17), 23.88 (*SD* = 2.70), and 25.50 (*SD* = 3.01), respectively. Closer inspection of the data indicates greater variability in the number of interaction turns for the AWS group than NFA group for session 1. However, this difference in variability between groups is reduced in subsequent sessions. Within session 1, the greatest variability in the number of turns used occurred during the first (AWS: *M* = 80.00, *SD* = 45.35; NFA: *M* = 66.60, *SD* = 25.56) and third trials (AWS: *M* = 28.00, S.D. = 50.22; NFA: *M* = 30.40, *SD* = 10.57) of session 1. This variability may be driven by outliers within the target and comparison groups. For the AWS group, during the first and third trials, Xavier and Olof (participant pair 4A) used 47% and 24% more turns than the average mean. Another target pair, Tebow and Cameron (participant pair 2A) used 22.8% more turns than the target group average during trial 3. For the NFA comparison group, during the first and third trials, Stella and Danny (participant pair 2B, comparison pair for Tebow and Cameron) used 41% and 39.2% more turns respectively than the group average. Within the AWS group for session 1, there was a 51.75% reduction in the number of interactional turns used from trial 1 to trial 2. In other words, by the second trial AWS pairs used less than turns than in the first trial. The reduction in the number of turns in the subsequent trials were varied, ranging between 27.46% (trial 2 to 3), 3.71% (trial 3 to 4), 11.00% (trial 4 to 5) and 5.00 % (trial 5 to 6). For the NFA group, the reduction in the number of turns used from trial 1 to trial 6 was 39. 64%, 24.38%, 15.79%, 3.13% to 3.03%, respectively.

Number of words used per trial. Contrary to prediction, there was no group difference in the number of words used per trial between the AWS and NFA groups (model: y = 4.50 + 0.13*words, z = 0.79, *p* = 0.43). As expected, the comparison groups showed a decrease in the number of words used across trials. However, contrary to what would be predicted by the stuttering literature, the target group also showed a decrease in the number of words across sessions and trials. Table 6 shows the average number of words across sessions and trials for both groups. Figure 8 is a line graph showing the average number of words used, a dramatic decrease in the number of words used after the first two trials of the first session for both groups can be seen in the graph. Both AWS and NFA groups used the highest number of words in the first trial in the first session (AWS: *M* = 716, *SD* = 269.79; NFA: *M* = 466.40, *SD* = 188.51) and the smallest number of words in last session of the barrier game (AWS: *M* = 47.2, *SD* = 30.57; NFA: *M* = 41.2, *SD* = 16.11). For AWS, the average number of words exchanged per trial for sessions 1, 2, 3 and 4 were 232.29 (*SD* = 252.73), 64.28 (*SD* = 27.91), 57.08 (*SD* = 29.07), and 54.40 (*SD* = 26.21), respectively. For NFA, the average number of words exchanged per trial during sessions 1, 2, 3 and 4 were 181.37 (*SD* = 161.07), 74.33 (*SD* = 30.93), 52.83 (*SD* = 22.11), and 48.27 (*SD* = 22.00), respectively. Closer inspection of the data indicates greater variability in the number of words used for the AWS group than NFA group for session 1. However, this difference in variability between groups is reduced in the subsequent sessions. Within the AWS group for session 1, there was a 63% reduction in the number of words used from trial 1 to trial 2. In other words, by the second trial AWS pairs used less than half of the words used in the first trial. Similarly, there was a dramatic reduction in the number of words in the subsequent trials, from 45.13% (trial 2 to 3), 26.31% (trial 3 to 4), 24.21% (trial 4 to 5) and 2.71% (trial 5 to 6). For the NFA group, there was also a reduction in the number of words used. The reduction in the number of words used from trial 1 to trial 6 in the first session for the NFA group was 54.25%, 39.27%, 24.85%, 8.62% and 3.82%, respectively.

Number of meaningful gestures used per trial. Contrary to prediction, there were no differences in the number of meaningful gestures used between AWS and NFA participant pairs (model: y = -0.54 + 0.28*gestures, z = 0.99, *p* = 0.32). As expected, the comparison groups showed a decrease in the number of meaningful gestures used across sessions and trials. However, contrary to expectation, the target group also displayed a decrease in the number of meaningful gestures used across trials. Table 7 shows the average number of gestures used for both groups. Figure 9 is a line graph showing the average number of meaningful gestures used, meaningful gestures were only used in the first few trials of the first session of the barrier game for both groups. The target group used meaningful gestures only during the first session of the barrier game, with the highest number of meaningful gestures per trial was recorded in the first trial (*M* = 16.00, *SD* = 12.65). In the second and third trials, the average number of gestures was reduced to 2 (*SD* = 3.46) and 0.60 (*SD* = 0.89), respectively. The average number of gestures used for AWS was 3.1 (*SD* = 7.67). In contrast, the comparison group used meaningful gestures in the first and second sessions of the barrier game. The highest average number of meaningful gestures used was 8.20 (*SD* = 4.32) in the first trial of the first session, while the lowest was recorded during the second trial of the second session (*M* = 0.2, *SD* = 0.45). The average number of gestures used for the NFA group was 2.23 (*SD* = 3.54) in the first session and 0.1 (*SD* = 0.40) in the second session. For AWS, the increased variability for the first session may be due to two outliers. Tom and Pat (participant pair 3A), and Noj and Tina (participant pair 5A) used 166% and 700% fewer meaningful gestures than the group mean during the first session respectively. Closer inspection of the data indicates greater variability in the number of gestures used for the AWS group than NFA group. Within the AWS group for session 1, there was a

87.50% reduction in the number of meaningful gestures used from trial 1 to trial 2. In other words, by the second trial AWS pairs used significantly less gestures in trial 2 than in the first trial. Similarly, there was a significant reduction of 70% in the number of turns used from trial 2 to 3. No gestures were used for the subsequent trials. For the NFA group, there was also a reduction in the number of gestures used across trials of the first session. The reduction in the number of turns used from trial 1 to trial 6 in the first session for the NFA group was 58.54%, 88.24%, 0%, 50% and 33.33% respectively.

Number of card placement sequence (CPS) per trial. There were a total of 2,766 CPS and ten (repair card placement sequence) RCPS across 240 in the study. Figure 10 shows the average number of CPS across all sessions and Table 8 shows the mean number of CPS and RCPS for all sessions and trials for target and comparison groups. There was a decrease in the number of CPS and RCPS per trial for target and comparison groups across sessions and trials. For AWS participant pairs, the average number of CPS coded per trial decreased slightly across sessions. The average number for CPS for sessions 1, 2, 3 and 4 were 11.8 (*SD* = 0.38), 11.6 (*SD* = 0.68), 11.3 (*SD* = 1.15) and 10.33 (*SD* = 2.40), respectively. The average number of RCPS for sessions 1 and 2 were 0.2 (*SD* = 0.55) and 0.03 (*SD* = 0.68), respectively. No RCPS were coded for sessions 3 and 4 for AWS pairs. For NFA comparison pairs, the average number for CPS for sessions 1, 2, 3 and 4 were 11.53 (*SD* = 2.01), 11.97 (*SD* = 0.18), 11.87 (*SD* = 0.43) and 11.60 (*SD* = 1.10), respectively. The average number of RCPS per trial for sessions 1 was 0.1 (*SD* = 0.40). No RCPS were coded for sessions 2, 3 and 4 for NFA comparison pairs.

Patterns of Disfluencies across Sessions

To compare the patterns of disfluencies across groups, the total number of disfluencies per trial across sessions, and proportion of stuttering-like disfluencies (SLD) and other disfluencies (OD) were evaluated. Additionally, in order to account for differences in the total number of words uttered by participants, a disfluencies coefficient was determined for each participant pair for all trials across all sessions. A coefficient of 1 would indicate a total of ten disfluencies per ten words uttered.

Number of disfluencies per sessions and trials. As expected, the number of disfluencies per trial was higher for the target than comparison group (model: y = 1.13 + 0.76*disfluencies, p=0.007). As predicted, there was a decrease in the average number of disfluencies across sessions and trials for the target and comparison groups. Table 9 shows the average number of disfluencies across sessions and trials for both groups. Figure 11 is a line graph displaying the average number of disfluencies per trial across all sessions. The average number of disfluencies per trial for AWS for session 1, 2, 3 and 4 were 21.50 (*SD* = 33.78), 3.60 (*SD* = 4.04), 3.07 (*SD* = 2.55), and 2.83 (*SD* = 3.16), respectively. For NFA pairs, there was a similar but less dramatic trend of decrease. The average number of disfluencies for NFA pairs for session 1, 2, 3 and 4 were 6.63 (*SD* = 7.74), 2.67 (*SD* = 3.19), 1.40 (*SD* = 1.67), and 1.20 (*SD* = 1.99), respectively. Across trials, the highest number of disfluencies was found in the first trial of the first session for both groups with an average of 76.60 (*SD* = 54.04) disfluencies for AWS pairs and 20.60 (*SD* = 9.29) for NFA pairs. For the AWS group, the lowest number of disfluencies (*M* = 0.40, *SD* = 0.55) was recorded for the fourth trial of the last session, while the NFA group did not display any disfluencies in the third trial of the fourth session. Within the AWS group for session 1, there was a dramatic decreased in the number of disfluencies across trials. The reduction across trials 1 to 6 for session 1 was 73.37%, 28. 43%, 46.58%, 25.64%, and 34.48%, respectively. For the NFA group, there was also a reduction in the number of disfluencies across trials of the first session. The reduction in the number of disfluencies across trial 1 to trial 6 in the first session for the NFA group was 67.96%, 15.15%, 60.71%, 18.18% and 15.38%, respectively.

The disfluencies coefficient which accounts for differences in the total number of words uttered between participant pairs also show the expected pattern of a higher number of disfluencies per ten words was higher in AWS pairs than NFA pairs. As expected, the number of disfluencies per ten words was also higher in the AWS participants than their FCP during the barrier game. Table 10 shows the total number of disfluencies per ten words for each AWS and their FCP across all sessions and trials. In a number of cases the number of disfluencies in AWS was lower than those of their FCP (see participant pair 1A, Session 2 Trial 1 and Session 4 Trial 1; participant pair 2A, Session 3 trial 5 and Session 4 Trial 1; participant pair 3A, Session 1 Trial 5, Session 3 Trial 2, and Session 4 Trial 4; participant pair 5A, Session 3 Trial 4). Table 11 shows the total number of disfluencies per ten words for each AWS and their FCP across all sessions and trials. The disfluencies coefficient for comparison pairs indicates that the number of disfluencies per ten words was higher in the NFA participants compared to their FCP. A line graph of the number of disfluencies per CPS for each participant pair can be found in Appendix L. Across all CPS, there were an average of 0.08 (*SD* = 0.04) disfluencies per ten words for the target group and 0.03 (*SD* = 0.01) disfluencies per ten words for the comparison group. For the number of disfluencies per ten words for the interview session for each participant see Appendix M.

Types of disfluencies (proportion of SLD and OD). An unexpected finding was that the patterns of SLD and OD produced during the barrier task were similar in both the target and the comparison groups. Across all sessions and trials, the proportion of OD was higher than SLD for both target (OD = 0.63, SLD = 0.37) and comparison groups (OD = 0.76, SLD = 0.24). Tables 12 and 13, show the total number and proportion of SLD and OD for each of the target and comparison pairs across all sessions and trials respectively. For both groups, interjections made up the highest proportion of disfluencies (AWS = 0.45, NFA = 0.61) while multisyllabic repetitions were the least common (AWS = 0.014, NFA = 0.008). For comparisons, blocks were also as uncommon as multisyllabic repetitions (0.008). Figure 12 and 13 are line graphs displaying the average number of SLD, average number of OD and average number of words used across all sessions and trials for both the target and comparison groups respectively. Tables for the proportions of SLD and OD for AWS and NFA groups across all trials in all four sessions can be found in Appendix N.

Development and Use of Specific Card Labels

To examine the pattern of development and use of specific card labels between groups, initiating referencing expressions for each card placement were categorized into eight different categories that reflect the levels of confidence of participant pairs in their interaction and use of initiating referencing expressions. Descriptive referencing expressions were regarded as the least confident while elementary (definite) expressions revealed most confidence.

Initiating referencing expressions. Contrary to expectation, target pairs appeared to settle on the specific card labels at the same rate as comparison pairs. For both groups, the initiating referencing expressions for each card placement sequence stabilized and simplified across trial. For example, in the first trial of the first session Tom and Pat described as card as *looks like somebody standing on one leg with his hind leg back*, this expressions was shortened to *person with the leg behind them* in the second trial, *leg in the air* in trial 3, *leg behind her* in trial 4, *leg behind his* in trial 5, and *leg behind* in trial 6 and in subsequent sessions. The use of elementary expressions increased across sessions and trials for both groups. Figure 14 is a bar chart that displays the number of initiating referencing expressions coded into different categories across all four sessions. Table 14 and 15 displays the total number and percentage of types of referencing expressions in the eight different categories for the target and comparison groups respectively. For target pairs, elementary expressions increased from 71.39% in session 1 to 93.84%, 99.4% and 96.67% in sessions 2, 3 and 4, respectively. Initiating expressions coded as other (0.83%) and proxy (0.83%) were the least common expressions in session 1. In the subsequent sessions, there was an absence of description (0%) and proxy (0%) expressions. For comparison pairs, elementary expressions increased from 73.33% in session 1 to 96.94%, 97.79% and 98.89 % in sessions 2, 3 and 4, respectively. Proxy (0.28%) expression was the least common type of expression in session 1. Similar to target pairs, there was an absence of description (0%) and proxy (0%) expressions in the subsequent trials in comparison pairs.

Summary

What was striking in these findings was how similar the two groups were in their collaborative effort and learning. As expected, no difference was found in the accuracy of card placements. Both the AWS and NFA groups were also similar in the time needed to complete trials, number of interactional turns, number of words exchanged, number of gestures used, and the number of CPS coded as basic exchanges. Also, as expected, the number of disfluencies was higher in the target group than the comparison group. Overall, both groups also showed a decrease across sessions and trials, being highest in the initial trials of the first session and decreasing dramatically in subsequent trials. Also, unexpected was the proportion of SLD and OD displayed by the target group. Interestingly, the AWS group appeared to show more within group variability in the measures of collaborative effort than the NFA groups. Both the target and comparison groups featured more OD than SLD. Finally, both groups displayed similar patterns of development and use of initiating referencing expressions. The target group displayed increasing levels of confidence in the task at a similar rate to the comparison group, using fewer descriptive references and more definite expressions across sessions and trials.

Table 4.

Average time needed to complete trials across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials.

Session	Trial	AWS pairs		NFA pairs		Total	
		M	*SD*	*M*	*SD*	*M*	*SD*
1	1	**303.20**	**127.88**	**312.00**	**117.71**	**245.20**	**131.01**
	2	122.80	36.83	87.20	28.76	45.20	36.37
	3	**96.40**	**69.74**	**66.80**	**22.69**	**81.60**	**51.32**
	4	62.02	17.68	54.40	19.62	58.30	18.08
	5	**40.20**	**19.20**	**50.20**	**17.46**	**45.20**	**18.08**
	6	41.80	5.85	48.80	23.04	45.30	16.27
	M	111.10		82.43		96.77	
	SD	108.36		68.65		91.09	
2	1	**59.00**	**15.31**	**47.00**	**24.40**	**53.00**	**20.22**
	2	37.00	15.68	48.60	24.28	42.80	20.21
	3	**35.60**	**10.14**	**37.00**	**12.25**	**36.30**	**10.63**
	4	31.00	7.07	31.80	15.09	31.40	11.12
	5	**34.00**	**9.19**	**32.20**	**11.48**	**33.10**	**9.85**
	6	30.00	19.11	35.40	15.37	32.70	16.59
	M	37.77		38.67		38.22	
	SD	15.77		17.69		16.62	
3	1	**28.00**	**14.66**	**33.40**	**11.44**	**30.70**	**12.72**
	2	28.80	17.40	32.00	10.72	30.40	13.73
	3	**34.20**	**5.50**	**31.00**	**11.60**	**32.60**	**8.72**
	4	32.00	6.44	30.40	10.71	31.20	8.38
	5	**33.20**	**8.58**	**35.80**	**10.43**	**34.50**	**9.11**
	6	32.80	12.83	25.80	9.18	29.30	11.15
	M	31.50		31.40		31.45	
	SD	10.94		10.23		10.50	
4	1	**39.40**	**11.15**	**33.00**	**50.92**	**36.20**	**11.66**
	2	34.80	8.07	38.20	26.81	36.50	18.75
	3	**30.60**	**7.40**	**35.00**	**13.27**	**32.80**	**10.39**
	4	30.60	7.09	34.20	22.65	32.40	15.94
	5	**32.40**	**5.32**	**29.20**	**14.66**	**30.80**	**10.41**
	6	32.20	12.50	29.00	15.89	30.60	13.58
	M	33.33		33.10		33.22	
	SD	8.70		17.04		13.41	

Bolded: Trials where the directors were the participants who stutter or normally fluent adults.

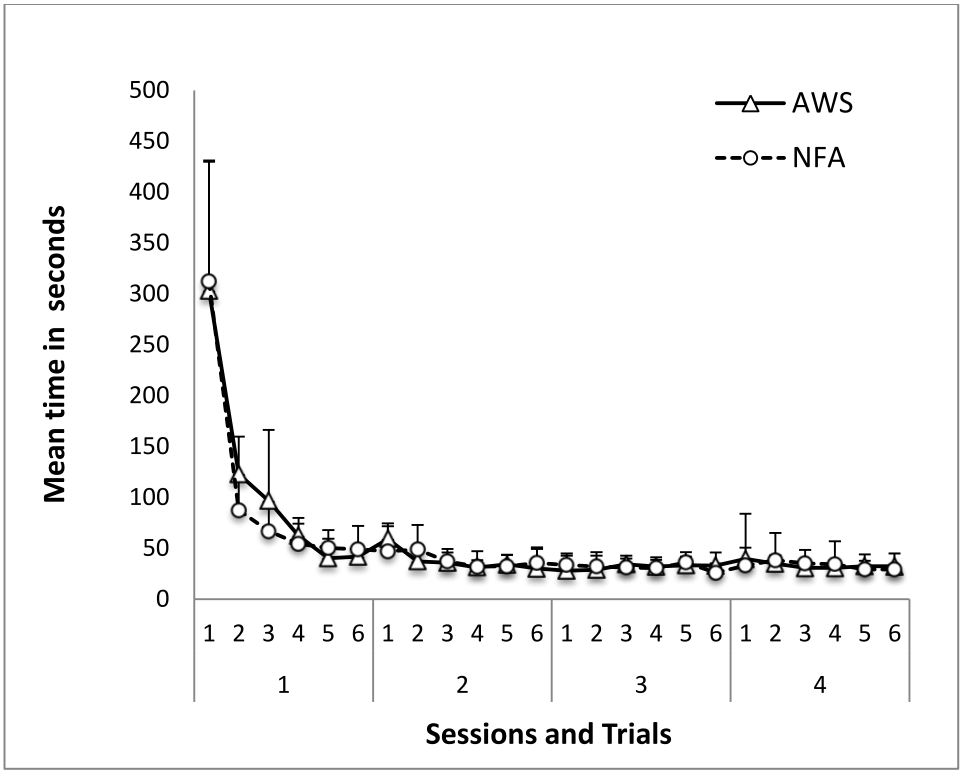

Figure 6. The average time needed to complete each trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials. Overall, there were no group differences in the time need to complete trials. Both target and comparison groups got faster in the barrier games across trials and sessions. They were slowest in the first trial of the first session. Error bars indicate standard deviation.

Table 5.

Average number of interactional turns used per trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials.

Session	Trial	AWS pairs		NFA pairs		Total	
		M	*SD*	*M*	*SD*	*M*	*SD*
1	1	**80.00**	**45.35**	**66.60**	**25.56**	**73.30**	**35.42**
	2	38.60	11.80	40.20	10.43	39.40	10.53
	3	**28.00**	**50.22**	**30.40**	**10.57**	**29.20**	**7.44**
	4	26.96	3.33	25.60	2.61	26.28	2.91
	5	**24.00**	**0.00**	**26.40**	**2.88**	**25.20**	**2.30**
	6	25.20	2.68	25.60	1.67	25.40	2.12
	M	37.13		35.80		36.46	
	SD	26.65		3.53		22.80	
2	1	**21.76**	**3.23**	**27.20**	**6.22**	**24.48**	**5.48**
	2	23.00	2.24	25.40	1.34	24.20	2.15
	3	**22.80**	**3.90**	**24.80**	1**.79**	**23.80**	**3.05**
	4	23.00	1.73	24.20	0.45	23.60	1.35
	5	**23.20**	**1.79**	**24.00**	**0.00**	**23.60**	**1.26**
	6	24.40	0.89	26.00	4.47	25.20	3.16
	M	23.03		25.27		24.15	
	SD	2.41		3.17		3.01	
3	1	**26.00**	**3.08**	**24.20**	**0.45**	**25.10**	**2.28**
	2	26.40	2.88	23.80	0.45	25.10	2.38
	3	**24.80**	**1.30**	**24.00**	**0.00**	**24.40**	**0.97**
	4	24.40	1.82	24.00	0.00	24.20	1.23
	5	**24.00**	**1.41**	**25.70**	**3.56**	**24.85**	**2.71**
	6	24.40	0.89	24.00	0.00	24.20	0.63
	M	25.00		24.28		24.64	
	SD	2.08		1.50		1.83	
4	1	**23.80**	**0.45**	**24.40**	**0.89**	**24.10**	**0.74**
	2	24.00	0	25.80	3.03	24.90	2.42
	3	**22.80**	2.68	**25.80**	**4.03**	**24.30**	**3.59**
	4	23.80	0.45	26.20	3.90	25.00	2.91
	5	**23.80**	**0.45**	**26.00**	**4.47**	**24.90**	**3.21**
	6	22.40	2.61	24.80	1.10	23.60	2.27
	M	23.43		25.50		24.47	
	SD	1.63		3.01		2.62	

Bolded: Trials where the directors were the participants who stutter or normally fluent adults.

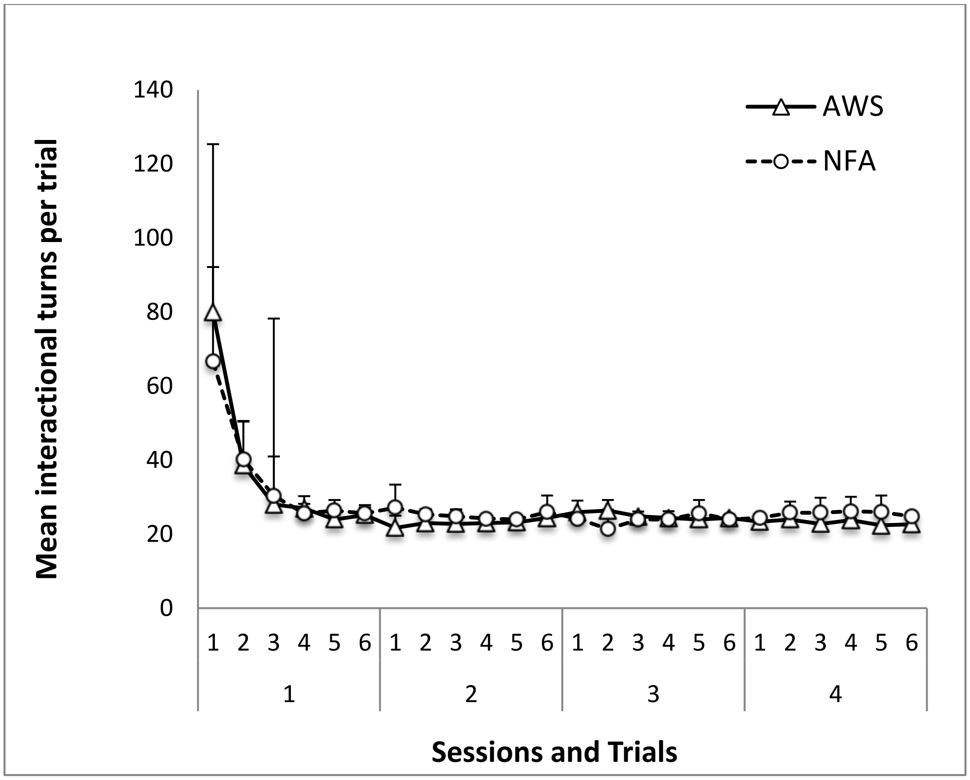

Figure 7. The average number interactional turns used per trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials. There was no group difference in the number of interactional turns used across sessions and trials. Both groups used less turns across trials with the highest number of turns used in the first trial of the first session. Error bars indicate standard deviation.

Table 6.

Average number of words exchanged per trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials.

Session	Trial	AWS pairs		NFA pairs		Total	
		M	*SD*	*M*	*SD*	*M*	*SD*
1	1	**716.00**	**269.79**	**466.40**	**188.51**	**591.20**	**35.42**
	2	265.00	72.24	213.40	76.71	239.20	75.33
	3	**145.40**	**50.22**	**129.60**	**82.34**	**137.50**	**64.84**
	4	107.14	21.45	97.40	40.83	102.27	31.17
	5	**81.20**	**24.44**	**89.00**	**36.49**	**85.10**	**29.57**
	6	79.00	27.87	92.40	36.48	85.70	31.41
	M	232.29		181.37		206.83	
	SD	252.73		161.07		211.68	
2	1	**76.60**	**38.38**	**93.00**	**48.58**	**84.80**	**42.17**
	2	62.80	24.75	81.20	29.41	72.00	27.40
	3	**60.90**	**25.61**	**73.20**	**29.54**	**67.05**	**26.86**
	4	55.60	23.30	65.00	19.51	60.30	20.85
	5	**62.00**	**29.25**	**66.00**	**30.81**	**64.00**	**28.40**
	6	67.80	34.40	67.60	27.56	67.70	29.39
	M	64.28		74.33		69.31	
	SD	27.91		30.93		29.64	
3	1	**60.20**	**28.66**	**61.00**	**23.18**	**60.60**	**24.58**
	2	62.20	27.81	55.80	20.83	59.00	23.40
	3	**61.60**	**23.20**	**50.40**	**22.21**	**56.00**	**22.21**
	4	47.54	33.03	46.80	20.28	47.17	25.84
	5	**48.60**	**27.65**	**54.40**	**29.86**	**51.50**	**27.30**
	6	62.44	42.77	48.60	24.56	55.52	33.68
	M	57.10		52.83		54.97	
	SD	29.07		22.11		25.70	
4	1	**61.39**	**26.75**	**54.20**	**27.12**	**57.80**	**25.68**
	2	51.80	33.05	41.20	16.11	46.50	25.29
	3	**58.00**	**28.38**	**51.40**	**30.90**	**54.70**	**28.19**
	4	47.20	30.57	50.40	25.11	48.80	26.43
	5	**59.00**	**21.55**	**55.80**	**17.58**	**57.40**	**18.62**
	6	49.00	27.16	36.60	15.96	42.80	21.99
	M	54.40		48.27		51.33	
	SD	26.21		22.00		24.19	

Bolded: Trials where the directors were the participants who stutter or normally fluent adults.

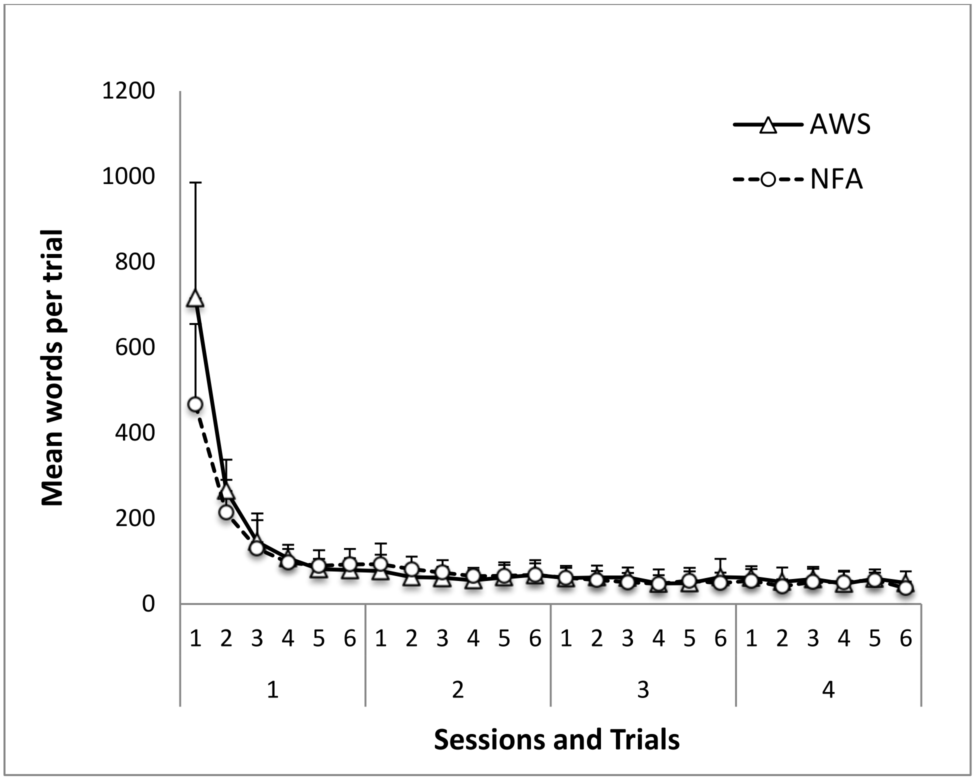

Figure 8. The average number of words exchanged per trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials. Overall, no group differences were found in the number of words exchanged across trials. There was a decrease in the number of words used across sessions and trials, with the highest number of words exchanged for the first trial of the first session. Error bars indicate standard deviation.

Table 7.

Average number of meaningful gestures used per trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials.

Session	Trial	AWS pairs		NFA pairs		Total	
		M	*SD*	*M*	*SD*	*M*	*SD*
1	1	**16.00**	**12.65**	**8.20**	**4.32**	**12.10**	**9.81**
	2	2.00	3.46	3.40	2.88	2.70	3.09
	3	**0.60**	**0.89**	**0.40**	**0.55**	**0.50**	**0.71**
	4	0	0	0.40	0.89	0.20	0.63
	5	**0**	**0**	**0.60**	**0.55**	**0.30**	**0.48**
	6	0	0	0.40	0.55	0.20	0.42
	M	3.10		2.23		2.67	
	SD	7.67		3.53		5.94	
2	1	**0**	**0**	**0.40**	**0.89**	**0.20**	**0.63**
	2	0	0	0.20	0.45	0.10	0.32
	3	**0**	**0**	**0**	**0**	**0**	**0**
	4	0	0	0	0	0	0
	5	**0**	**0**	**0**	**0**	**0**	**0**
	6	0	0	0	0	0	0
	M	0		0.10		0.05	
	SD	0		0.40		0.29	
3	1	**0**	**0**	**0**	**0**	**0**	**0**
	2	0	0	0	0	0	0
	3	**0**	**0**	**0**	**0**	**0**	**0**
	4	0	0	0	0	0	0
	5	**0**	**0**	**0**	**0**	**0**	**0**
	6	0	0	0	0	0	0
	M	0		0		0	
	SD	0		0		0	
4	1	**0**	**0**	**0**	**0**	**0**	**0**
	2	0	0	0	0	0	0
	3	**0**	**0**	**0**	**0**	**0**	**0**
	4	0	0	0	0	0	0
	5	**0**	**0**	**0**	**0**	**0**	**0**
	6	0	0	0	0	0	0
	M	0		0		0	
	SD	0		0		0	

Bolded: Trials where the directors were the participants who stutter or normally fluent adults.

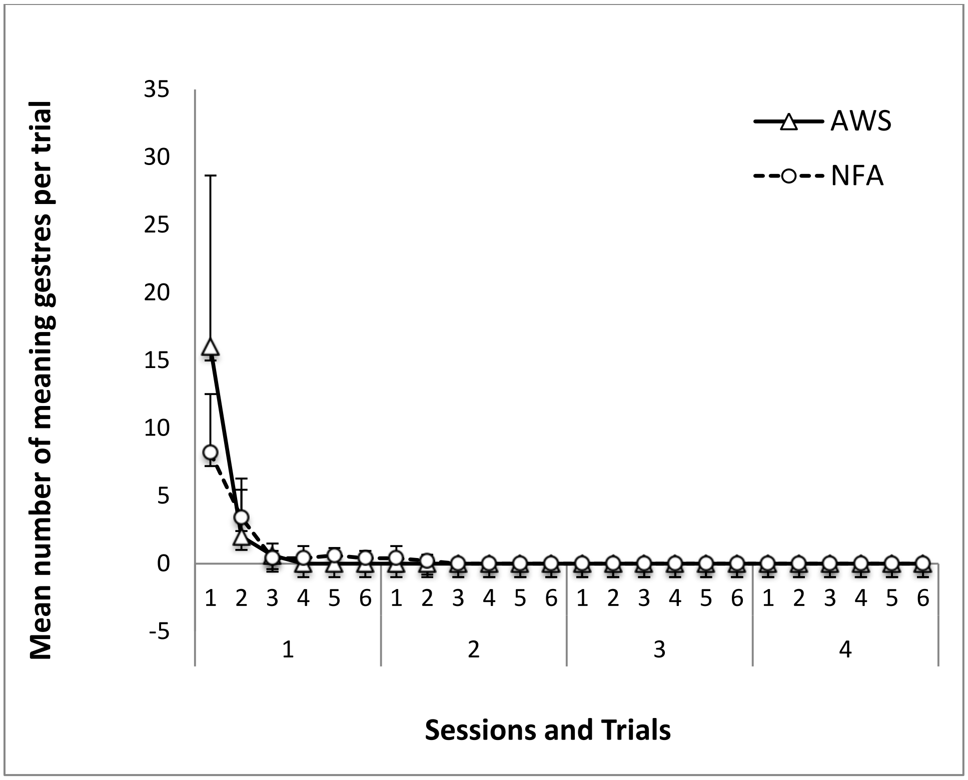

Figure 9. The average number meaningful gestures used per trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials. Overall, there were no group differences in the number of meaningful gestures. Both groups used less meaningful gestures across trials. Error bars indicate standard deviation.

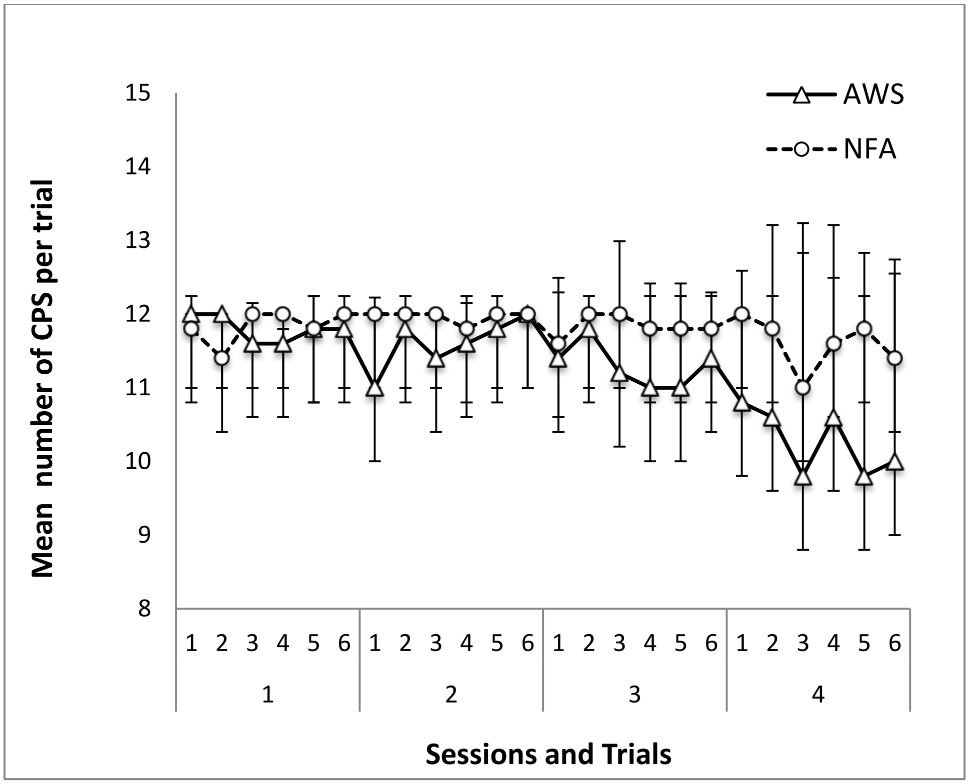

Figure 10. The average number of card placement sequences (CPS) coded as basic exchanges per trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials. Across trials and session, there was a decrease in the CPS. Error bars indicate standard deviation.

Table 8.

Mean number of card placement sequences (CPS) and repair card placement sequence (RCPS) for across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across sessions and trials.

		AWS				NFA			
		CPS		RCPS		CPS		RCPS	
Session	Trial	*M* (*SD*)	Range	*M* (*SD*)	Range	*M* (*SD*)	Range	*M* (*SD*)	Range
1	1	**12.00 (0)**	**0**	**0.60 (0.89)**	**0-2**	**11.80 (0.45)**	**11-12**	**0.6 (8.89)**	**0-2**
	2	12.00 (0)	0	0.40 (0.89)	0-2	11.40 (0.55)	11-12	0	0
	3	**11.60 (0.55)**	**11-12**	**0**	**0**	**12.00 (0)**	**0**	**0**	**0**
	4	11.60 (0.20)	11-12	0.20 (0.45)	0-1	12.00 (0)	0	0	0
	5	**11.80 (0.45)**	**11-12**	**0**	**0**	**11.80 (0.45)**	**11-12**	**0**	**0**
	6	11.80 (0.45)	11-12	0	0	12.00 (0)	**0**	0	0
2	1	**11.00 (1.22)**	**9-12**	**0**	**0**	**12.00 (0)**	**0**	**0**	**0**
	2	11.80 (0.45)	11-12	0	0	12.00 (0)	0	0	0
	3	**11.40 (0.55)**	**11-12**	**0**	**0**	**12.00 (0)**	**0**	**0**	**0**
	4	11.60 (0.55)	11-12	0.20 (0.45)	0-1	11.80 (0.45)	11-12	0	0
	5	**11.80 (0.45)**	**11-12**	**0**	**0**	**12.00 (0)**	**0**	**0**	**0**
	6	12.00 (0)	0	0	0	12.00 (0)	0	0	0
3	1	**11.40 (0.89)**	**10-12**	**0**	**0**	**11.60 (0.89)**	**10-12**	**0**	**0**
	2	11.80 (0.45)	11-12	0	0	12.00 (0)	0	0	0
	3	**11.20 (1.79)**	**8-12**	**0**	**0**	**12.00 (0)**	**0**	**0**	**0**
	4	11.00 (1.41)	9-12	0	0	11.80 (0.45)	11-12	0	0
	5	**11.00 (1.41)**	**9-12**	**0**	**0**	**11.80 (0.45)**	**11-12**	**0**	**0**
	6	11.40 (0.89)	10-12	0	0	11.80 (0.45)	11-12	0	0
4	1	**10.80 (1.79)**	**8-12**	**0**	**0**	**12 (0)**	**0**	**0**	**0**
	2	10.60 (2.61)	6-12	0	0	11.80 (0.45)	11-12	0	0
	3	**9.80 (3.03)**	**6-12**	**0**	**0**	**11.00 (2.24)**	**7-12**	**0**	**0**
	4	10.60 (2.61)	6-12	0	0	11.60 (0.89)	10-12	0	0
	5	**9.80 (3.03)**	**6-12**	**0**	**0**	**11.80 (0.45)**	**11-12**	**0**	**0**
	6	10.00 (2.55)	6-12	0	0	11.40 (1.34)	9-12	0	0

Bolded: Trials where the directors were the participants who stutter or normally fluent adults.

Table 9.
Average number of disfluencies per trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials.

Session	Trial	AWS pairs		NFA pairs		Total	
		M	*SD*	*M*	*SD*	*M*	*SD*
1	1	**76.60**	**54.04**	**20.60**	**9.29**	**44.90**	**40.80**
	2	20.40	22.11	6.60	3.29	13.90	13.90
	3	**14.60**	**6.35**	**5.60**	**2.30**	**7.50**	**6.95**
	4	7.80	2.77	2.20	1.79	4.40	3.06
	5	**5.80**	**4.71**	**2.60**	**2.41**	**3.30**	**2.54**
	6	3.80	1.64	2.20	2.86	2.50	2.42
	M	21.50		6.63		12.75	
	SD	33.78		7.74		23.11	
2	1	**8.00**	**6.96**	**4.40**	**3.21**	**6.70**	**4.62**
	2	2.20	1.79	5.20	5.26	2.50	2.12
	3	**4.60**	**3.13**	**1.80**	**1.79**	**2.20**	**2.30**
	4	1.80	2.05	1.80	2.49	1.80	2.39
	5	**4.20**	**3.11**	**1.80**	**1.79**	**2.80**	**2.66**
	6	0.80	0.84	1.00	2.24	0.70	1.25
	M	3.60		2.67		2.78	
	SD	4.04		3.19		3.24	
3	1	**5.20**	**3.11**	**1.20**	**1.79**	**2.80**	**2.78**
	2	2.20	1.64	0.80	1.30	1.20	1.40
	3	**4.60**	**2.51**	**1.80**	**1.79**	**3.00**	**3.33**
	4	2.00	1.63	1.60	2.51	1.60	1.96
	5	**3.60**	**2.88**	**1.60**	**1.52**	**2.60**	**2.55**
	6	1.00	0.71	1.40	1.67	0.80	0.79
	M	3.07		1.40		2.00	
	SD	2.55		1.67		2.36	
4	1	**6.00**	**3.32**	**1.40**	**1.14**	**3.50**	**3.03**
	2	1.20	1.10	1.40	3.13	1.00	2.21
	3	**4.80**	**3.56**	**0.00**	**0.00**	**1.60**	**3.06**
	4	0.40	0.55	0.80	1.79	0.90	1.37
	5	**3.20**	**3.11**	**1.80**	**2.05**	**2.20**	**2.53**
	6	1.40	2.61	1.80	2.68	1.20	**1**.99
	M	2.83		1.20		1.73	
	SD	3.16		1.99		2.50	

Bolded: Trials where the directors were the participants who stutter or normally fluent adults.

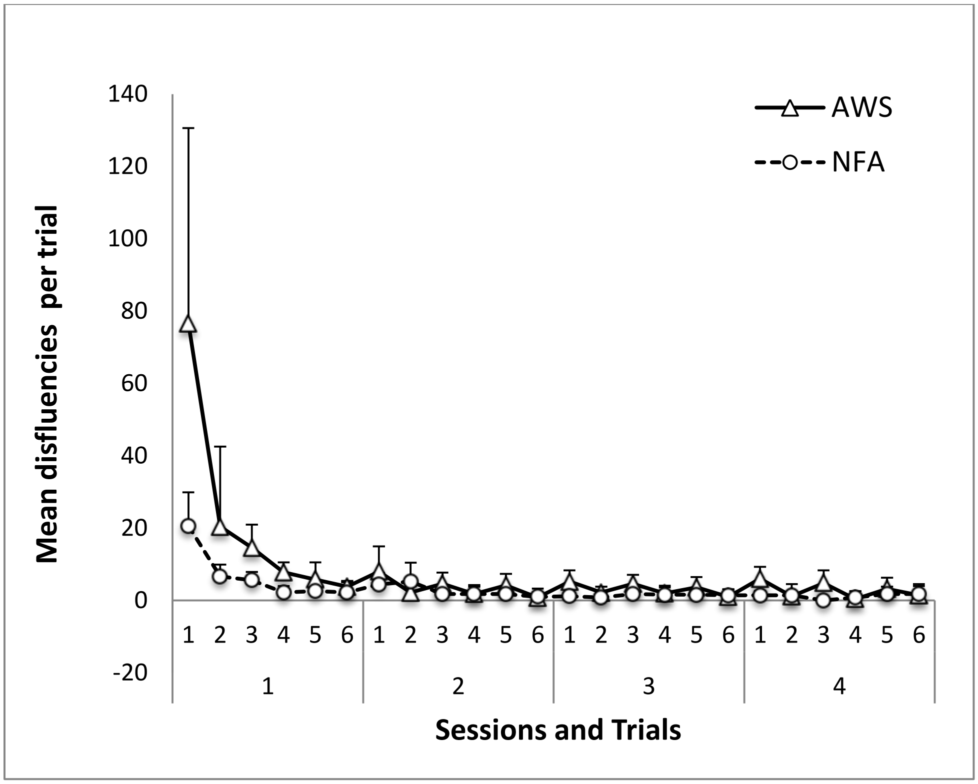

Figure 11. The average number of disfluencies per trial across five pairs in each target (adults who stutter; AWS) and comparison (normally fluent adults; NFA) group across four sessions consisting of 24 trials. Overall, there were more disfluencies for the target than comparison group. Across sessions and trials, the number dislfuencies decreased for both groups. Error bars indicate standard deviation.

Table 10.

The total number of disfluencies per 10 words for each target adult who stutter (AWS) and their familiar communication partners (FCP).

Session	Trial	AWS (FCP)				
		1A	2A	3A	4A	5A
1	1	**0.74 (0.61)**	**0.71 (0.58)**	**1.60 (0.14)**	**2.11 (0)**	**0.19 (0)**
	2	0.85 (0.67)	0.32 (0.46)	0.38 (0.59)	2.32 (1.10)	0.24 (0.15)
	3	**0.70 (0)**	**1.22 (0.26)**	**1.00 (0)**	**2.26 (0.92)**	**0 (0)**
	4	0 (0.59)	0.36 (0.37)	2.71 (0)	2.35 (0)	0 (0.70)
	5	**0.49 (0)**	**0.70 (0)**	**0 (1.76)**	**0.15 (0)**	**1.58 (0)**
	6	0 (0.25)	0 (0.76)	2.22 (0)	0.40 (0)	0 (0.70)
	M	0.46 (0.35)	0.55 (0.41)	1.32 (1.05)	1.60 (0.34)	0.33 (0.26)
	SD	0.38 (0.31)	0.42 (0.26)	0.42 (0.70)	1.03 (0.52)	0.62 (0.35)
2	1	**0.51 (0.71)**	**0 (0.38)**	**2.94 (0)**	**2.11 (0)**	**1.14 (0)**
	2	0.59 (0.13)	1.43 (0.67)	0 (0.50)	1.18 (0)	0 (0)
	3	**0.34 (0)**	**0 (0)**	**2.19 (0)**	**0.78 (0)**	**0 (0)**
	4	0 (0.73)	0.71 (0.75)	0 (0)	2.50 (0)	0 (0)
	5	**0.33 (0)**	**0 (0.21)**	**1.79 (0)**	**1.88 (0)**	**0.65 (0)**
	6	0.83 (0)	0 (0.12)	0 (0)	2.50 (0)	0 (0)
	M	0.43 (0.26)	0.36 (0.36)	1.15 (0.08)	1.82 (0)	0.30 (0)
	SD	0.28 (0.36)	0.60 (0.30)	1.32 (0.20)	0.71 (0)	0.49 (0)
3	1	**0.33 (0)**	**1.43 (0)**	**1.90 (0)**	**1.48 (0)**	**1.32 (0)**
	2	0 (0.33)	0.86 (0)	0 (1.67)	0.87 (0)	0 (0)
	3	**0.24 (0)**	**0.32 (0.23)**	**1.84 (0)**	**2.04 (0)**	**1.67 (0)**
	4	0 (0.11)	1.00 (0.43)	0 (0)	2.31 (0)	0 (0.81)
	5	**0.49 (0)**	**0.38 (0.83)**	**1.88 (0)**	**0 (0)**	**2.22 (0)**
	6	0 (0.10)	0.56 (0)	0 (0)	0.59 (0)	0 (0.11)
	M	0.18(0.09)	0.76 (0.25)	0.94 (0.28)	1.21 (0)	0.87 (0.15)
	SD	0.21(0.13)	0.42 (0.34)	1.03 (0.68)	0.89 (0)	0.99 (0.32)
4	1	**0.11 (1.54)**	**0.44 (0.57)**	**2.57 (0)**	**0.73 (0.37)**	**2.40 (2.50)**
	2	0 (0.24)	0 (0)	0 (0)	0 (0)	0
	3	**0 (1.54)**	**0.26 (0)**	**2.78 (0)**	**0 (0)**	**0**
	4	0 (0)	0 (0)	0 (0.50)	0 (0)	0
	5	**0.12 (0)**	**0 (0)**	**1.88 (0)**	**0 (0)**	**1.62 (0)**
	6	0 (0.13)	0 (0)	0 (0)	0 (0)	0 (0)
	M	0.04 (0.57)	0.12 (0.10)	1.20 (0.08)	0.12 (0.06)	0.67 (0.42)
	SD	0.06 (0.75)	0.19 (0.23)	1.35 (0.20)	0.30 (0.15)	1.07 (1.02)

Bolded: Trials where the directors were participants who stutter.

Table 11.

The total number of disfluencies per 10 words for each comparison normally fluent adult and their familiar communication partners (FCP).

Session	Trial	NFA (FCP) 1B	2B	3B	4B	5B
1	1	**0.90 (0)**	**0.50 (0.25)**	**0.25 (0.11)**	**1.31 (0.09)**	**0.63 (0.08)**
	2	0.33 (0.42)	0.14 (0.09)	0 (0.57)	0.60 (0.04)	0.34 (0.43)
	3	**0.47 (0)**	**0.26 (0.14)**	**0.69 (0)**	**0.71 (0)**	**0.43 (0.20)**
	4	0 (0.14)	0.24 (0.17)	0.0 (0.23)	0.53 (0.04)	0 (0.12)
	5	**0.51 (0)**	**0.21 (0)**	**0.33 (0)**	**0.40 (0)**	**0.14 (0)**
	6	0.79 (0.16)	0 (0)	0 (0)	0.45 (0.07)	0 (0)
	M	0.50 (0.12)	0.23 (0.11)	0.21 (0.15)	0.67 (0.04)	0.25 (0.14)
	SD	0.32 (0.16)	0.17 (0.10)	0.28 (0.22)	0.34 (0.04)	0.25 (0.16)
2	1	**0.59 (0)**	**2.31 (0.11)**	**1.15 (0)**	**0.79 (0)**	**0.17 (0)**
	2	0 (0.27)	0 (4.44)	0 (0.07)	0 (0.07)	0 (0.48)
	3	**0.40 (0)**	**0 (0)**	**0 (0)**	**0.41 (0)**	**0.34 (0)**
	4	0 (0)	0 (2.86)	0 (0)	0 (0.08)	0 (0)
	5	**0.28 (0)**	**1.67 (0.11)**	**0 (0)**	**0 (0)**	**0.57 (0)**
	6	0 (0)	0 (0)	0 (0.05)	0 (0.05)	0 (0)
	M	0.21 (0.04)	0.66 (1.25)	0.19 (0)	0.20 (0.03)	0.18 (0.08)
	SD	0.25 (0.11)	1.05 (1.92)	0.47 (0)	0.33 (0.04)	0.23 (0.20)
3	1	**0 (0)**	**0 (0)**	**0 (0)**	**0.46 (0)**	**0 (0)**
	2	0 (0)	0 (0)	0 (0)	0 (0.05)	0 (0)
	3	**0.29(0)**	**0 (0)**	**0 (0)**	**0.41 (0)**	**0 (0)**
	4	0 (0.23)	0 (0)	0 (0)	0 (0.09)	0 (0)
	5	**0.29 (0)**	**0 (0)**	**0.54 (0.63)**	**0 (0)**	**0 (0)**
	6	0.91 (0.15)	0 (0)	0 (0)	0 (0.03)	0 (0)
	M	0.25 (0.06)	0 (0)	0.09 (0.10)	0.14 (0.03)	0 (0)
	SD	0.35 (0.10)	0 (0)	0.22 (0.26)	0.23 (0.04)	0 (0)
4	1	**0.51 (0)**	**1.50 (0)**	**0 (0)**	**0 (0.08)**	**0 (0.83)**
	2	0 (0)	0 (0)	0 (0)	2.78 (0.06)	2.78 (0.65)
	3	**0 (0)**	**0.23 (0.19)**	**0 (0)**	**0 (0.09)**	**0 (0.91)**
	4	0 (0)	0.22 (0)	0 (0)	0.65 (0.04)	0.65 (0.35)
	5	**0.74 (0)**	**0.83 (0.30)**	**0 (0)**	**0.61 (0)**	**0.61 (0)**
	6	3.13 (0.21)	0 (0)	0 (0)	0 (0.14)	0 (1.43)
	M	0.72 (0.03)	0.46 (0.08)	0 (0)	0.67 (0.05)	0.67 (0.69)
	SD	1.22 (0.09)	0.59 (0.13)	0 (0)	1.08 (0.05)	1.08 (0.49)

Bolded: Trials where the directors were the normally fluent adults.

Table 12.

Total number and proportion (in parentheses) of stuttering-like (SLD) and other disfluencies (OD) across all sessions for the target group of adults who stutter (AWS).

	SLD						OD					Total SLD and OD
Session	PW	SS	WW	BL	PO	Total	ML	P	R	I	Total	
1	56 (0.09)	71 (0.11)	76 (0.12)	19 (0.03)	57 (0.09)	**279 (0.43)**	7 (0.01)	38 (0.06)	77 (0.12)	244 (0.38)	**366 (0.57)**	**645 (1)**
2	4 (0.04)	2 (0.02)	2 (0.02)	6 (0.06)	24 (0.22)	**38 (0.35)**	1 (0.01)	2 (0.02)	9 (0.08)	58 (0.54)	**70 (0.69)**	**108 (1)**
3	4 (0.03)	3 (0.03)	9 (0.07)	5 (0.04)	6 (0.05)	**27 (0.22)**	4 (0.03)	2 (0.02)	15 (0.12)	74 (0.61)	**95 (0.78)**	**92 (1)**
4	5 (0.05)	1 (0.01)	5 (0.05)	2 (0.02)	7 (0.07)	**20 (0.19)**	2 (0.02)	5 (0.05)	12 (0.11)	68 (0.64)	**87 (0.81)**	**85 (1)**
Total (Overall proportions)	**69 (0.07)**	**77 (0.08)**	**92 (0.09)**	**32 (0.03)**	**94 (0.10)**	**364 (0.37)**	**14 (0.01)**	**47 (0.05)**	**113 (0.12)**	**444 (0.45)**	**618 (0.63)**	**930 (1)**

Table 13.

Total number and proportion (in parentheses) of stuttering-like (SLD) and other disfluencies (OD) across all sessions for the comparison group of normally fluent adults (NFA).

Session	SLD						OD					**Total SLD and OD**
	PW	SS	WW	BL	PO	Tota l	ML	P	R	I	Total	
1	5 (0.03)	10 (0.05)	12 (0.06)	3 (0.02)	14 (0.07)	**44 (0.22)**	3 (0.02)	3 (0.02)	31 (0.17)	107 (0.57)	**155 (0.78)**	**199 (1)**
2	5 (0.06)	2 (0.03)	2 (0.03)	0 (0.0)	10 (0.13)	**19 (0.24)**	0 (0.0)	0 (0.0)	9 (0.11)	52 (0.65)	**61 (0.76)**	**80 (1)**
3	5 (0.12)	1 (0.02)	1 (0.02)	0 (0.0)	6 (0.14)	**13 (0.31)**	0 (0.0)	1 (0.02)	4 (0.10)	24 (0.57)	**29 (0.69)**	**42 (1)**
4	1 (0.03)	0 (0.0)	0 (0.0)	0 (0.0)	9 (0.25)	**10 (0.28)**	0 (0.0)	0 (0.0)	1 (0.03)	25 (0.69)	**26 (0.72)**	**36 (1)**
Total (Overall Proportions)	**16 (0.05)**	**13 (0.04)**	**15 (0.04)**	**3 (0.01)**	**39 (0.11)**	**86 (0.25)**	**3 (0.01)**	**4 (0.01)**	**45 (0.13)**	**208 (0.60)**	**260 (0.75)**	**357 (1)**

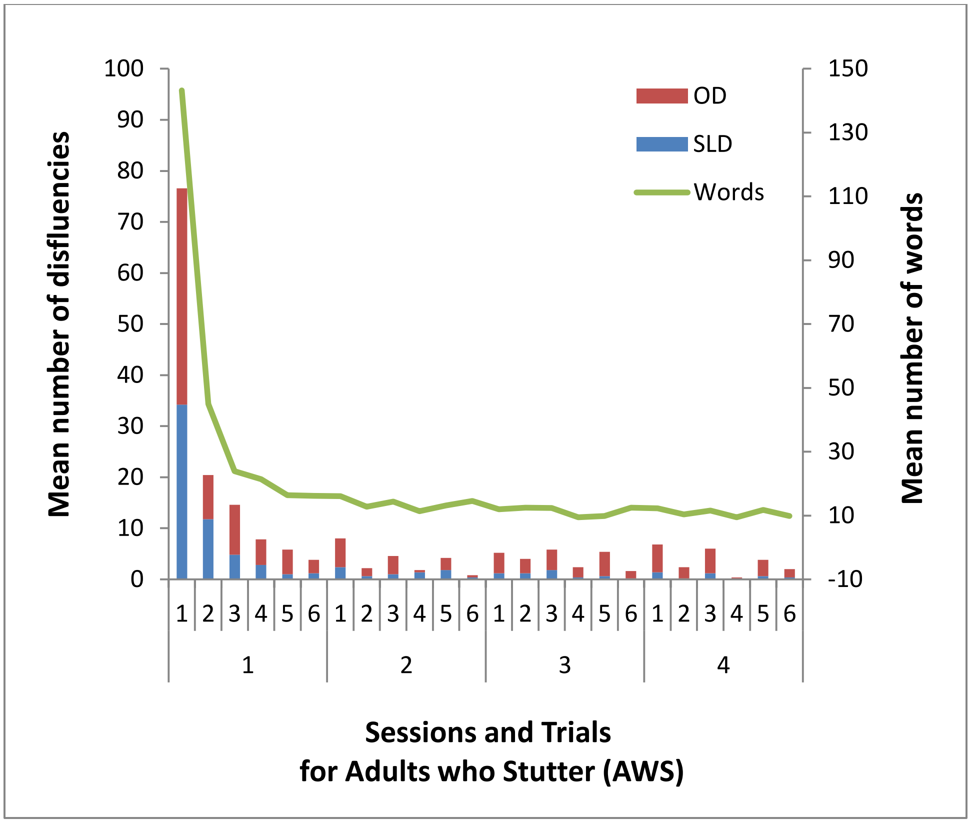

Figure 12. The average number of stuttering-like disfluencies (SLD), average number of other disfluencies (OD), and average number of words for five target (adults who stutter; AWS) pairs across all sessions and trials. Stuttering-like disfluencies (SLD) consisted of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks and prolongations; and other disfluencies (OD) consisted of multi-syllabic repetitions, phrase repetitions, revisions and interjections. Overall, the proportion of OD was higher than SLD. In general, the average number of SLD and OD decreased across all sessions and trials. (Note: The axis for the mean number of disfluencies is on the left and the axis for the average number of words is on the right side of the graph).

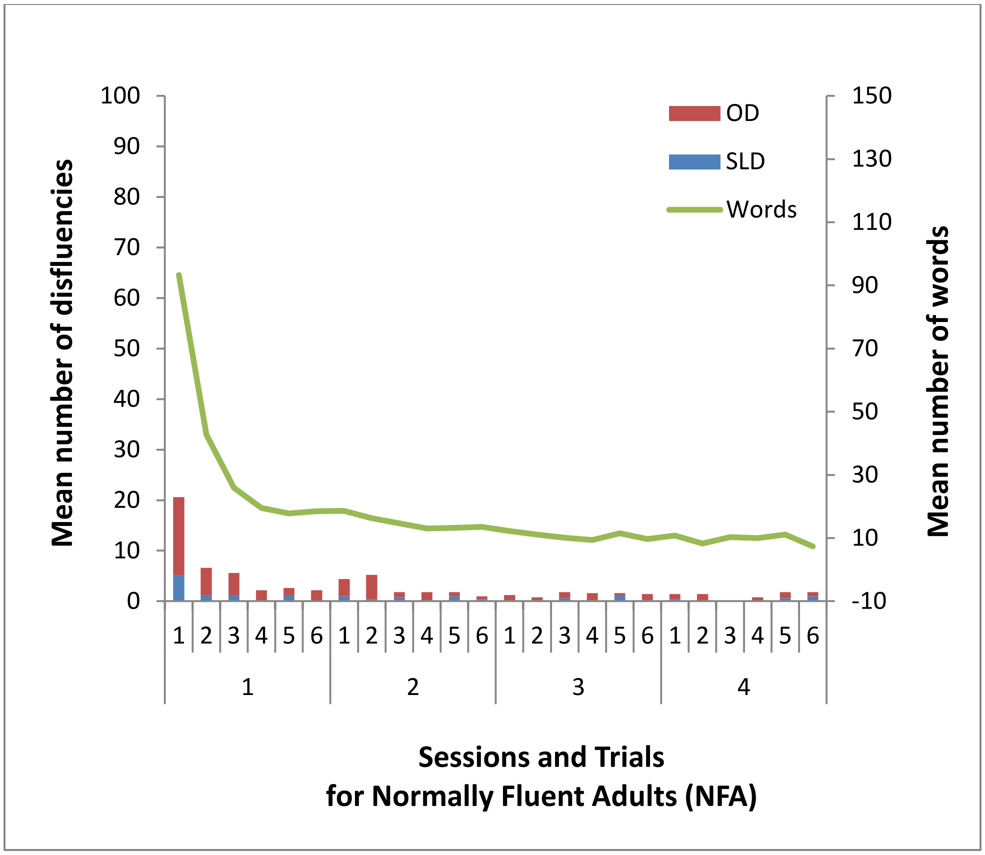

Figure 13. The average number of stuttering-like disfluencies (SLD), average number of other disfluencies (OD), and average number of words for five comparison (normally fluent adults; NFA) pairs across all sessions and trials. Stuttering-like disfluencies (SLD) consisted of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks and prolongations; and other disfluencies (OD) consisted of multi-syllabic repetitions, phrase repetitions, revisions and interjections. Overall, the proportion of OD was higher than SLD. In general, the average number of SLD and OD decreased across all sessions and trials. (Note: The axis for the mean number of disfluencies is on the left and the axis for the average number of words is on the right side of the graph).

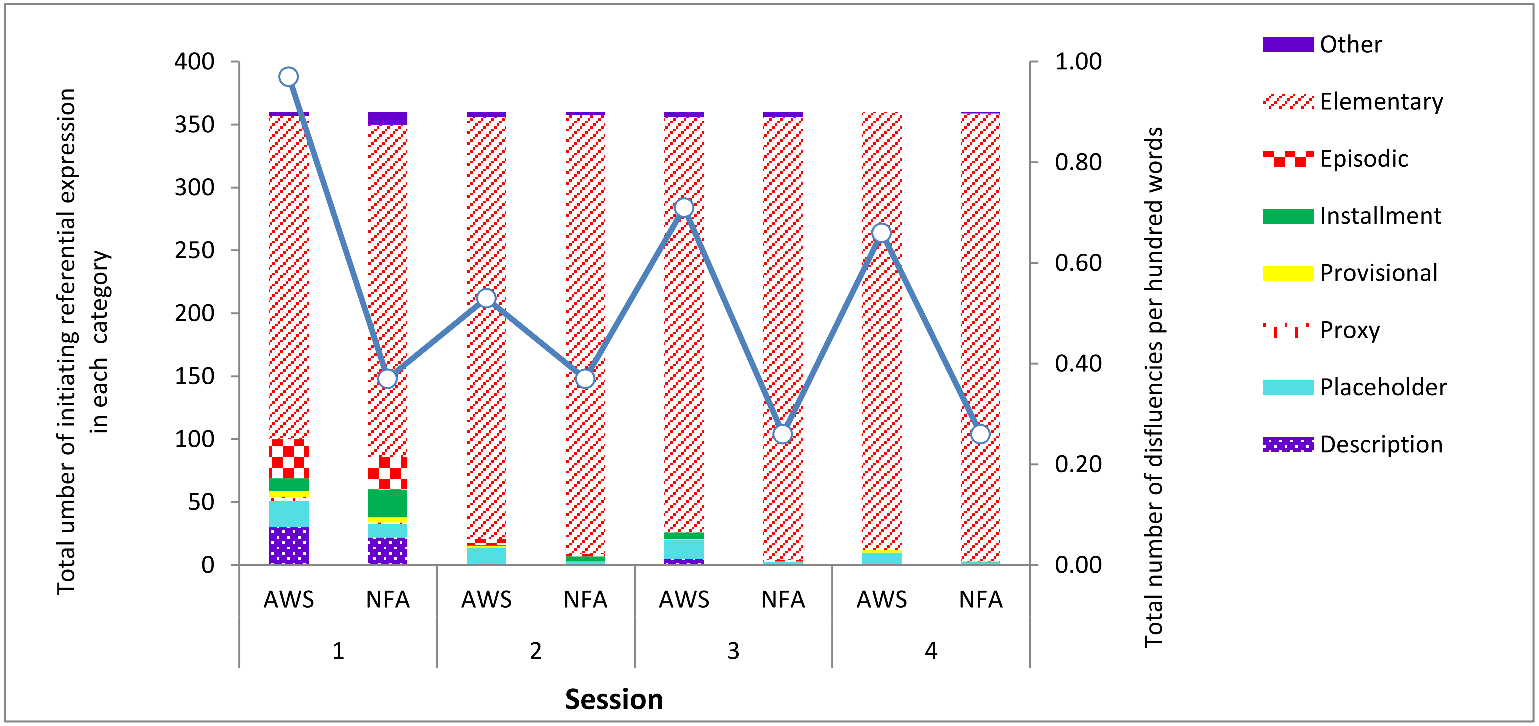

Figure 14. Total number of initiating referencing expressions that were coded into the different categories for target and comparison groups across all sessions. The eight categories used to classify the initiating referential expressions consisted of: other, elementary, episodic, installment, provisional, proxy, placeholder, and description (listed in decreasing order of confidence or certainty the director has that a particular label will be readily understood by the matcher). Elementary expressions are regarded as revealing the highest level of confidence in the interaction and use of initiating referencing expressions while descriptive expressions are regarded as the least confident. Both target and comparison groups displayed similar patterns in their initiating referencing expressions. In both cases, the referencing expression simplified and stabilized over time.

Table 14.

Types of referencing expression (listed in decreasing order of confidence from left to right) used during the barrier game reported as a total number and percentage (in parenthesis) for the target group of adults who stutter.

		Types of initiating referencing								
Session	Trial	Other	Elementary	Episodic	Installment	Provisional	Proxy	Placeholder	Description	Total
1	**1**	**1 (1.7%)**	**13 (21.7%)**	**18(30.0%)**	**6 (10%)**	**3 (5%)**	**0 (0%)**	**0 (0%)**	**19 (31.7%)**	**60 (100%)**
	2	1(1.7%)	41 (68.3%)	4 (6.7%)	1 (1.7%)	0 (0%)	2 (3.3%)	0 (0%)	10 (16.7%)	60 (100%)
	3	**0 (0%)**	**46 (76.7%)**	**4 (6.7%)**	**1 (1.7%)**	**1 (1.7%)**	**1(1.7%)**	**6 (10%)**	**1 (1.7%)**	**60 (100%)**
	4	0 (0%)	53 (88.3%)	3 (5.0%)	2 (3.3%)	0 (0%)	0 (0%)	3 (3.3%)	0 (0%)	60 (100%)
	5	**0 (0%)**	**51 (85.0%)**	**1 (1.7%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**60 (100%)**
	6	1(1.7%)	53 (88.3%)	1 (1.7%)	0 (0%)	1 (1.7%)	0 (0%)	4 (6.7%)	0 (0%)	60 (100%)
2	1	**1 (1.7%)**	**53 (88.3%)**	**0 (0%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**5 (8.3%)**	**0 (0%)**	**60 (100%)**
	2	0 (0%)	59 (98.33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1.7%)	0 (0%)	60 (100%)
	3	**1 (1.7%)**	**53 (88.3%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**6 (10%)**	**0 (0%)**	**60 (100%)**
	4	2 (3.3%)	52 (86.7%)	5 (8.33%)	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	5	**0 (0%)**	**58 (96.7%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**2 (3.3%)**	**0 (0%)**	**60 (100%)**
	6	0 (0%)	60 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
3	1	**0 (0%)**	**55 (91.7%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**0 (0%)**	**3 (5%)**	**0 (0%)**	**60 (100%)**
	2	0 (0%)	59 (98.33%)	0 (0%)	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	3	**0 (0%)**	**6 (54.0%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**0 (0%)**	**5 (8.3%)**	**0 (0%)**	**60 (100%)**
	4	2 (3.3%)	56 (93.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (3.3%)	0 (0%)	60 (100%)
	5	**0 (0%)**	**54 (90.0%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**0 (0%)**	**5 (8.3%)**	**0 (0%)**	**60 (100%)**
	6	2 (3.3%)	52 (86.7%)	0 (0%)	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)	5 (8.3%)	60 (100%)
4	1	**0 (0%)**	**55 (91.7%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**5 (8.3%)**	**0 (0%)**	**60 (100%)**
	2	0 (0%)	60 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	3	**0 (0%)**	**56 (93.3%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**4 (6.7%)**	**0 (0%)**	**60 (100%)**
	4	0 (0%)	60 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	5	**0 (0%)**	**57 (95%)**	**0 (0%)**	**0 (0%)**	**2 (3.3%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**60 (100%)**
	6	0 (0%)	60 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)

Bolded: Trials where the directors were participants who stutter.

Table 15.

Types of referencing expression (listed in decreasing order of confidence from left to right) used during the barrier game reported as a total number and percentage (in parenthesis) for the comparison group of normally fluent adults.

		Types of initiating referencing								
Session	Trial	Other	Elementary	Episodic	Installment	Provisional	Proxy	Placeholder	Description	Total
1	1	**8 (13.3%)**	**5 (8.3%)**	**12 (20.0%)**	**12 (20%)**	**0 (0%)**	**0 (0%)**	**1 (1.7%)**	**22 (36.7%)**	**60 (100%)**
	2	1 (1.7%)	40 (66.7%)	8 (13.3%)	1 (1.7%)	4 (6.7%)	0 (0%)	2 (3.3%)	0 (0%)	60 (100%)
	3	**0 (0%)**	**50 (83.3%)**	**1 (1.7%)**	**4 (6.7%)**	**0 (0%)**	**0 (0%)**	**5 (8.3%)**	**0 (0%)**	**60 (100%)**
	4	0 (0%)	56 (93.3%)	2 (3.3%)	1 (1.7%)	0 (0%)	0 (0%)	1 (1.7%)	0 (0%)	60 (100%)
	5	**0 (0%)**	**58 (96.7%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**1 (1.7%)**	**1 (1.7%)**	**0 (0%)**	**60 (100%)**
	6	0 (0%)	55 (91.7%)	3 (5%)	1 (1.7%)	0 (0%)	0 (0%)	1 (1.7%)	0 (0%)	60 (100%)
2	1	**2 (3.3%)**	**55 (91.7%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**0 (0%)**	**2 (3.3%)**	**0 (0%)**	**60 (100%)**
	2	0 (0%)	57 (95.0%)	2 (3.3%)	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	3	**0 (0%)**	**58 (96.7%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**60 (100%)**
	4	0 (0%)	59 (98.3%)	0 (0%)	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	5	**0 (0%)**	**60 (100%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**60 (100%)**
	6	0 (0%)	60 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
3	1	**0 (0%)**	**59 (98.3%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**60 (100%)**
	2	1 (1.7%)	59 (98.33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	3	**0 (0%)**	**58 (96.7%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**2 (3.3%)**	**0 (0%)**	**60 (100%)**
	4	1 (1.7%)	58 (96.7%)	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	5	**1 (1.7%)**	**59 (98.3%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**60 (100%)**
	6	1 (1.7%)	59 (98.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
4	1	**0 (0%)**	**57 (95.0%)**	**0 (0%)**	**1 (1.7%)**	**0 (0%)**	**0 (0%)**	**2 (3.3%)**	**0 (0%)**	**60 (100%)**
	2	1 (1.7%)	59 (98.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	3	**0 (0%)**	**60 (100%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**60 (100%)**
	4	0 (0%)	60 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)
	5	**0 (0%)**	**60 (100%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**60 (100%)**
	6	0 (0%)	60 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	60 (100%)

Bolded: Trials where the directors were participants who stutter.

CHAPTER 6

DISCUSSION

The aim of the present study was to examine stuttering within a social context that represents how the disorder may impact communication by investigating how people who stutter and their communication partners manage fluency breakdowns during a barrier task, a collaborative referencing activity. The barrier task adopted from Hengst (2001, 2003) and Hengst et al. (2010) was used in the present study to investigate how stuttering impacts social interaction in a research setting. Overall, findings suggest that the functional communication system managing stuttering may be strategically managing fluency breakdowns and successfully accommodating deviations.

Stuttering, Collaborative Effort and Learning

As predicted by Clark's model of common ground, participant pairs not managing stuttering successfully placed cards across all sessions and trial with decreased collaborative effort at each subsequent session. Clark's (1992) *Principle of Least Collaborative Effort* proposes that communication partners attempt to minimize collaborative effort from start to the end of the collaborative process. Communication partners do not work alone but in alignment with their partners, in other words, this work is distributed across partners. As expected, comparison pairs in the present study were observed to decrease their collaborative effort across sessions and trials. However, the management of stuttering was expected to interfere with the minimization of collaborative effort in target pairs. Participant pairs managing stuttering were expected to use greater collaborative effort than comparison pairs. However, contrary to the stuttering literature, Clark's *Principle of Least Collaborative Effort* would still predict a reduction in collaborative effort across sessions and trials for pairs managing stuttering. In the present study, no group differences in collaborative effort and learning were found between targets and comparisons, and target pairs were observed to minimize their collaborative effort across sessions and trials. However, the AWS group displayed greater variability in the measures of collaborative effort than the NFA group in the first session, although this difference was absent in later sessions.

In the current study, informed by the stuttering literature, increased collaborative effort and greater variability in performance were expected in participant pairs managing stuttering compared to pairs not managing stuttering as a result of higher number of disfluencies and consequently, poorer recall of target card labels. Previous studies by Panico and Healy (2009), and Cyprus et al. (1984) point to the negative impact of disfluencies on listeners' recall. In the present study, during the first trial of the first session where the number of disfluencies was highest, AWS participants, who were the designated director, were responsible for describing the tangram cards to their partners. Thus, the communication partners of AWS were hypothesized to face difficulties in recalling the target card labels initiated by AWS. Consequently, increased collaborative effort was expected for participant pairs managing stuttering as they worked to accurately place cards on the numbered board. However, AWS and NFA pairs were observed to settle on specific card labels at the same rate and showed similar levels of confidence in developing and using target card labels. Contrary to prediction, AWS pairs did not demonstrate increased collaborative effort during the barrier task, and developed and used initiating referencing expressions in a similar way to comparison pairs not managing stuttering across sessions and trials. The initiating referential expressions generated by AWS participants were established early on in the barrier game and were observed to stabilize and simplify in subsequent sessions and trials conducted days or weeks later. However, the AWS group displayed greater variability in the measures of collaborative effort than the NFA group for the first session of the barrier task.

These differences in recall of listeners' reported by different studies including the present study may be due the differences in familiarity and personal common ground between participants. Familiarity with the topic has been observed to promote recall. In the Panico and Healey's study (2009) participants displayed better recall when they were familiar with the topic presented. In the Panico and Healy (2009), and Cyprus et al., (1984) studies, participants were instructed to listen to audio speech samples (on various topics including 9/11, Titanic, Harriet Tubman, parakeets, and the life and music of Richard Wagner) that were inserted with simulated speech disruptions, and asked a series of questions to ascertain their comprehension and recall. In the present study, participant pairs were familiar communication partners who collaboratively developed meaningful target card labels based on their shared histories and experiences. Personal common ground, that is, shared mutual knowledge, beliefs and assumptions was key to generating the target card labels in the present study. For example, Tebow, an AWS, described a card as resembling Jesus, to his partner Cameron, *Jesus guy. Like he's being crucified, but he's kinda falling backwards*. The referencing expression generated by Tebow would not have been meaningful or as easily recalled without a mutual knowledge of and familiarity with Christianity and the crucifixion.

Another explanation for the difference in recall may be the due to the study protocol and instructions given to participants. The setting of the studies by Panico and Healey (2009) and Cyprus et al. (1984), and nature of the recall may have been more stressful than the current study. In the current study, participants were explicitly told to have fun, and the activity was presented as a game. Whereas in the Panico and Healey, and Cyprus et al. studies, participants were presented with speech samples and "were instructed to focus on both the man's speech and the content of his story because they would be asked to recall and comprehend facts about the story as well as rate the mental effort they used while listening to each story" (Panico & Healey, p. 538) or "were informed that they had been selected to evaluate material presented via the auditory channel exclusively, and that they would be asked to fill out a brief questionnaire after listening to the presentation" (Cyprus et al. 1984, p. 194). Following the speech sample presentation, participants in both studies were promptly asked to recount what they heard verbally and/or instructed to respond to a questionnaire on the selected topics which are likely to be more stress inducing. In the present study, participants were not explicitly tested on their recall, although participant pairs were asked to provide (written and verbal) target labels for individual cards at the end of each session. Studies in healthy adults report decreased memory with increased stress (Kirschbaum, Wolf, May, Wippich, & Hellhammer, 1996; Lee et al., 2007; Newcomer et al., 1999). In the present study, participant recall may be facilitated by the nature of the instructions and research procedure that is less likely to induce stress than the past studies reporting lower recall.

Overall, in the current study participant pairs including those managing stuttering displayed more OD than SLD across all trials. Interjections (including *uh* and *uhm*), also commonly referred to as fillers, were the most common type of disfluencies recorded. However, in the studies by Panico and Healey (2009) and Cyprus and colleagues (1984), speech samples were interspersed with SLD, consisting of part-word repetitions, whole-word repetitions, prolongation and blocks. In the current study, part-word repetitions (7%), whole-word repetitions (9%), and blocks (3%) made up only a small proportion of the disfluencies in both groups. The difference in the type of disfluencies used or observed in the past and present studies may be a contributing factor in the level of recall. Research from psycholinguistics suggests that disfluencies primarily fillers may be beneficial to recall and comprehension. According to this perspective, disfluencies typically precede items that are less predictable in speech or signal upcoming difficulties and accordingly, heighten listeners' attention to utterances that follow disfluencies (Beattie & Bradbury, 1979; Fox Tree, 2001). For listeners, disfluencies typically signal a new and/or difficult topic or object and thus, are likely to bias their attention to object or topic (Arnold, Hudson Kam, & Tanenhaus, 2007). The work by Fraundorf and Watson (2011), and Brennen and Schober (2001) support the view that increased vigilance enhances attention to the upcoming utterance following disfluencies facilitating recall and even response time. Fraundorf and Watson (2011) reported better recall for words that followed disfluencies while Brennan and Schober (2001) reported faster response time to instructions that contained disfluencies than instruction that did not. In the present study, interjections, the most common type of disfluencies displayed by participants, may facilitate recall of target card labels days or weeks after they were first generated.

One striking observation from the present study was the high levels of variability within the AWS group compared to the NFA group for the measures of collaborative effort during the first session of the barrier task. This variability within the AWS group compared to the NFA group may be due to differences in stuttering severity across AWS pairs. Overall, the AWS group displayed a higher number of disfluencies than the NFA group. However, within the AWS group, there were varying degrees of stuttering severity and number of disfluencies, particularly in the first session. While some AWS pairs featured disfluencies that were closer to the mean, others displayed a significantly higher number of disfluencies than the mean. Accordingly, the effort by each AWS pair to manage their fluency breakdowns may have varied widely and impacted their collaborative effort during the barrier game. In other words, some AWS pairs may have exerted greater effort to manage their disfluencies. Plausibly, pairs managing a higher number of disfluencies may display greater variability in their measures of collaborative effort. In subsequent sessions, the variability observed in the first session between groups became less prominent. This observation may suggest that although the functional communication system is able to compensate for speech disruptions, this ability to adapt or compensate is gradual.

In the current study, AWS pairs did not demonstrate increased collaborative effort to accurately place cards. Although the presence of a greater number of disfluencies was expected to increase collaborative effort for AWS pairs compared to NFA pairs, other factors such as personal common ground, nature or context of the task/instruction, and type of disfluencies may have contributed to better recall and ultimately, no increase in collaborative effort for participant pairs managing stuttering who had a higher number of disfluencies than comparisons.

Types of Disfluencies

As predicted by past behavioral research in stuttering AWS displayed more disfluencies than NFA. However, contrary to the stuttering literature AWS also displayed more OD than SLD. These differences in proportion of SLD and OD reported in past and current studies may be related to the collaborative nature of the barrier task where speaking turns were interspersed with verbal communicative silences. In comparison, monologues used by past studies that reported higher SLD required participants to speak continuously (e.g., Staróbole Juste & Furquim de Andrade, 2011). In a study designed to examine the efficacy of time-out as a treatment procedure to reduce stuttering severity, Franklin, Taylor, Hennessy and Beilby (2008) reported not only a reduction in the level of stuttering severity but also a change in the type of disfluencies observed after moments of communicative silence in AWS. A total of 60 participants who stutter, over the age of 15 years, were recruited for the study. The criteria for stuttering included the presentation of SLDs, comprising sound/syllable repetitions, prolongations and blocks. Participants were randomly placed into two groups: target group who received the time-out procedure, and controls. Three baseline speech samples comprised of 500 syllables were obtained from all participants who were instructed to talk spontaneously on a topic they selected or one suggested by the experimenter (who was seated across from participants). During the experimental procedure which consisted of two 20 minute speaking periods, target participants were instructed to talk spontaneously until they were signaled to stop talking by a red light which would illuminate in front of them. The red light was illuminated at the beginning of moments of fluency breakdown and remained on for five seconds during which participants were asked to cease talking until the red light turned off. Following the treatment procedure three spontaneous speaking samples were collected. All speaking periods were audio recorded. Franklin and colleagues reported a reduction in the % SS or the percent of syllable stuttered (from 5.8% to 3.9%) for the time-out participants from the baseline to post-treatment speaking tasks. In contrast, control participants showed the opposite trend, increasing their % SS from 4.9% in the baseline to 6.4% in the post-treatment speaking task. Franklin et al. also reported a “shift from effortful prolongations and blocks to easier repetitions of sounds, syllables and words during treatment" after communicative silences in time-out participants (p. 296). In the present study, participants who stutter were not speaking continuously, instead they had periods of talking interspersed with communicative silences similar to Franklin et al.'s time-out participants which may explain the lower proportion of SLD to OD. Additionally, speech motor control models may offer insight into the disparities between monologues and conversations in the frequency of fluency breakdowns.

According to Max and colleagues' (2004) *Unstable or Insufficiently Activated Internal Models* hypotheses, fluency breakdowns result from discrepancies between the "predicted and actual consequences of the executed movements, regardless of whether or not the generated commands were accurate with respect to the desired movement outcome" (p. 113). In people who stutter, the central nervous system responds to the discrepancy by attempting the movement again until the conflict is resolved or avoided by using moment-to-moment afferent feedback, or when a different set of motor command is issued. Within this model attempted repairs or maladaptive response to the discrepancies between predicted and executed movements result in fluency breakdowns. Max and colleagues propose that the frequency of fluency breakdowns could be reduced when people who stutter employ motor control strategies that allow more time for processing and integrating afferent inputs/feedback. For example, fluency treatments such as prolonged speech that results in longer movement durations and accordingly, longer processing time and sensorimotor adjustments, reduce fluency breakdowns. Other strategies such as time-out may have a similar effect. During time-out, fluency breakdowns can be avoided or reduced when the conflict between predicted and actual movement is resolved by issuing a new motor command. In the barrier task activity, AWS participants had periods of speaking interspersed with communicative silence. These periods of communicative silence may help to reduce or avoid fluency breakdowns by providing a longer time for processing or sensorimotor adjustment, or time for a new motor command to be issued. Essentially, these studies point to variability in the frequency and severity of stuttering that results from interactions between biological factors (e.g., speech motor control), and context and setting of the speech activity (e.g., treatment procedure, and social interaction). In other words, although there is an underlying biological basis to the disorder, the manifestation of stuttering is impacted by on-going interactions.

As predicted, the number of disfluencies per ten words was observed to decrease across sessions and trials. The phenomenon of adaptation in people who stutter offers a plausible explanation for this observation. Research into adaptation, which refers to a reduction in the frequency of fluency breakdowns in successive reading of the same material, reports a dramatic reductions (around 50%) in disfluencies with the most evident changes occurring by the fifth successive reading (see Bloodstein & Bernstein Ratner, 2008). The adaptation phenomenon has only been observed in reading of the same material and not during spontaneous speech. Kroll and Hood (1974) examined adaptation in ten AWS' reading of a passage and spontaneous speech tasks (where participants were asked to describe a picture). During the tasks participants were asked to use their usual reading and speaking styles, and to read or describe the picture five times without any breaks. All speech samples were audio recorded for analysis. During the reading task, a significant reduction (-41%) in the number of disfluencies was observed from the first to the last reading. However, there were no differences in the number of disfluencies for the spontaneous picture descriptions. The authors did not report if the pictures descriptions remained identical across successive descriptions (it is unlikely that the adaptation effect will be present if participants described the picture differently each time).

Wingate (1966) presents two explanations for the phenomenon of adaptation. First, he proposes that the adaptation is due to a general psycho-physiological adaptation to the situation. In other words, there is a decrease in the level of psychological and physiological stress which results in a reduction of disfluencies. This view is supported by studies that report greater number of disfluences and magnitude of physiological responses (such as increase in blood pressure) in stressful situations for AWS compared to NFA (Blood, Blood, Bennett, Simpson, & Susman, 1994; Caruso, Chodzko-Zajko, Bidinger, & Sommers, 1994; Ezrati-Vinocour & Levin, 2004). Second, Wingate proposes that adaptation is also influenced by sociolinguistics factors, "with repeated readings of the same material, the reader becomes more skillful in executing the prosody or melody of the material" (p. 553). Others attribute this phenomenon to motor rehearsal and learning (Frank & Bloodstein, 1971; Max, Caruso, & Vandevenne, 1997; Max & Caruso, 1998). According to the motor learning hypothesis, increased fluency is the result of improvements with speech motor skills as readers engage in the same sequences of articulatory and phonatory movements with each successive reading, and the basis of reductions in the number of fluency breakdowns is the learning process behind modifications and improvements of motor patterns. If the reduction in fluency breakdowns is due to an overall reduction in psychological stress, and oral motor rehearsal and learning, then the adaptation effect must also be observable in NFA. In a study examining adaptation in NFA without a history of stuttering (n=20), Silverman (1970) reported a significant decrease in the number of disfluencies during readings the *Rainbow Passage*. Reading samples were audio recorded and analyzed for disfluencies. Silverman reported the most prominent adaptation during the second reading. The lowest number of disfluencies was recorded on the ninth reading of the passage. The findings of the current study are consistent with this observation. Not only did the number of disfluencies decrease across sessions and trials for AWS, this reduction was also observed in NFA in the present study.

Research also suggests that the adaptation effect may be influenced by other variables including the social environment. Siegel and Haugen (1964) studied the adaptation effect as a function of audience size. A total of 25 AWS (20 males and five females; stuttering severity ranged from mild to severe) were randomly placed into two groups: increasing audience size and decreasing audience size. For the increasing audience size condition, participants read the passage five times, starting with an audience of one person with a new listener added to the audience with each successive reading. For the decreasing audience condition, participants started the first reading with five participants, with a reduction of one audience with every successive reading. There was a constant interval of 20 s between each reading. The audience were seated in a row in front of the reader and consisted of individuals who were unknown to the participant. For the control condition, participants read the passage five times to an audience of one. The authors "did not attempt to distinguish between normal disfluencies and 'true' stuttering" in the analysis of disfluencies (p. 383). Similar to other studies, adaptation was computed as (A-E/A) X 100 where A is the number of fluency breakdowns for the first reading and E is the number of fluency breakdowns for the last reading. Overall, there was a decrease in the number of disfluencies with each successive reading for both audience conditions. However, the adaptation effect was greater for the decreasing audience size compared to the increasing audience size, and readers showed similar magnitudes of adaptation during the decreasing audience and control conditions. This suggests that audience size impacts the adaptation effect. In the present study, the "audience" size remained constant at one person, essentially, the director of the barrier task had a single audience member throughout all sessions and trials. This would plausibly result in a considerable adaptation effect and lower number of disfluences, as seen in the decreasing audience conditions of Siegel and Haugen's study.

The phenomenon of adaptation offers insight into the performance of AWS and NFA in the present study. Firstly, unlike the previous studies, participants were familiar communication partners and not strangers in the present study, and hence, likely to result in a less stressful social situation. Also, the barrier game was presented as a game, and not an experimental task as in the other studies which according to Wingate (1966) would result in significant reductions in the number of disfluencies for both AWS and NFA. This was observed across sessions and trials of the barrier task. Similarly, according to Max and colleagues there should be a reduction in disfluencies as speakers practice and improve their sequences of articulatory and phonatory movements with repeated engagements. In the barrier task, participants repeated their referencing expressions almost identically after the first few trials of the first session. In other words, in the present study, participants were engaged in oral motor rehearsal and learning across 24 trials, which resulted in significant improvements in their articulatory and phonatory movements, which in turn, increases fluency. These findings surrounding the adaptation effect suggest that stuttering is a disorder that is influenced by the social environment and interaction, as much as it is impacted by speech motor control.

Alternatively, the success of participant pairs in the present study can be viewed from another perspective, related to the priming or specifically, repetition effect. Research suggests that more repetitions facilitate memory and retention (Grant & Logan, 1993). Salasoo, Shiffrin and Feustel (1985) defined the repetition priming effect as the “prior occurrence of a word causes faster and more accurate identification of that word in a subsequent threshold identification task-even after a considerable period of time” (p. 51). In their study to determine the development and retention of words and pseudowords, Salasoo and colleagues (1985) reported an improvement in performance with repetition. With just six repetitions, participants were able to identify both pseudowords and words even after one year. Brown, Jones and Mitchell (1996) observed a similar phenomenon using a picture naming task. In their task, participants were presented with a set of pictures three times, with either several minutes or one week delay between presentations. Some pictures were presented only once during each presentation, while others were presented multiple times. During the second and third picture presentations, new pictures were added to the set, and participants were asked to name all the pictures presented to them, and to indicate if it was a picture they had seen before during the previous picture presentation task. The authors reported better recognition for pictures that were presented multiple times compared to those presented only once. In the present study, the repetition priming effect may have facilitated performance of participant pairs. In each session of the barrier task, participants saw each tangram card multiple times. During half of the session (three trials) as the director, each participant was also responsible for naming the card. Both AWS and NFA pairs successfully named, identified and placed the tangrams cards even when sessions were held weeks apart.

While the theories related to the phenomena of adaptation in stuttering and priming in memory and recognition predicted some of the findings in the present study, the observed performance of AWS and NFA groups who were and were not managing stuttering extends and complicates these theories. Other factors such as common ground which are not considered by these theories are also likely to play a crucial role the performance of AWS and NFA pairs in the present study.

Initiating Referencing Expressions

Clark's collaborative model for the process of referencing and Duff and colleagues' findings in amnesic patients predicted that participant pairs managing and not managing stuttering would demonstrate successful referencing; initiating referencing expressions were expected to stabilize and simplify across sessions. As predicted, comparison pairs demonstrated successful referencing described by Clark with the initiating referencing expressions stabilizing and simplifying across sessions and trial, reflecting the ability of NFAs to maneuver the collaborative process, and growing confidence and common ground across sessions. The work of Hengst (2001) and Duff et al. (2011) with patients with aphasia and amnesia would predict that AWS pairs (who are not expected to display deficits in procedural or non-declarative memory) would successfully develop and use initiating and using referencing expressions although they may demonstrate more variability in the types of initiating references used. Hengst (2001) reported that "although both directors used all types of noun phrases, aphasic directors displayed a higher variability in the types of noun phrases used to initiate references" (p. 113). In the study by Duff and colleagues (2011) comparing the performance of pairs with and without amnesia, "the healthy partners of the amnesia participants used a definite reference to initiate referencing with their profoundly memory impaired partner less than half as often as the directors of the comparison pairs without brain damage" (p. 685). In the present study, AWS pairs displayed successful referencing as described in Clark's model.

According to Clark's model of collaborative referencing, there are three essential elements that impact coordination between communication partners. First, partners have limited time for planning and revision. For successful collaborations, they must overcome this restraint by exploiting "techniques possible only in conversational settings" (Clark, 1992, p. 109). Second, Clark points out that "speech is evanescent. The listener has to attend to, hear, and try to understand an utterance at virtually the same time it is being issued" which requires synchronization or alignment between partners (Clark, 1992, p. 109). Finally, "listeners in conversations are not mute or invisible during and utterance. Speakers may alter what they say midcourse based on what addressees say and do" (Clark, 1992, p. 110). To be successful, partners must be able to maneuver the conversation landscape by exploiting resources available, aligning themselves, and adjust their utterances based on their partners' responses. In other words, the on-going management of stuttering which was expected to interfere with the ability to exploit conversational resources, alignment with their communication partners and adjust their utterances in target pairs was not observed in the present study. Similar to comparison pairs, targets demonstrated successful referencing. Their initiating referencing expressions stabilized and simplified across sessions.

The shift from using more descriptive to definite initiating referencing expressions may also reflect the pattern of collaborative learning for both AWS and NFA pairs. Duff and colleagues (2006) suggests that collaborative learning facilitated a "common perspective" for the directors and matchers during the barrier game (p. 144). In other words, communication partners came to similar perceptual and conceptual perspectives across repeated engagements of the barrier task, and their initiating referential expressions reflected their increasing confidence and "conciseness" with the task (Duff et al., 2006, p. 144). In addition to the perceptual and conceptual levels, collaborative learning and common ground is likely to have also taken place on linguistic and semantic levels. Overall, collaborative learning and common ground is thought to be bolstered by various types of memory including more implicit and procedural forms of memory (Duff et al., 2006). Procedural memory can be defined as a "collection of nonconscious memory abilities", more specifically, memory related to "skill-based kinds of learning" (Squire, 1992, p. 233). Additionally, the effective use of definite referencing expressions as observed in the present study may also require more declarative memory (Duff et al., 2011), that is, "fact-and-event memory" or "memory for words, scenes, faces, and stories" (Squire, 1992, p. 232). In the present study, both AWS and NFA participants did not report any cognitive impairment that may have affected their procedural and/or declarative memories and consequently, their development and use of definite referencing expressions.

In terms of stuttering, the use of compensatory coping strategies was expected to negatively influence the use of initiating referencing expressions in target pairs. However, contrary to predictions, target pairs managing stuttering displayed similar levels of confidence to comparison pairs and demonstrated increasing levels of confidence in their interaction and use of initiating referencing expressions across sessions. Participant pairs managing stuttering were expected to have difficulties in the production of card target labels as a consequence of compensatory behaviors, including word avoidance or substitution, and circumlocutions. However, contrary to predictions, participant pairs managing stuttering did not have difficulty in establishing, stabilizing and simplifying target card labels. They demonstrated similar levels of confidence across sessions and trial in the production and use of referencing expressions compared to pairs not managing stuttering.

Coping strategies such as word/sound avoidance and circumlocution are commonly employed by people who stutter to avoid fluency breakdowns (Bloodstein & Bernstein Ratner, 2008; Kalinowski, Kalinowski, Stuart, & Rastatter, 1998). These strategies are common in both children and adults who stutter. Bloodstein (1960) described a range of behaviors including word substitution and avoiding talking in 418 children who stutter (boys=336, girls=82) with and without a history of stuttering therapy between the ages of 2 to 16 years. The data for the study aimed at tracing the development of stuttering were obtained from reports by the children and parents, and direct observation. In the study, difficulty in speaking was often related to the speaking situation, for example, “reciting in school (especially oral reading), talking to stranger, going to the store or on other errands, asking directions, and talking when there is company in the home. Situations mentioned less often are speaking to friends or to members of the immediate family” (p. 231). Bloodstein also reported greater anticipation or expectancy of moments of fluency breakdowns in older children. Older children were also more cognizant that certain sounds or words were difficult for them to say: “by age eight, the consciousness of words and sound difficulties appeared to be fully developed in the majority of the group” (p. 231). In younger children, parental reports indicate consistent difficulty with specific sounds and words may occur in CWS as young as 2.5 years. Sound and word difficulties may lead to avoidance behaviors when children use habitual word substitutions or circumlocution. One anecdotal report indicates the severity of this problem in some children: “The mother of one 11-year-old stutterer said, ‘I wanted him to buy some things’. He said ‘Yes. All right. I can say those letters’ (Bloodstein, 1960, p. 232). With age, avoidance and substitution behaviors may become more entrenched and acute. A study by Vanryckeghem, Brutten, Uddin and Van Borsel (2004), to examine how AWS respond to the presence or anticipation of fluency breakdowns, found similar avoidance and substitution behaviors described in AWS. A total of 41 AWS (males = 33, females = 9) and 76 (males = 34, females = 42) NFA participants were administered the Dutch version of the Behavior Checklist (Brutten & Vanryckeghem, 2003), a self-report test procedure that describes various types of responses used to avoid fluency breakdowns or an anticipated breakdown. Adults who stutter were recruited from clinics around the Flanders region in Belgium and all reported receiving therapy at the time of the study. The NFA participants were recruited from different Flemish provinces. Participants are instructed to rate items such as *Avoid eye contact*, *Take a deep breath*, *Omit particular word or words* and *Substitute one word for another* on a scale of 1 to 5 (1 = very infrequently, 5 = very frequently). Overall, AWS participants in the study reported an average of 18 different types of coping responses in anticipation or as a consequence of fluency breakdowns. The most common responses were word substitution (82% of AWS reported doing so); pausing before saying a difficult word (72%); avoiding eye contact (64%); repeating syllables prior to saying a feared word (64%); using a carrier phrase such as “let me see” or “well now” (59%); silent rehearsal of a sound, word or phrase (56%); pretending not to know the answer (56%); taking a deep breath before speaking (54%); omitting a particular words (51%) and looking away from the listener (49%). In contrast, a smaller number of NFA reported using coping responses, including substituting the difficult word with another (28%); touching hair (21%); avoiding eye contact (21%); pretending to be thinking of something else (20%); wrinkling forehead (17%); looking away (17%); moving hands (17%); repeating syllables prior to saying a feared word (17%); using a carrier phrase (17%); and sighing (17%). The studies by Bloodstein (1960) and Vanryckeghem et al. (2004) indicate that coping mechanisms such as word substitution in anticipation or as a consequence of fluency breakdowns are a common strategy in people who stutter and may interfere with social interactions.

Bloodstein (1960) suggests that coping or concealment mechanisms are the result of fear and embarrassment of their disfluencies by people who stutter. Specifically, he proposes that "word substitutions like associated symptoms, frequently develops prior to the development of chronic fear of stuttering, and may occur initially merely as a reaction to the frustration of blocking" (p. 237). Coping and concealment mechanisms such as word substitutions are thought to be due to frustration, fear or embarrassment of fluency breakdowns and are "marked by a high level of self-consciousness" (Petrunik & Shearing, 1983, p. 136). Thus, in situations where there is an absence or reduction of frustration, fear or embarrassment either as a consequence of a perceived reduction in difficulty of the speaking situation, and/or a reduction of fluency breakdowns, coping mechanisms such as avoidance may be absent or reduced significantly. Generally, speaking situations such as talking to family and friends have been perceived as less difficult than talking to strangers and to a large audience (Bloodstein, 1960; Bloodstein & Bernstein Ratner, 2008; Dalton & Hardcastle, 1989; Mahr & Torosian, 1999), and as a result may not only lead to a lower frequency of fluency breakdown but also a reduction in coping mechanisms.

In the barrier task, coping strategies were expected to result in difficulties in the production of card labels. However, this was not observed. One explanation may be that when participants who stutter are engaged with familiar communication partners, which is perceived as less difficult or stressful, and consequently, coping mechanisms which would affect the development and use of target card labels are reduced or absent. Generally, people who stutter view speaking to friends and family members as less difficult than speaking to strangers (Bloodstein, 1960; Klompas & Ross, 2004). Therefore, it is highly plausible in the present study that the relationship between participant pairs, friends (instead of strangers), reduces the stress of communication and the level of self-consciousness for AWS and accordingly, coping and concealment strategies that would interfere with the development and use of target card labels are reduced or removed.

From the perspective of Clark's collaborative model, successful performance in the barrier task was the result of the target pairs' ability to exploit and use available strategies in conversation to successfully manage stuttering. Their performance signals their ability to attend to, listen to and comprehend each other, that is, align with their partner despite the presence of disfluencies. The success of target pairs also reflects the ability of conversation pairs managing stuttering to adapt to their partner's behaviors and responses. Essentially, the success of target pairs was a reflection of the adaptability and ability of the functional communication to handle disruptions and deviations, essentially to manage stuttering.

Alignment between Communication Partners

Alignment between communication partners essentially means that partners "have no need to construct separate representations for themselves, and for their communication partner, or to reason with such representations" (Garrod & Pickering, 2004, p. 10). From Clark's perspective, this is a means achieving common ground, where communication partners have a common set of information or presumptions. Garrod and Pickering (2004) suggest that during interactions, alignment distributes the processing load between communication partners because each communication partner repeats and/or constructs utterances based on what was previously said. The primary mechanism behind alignment is also thought to be unconscious and automatic, and the result of the tendency of communication partners to produce and maintain expressions and representations (which are multidimensional and includes knowledge about space, time, causality, intentionality and individuals) that are similar to their partner's (Garrod & Pickering, 2004; Pickering & Garrod, 2006).

In the barrier task, one of the requirements for successful collaboration was that communication partners were referring to the same cards although they were not able to see them over the barrier. In the present study, participant pairs in the functional communication system managing and not managing stuttering were aligned, and performed this activity successfully, achieving similar representations for each card by using their communication partners' words and meanings. Through interactions, representations about target card labels were aligned. According to Garrod and Pickering's perspective, the processing load and responsibility of card placements would be shared, although the director was responsible for describing the cards and telling the matcher where to place them on the board. In other words, alignment between partners within the functional communication system may be a significant factor that contributes to successful engagements during the barrier game.

Methods and Approaches

In order to bring a more comprehensive lens to the study of stuttering, the present research combined the situated theories of communication and communication disorders approaches to investigate the functional communication system managing stuttering. The situated perspective offers to the present dissertation research a wealth of approaches and perspectives that the extant communication disorders research seldom does. Namely, the situated perspective provides a theoretical framework that shifts the research lens from individual productions and isolated moments of fluency breakdown to the functional communication system and activities where those breakdowns occur.

Situated perspectives bring into focus the shared experience of stuttering, a crucial but often neglected component of the disorder, shifting the unit of analysis from the person who stutters and moments of fluency breakdown to the functional communication system managing stuttering. The situated perspective offers an approach to researching, interpreting and understanding stuttering that takes into consideration the experience, social environment, context and setting that shape how the disorder manifests. The boundary and experience of stuttering is re-drawn to encompass the person who stutters and their familiar communication partners, their shared histories, communicative practices and moments before, during, and after fluency breakdowns. The experience and management of stuttering is distributed across communication partners within the functional communication system, as the person who stutters and their communication partner manage moments of fluency breakdown. In the present study, the functional communication system was observed to be operating within the full range of other resources, orchestrating successful communication while managing stuttering.

As a person who stutters, the experience of stuttering -- including my moments of fluency breakdown and periods of fluency -- are not mine alone but shared with my communication partners. Shifting the unit of analysis to the functional communication system captures that shared experience that is informed by the experiential, behavioral and biological. What I do as a person who stutters goes beyond production of disfluencies but includes how I interact with my communication partner before, during and after moments of fluency breakdowns. As I reflect on the question as to whether the way stuttering has been described in research and texts accurately or fully portrays what I do during those moments of fluency breakdown, I am convinced that research and descriptions of the disorder must encompass the dynamic and emerging roles of the personal, experiential, behavioral and biological in stuttering.

Clinical Implications

The results of the present study may have implications on how we treat stuttering. First, the results suggest that fluency breakdowns are impacted by a number of inseparable factors including speech motor control, and social context and interaction. Individuals who stutter often report and/or have been observed to be more fluent during their treatment sessions than outside sessions. Similarly, they may also report being more fluent with certain people but being more disfluent with others. These observations and reports along with the findings of the present study indicate the need to take into account the context and surrounding of the social interaction as a variable in treatment success. The findings of the present study also indicate the crucial role of the communication partner as a resource for successful communication, and thus, must be considered in our treatment of stuttering.

Areas for Further Study

The aim of this dissertation research was to examine the impact of stuttering on "real" world communication by focusing on the functional communication system managing stuttering. The current analysis has begun to characterize the impact of stuttering on communication. However, a number of questions remain to be answered. First, participant pairs both managing and not managing stuttering successfully collaborated with their communication partners who were friends in the present study. The questions remains if these collaborations would still be successful when AWS are partnered with mere acquaintances or strangers. Second, two participant pairs who were non-Native English speakers (who were not included in the final analysis) expressed difficulty in generating initiating referencing expressions in English. The participant pair who was managing stuttering appeared to have an even more challenging time in developing and using target labels compared to their comparison pair not managing stuttering. Further investigation is needed to examine if language proficiency is a factor in determining how well the functional communication system is able to adapt and accommodate deviations. Following, a different line of thinking, research on the dopamine system suggests that it is a neurotransmitter that may have far reaching motor affective and social consequences in people who stutter (Lan et al., 2009; Lavid, Franklin & Maguire, 1999; Maguire et al., 2000; Maguire et al., 2004; Rodriguez-Jimenez et al., 2006; Wu et al., 1997). In the present study, AWS displayed variability in the frequency and severity of fluency breakdown, and types of stuttering that are likely to be associated with motor and affective factors. In Parkinson's disease, the severity of symptoms is thought to be linked to a dopamine dysfunction, specifically dopamine D3 receptor (D3R) gene expression and binding (Nagai et al., 1996). A similar dysfunction may be present in stuttering that influences severity of the disorder and motor performance in people who stutter.

Further investigations are warranted to study the link between dopamine dysfunction; and the experiential, behavioral and cognitive components; and overt manifestations of the disorder.

I also plan to continue analyzing the rich data set from this study. The barrier design in the present study adopted from Hengst (2001, 2003) and Hengst et al. (2010) allowed participants to use gestures, facial expressions and other non-verbal communication to interact with their communication partners. The collection of videos acquired for this study will let me conduct detailed analysis of verbal and nonverbal actions across all sessions and trials for both groups of participants. Also included in this data are individual and joint interview narratives, I plan to conduct qualitative analysis of the interviews to uncover the patterns and themes around the experience of stuttering. Another direction of research is the impact of fluency breakdowns on conversational repetition. Presently, I have started analyzing the impact of fluency breakdowns on three dimensions of repetition: self/other, immediate/delayed and paraphrase/verbatim. Additionally, I plan to investigate whether the modality of response (verbal versus written) influences the production of target card labels particularly for participants who stutter, by comparing verbally produced target card labels during the barrier game sessions and written labels supplied by participants at the end of each session.

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APPENDIX A: ILLINOIS CLINICIAN STUTTERING SEVERITY SCALE FORM

Clinician Observation Form

Today's Date:________________

Clinician:______________________________

Participant's pseudonym: _______________________________

Participant's Name: ______________________ ______________________________

Last First

Observation:

1. Did the participant stutter overtly during the examination Yes No

2. Did the participant exhibit covert stuttering during the examination? Yes No

3. How often did the participant have disfluencies during the examination?

____Rarely ____Sometimes ____Frequently ____Almost all the time

4. Classify the main characteristics of the disfluencies

____Repetition ____Prolongations ____Blocks ____Interjections

____Hesitations ____Other(specify): ______________________________

5. Did you observe any secondary behaviors? Yes No

If yes, list them ____

1. Other observations:

Illinois Clinician Stuttering Severity Scale

Participant: _________________________________ Date of Interview:_________________

Rater: ________________________________

Circle the appropriate level for SLD, duration and tensions and enter below.

SLD	Score		Duration or Units		Score		Tension	Score
0-3	0		none	1	0		none	0
3-5	1		none/fleeting	1+	1		none-slight	1
5-7	2		< 0.5 sec	1.5	2		Slight	2
7-10	3		< 1 sec	2	3		Slight-moderate	3
10-15	4		< 1.5 sec	3	4		moderate	4
15-30	5		< 2 sec	4	5		Moderate-excessive	5
>20	6		> 2 sec	>4	6		excessive	6

Secondary Characteristics

.25 ___mild, very few, infrequent, minimal; not noticeable unless looking for it

.33 ___mild, few & occasional; barely noticeable

.50 ___moderate, few & sometimes; noticeable

.66 ___moderate, some&/or often; obvious

.75 ___ severe, many &/or frequent; distracting

1.00 ___severe, many & frequent; severe and painful looking

SLD points +duration + tension points divided by 3 =

(_____ + _____ + ______) = ______/3 = _______

Additional points for secondary characteristics _______

Total Severity Score _______

Comments:

Instructions:

1. On a scale of 1-6 as indicated, circle the number of SLDs (part-word repetition, single syllable word repetitions, and blocks and prolongations) per 100 syllables.
2. Rate the length of the average of the 5 longest disfluencies in repetition units (RU; bu-bu-but = 2 units, and-and-and-and= 3units) and/or length of prolongations, whichever is more predominant and severe.
3. Rate the tension of disfluencies.
4. Add the three scores and divide by 3.
5. Add any points for secondary behaviors

APPENDIX B: PHONE SCRIPT

Hello. My name is ________________________. I am calling on behalf of the Discourse Laboratory at the Speech and Hearing Science department of the University of Illinois. Thank you for your interest in participating in our study to learn more about how people who stutter communicate.

Let me tell you more about the study. Please stop me at anytime if you have questions. The study involves two participants who are familiar with each other playing a barrier card game. During the card game, one of the participants will be the director and the other person the matcher. The goal of the barrier game is for director to tell the matcher how to arrange his or her card so that both boards match at the end of the trial. There will be a total of four barrier game sessions and one final interview session where you will be shown brief videos clips of their barrier game sessions and asked to discuss how you both worked together during those sessions. Also, you will be asked to identify an individual you would like to have participate with you in the study, someone you communicate with regularly-at least once a week and have known at least 4 months.

Let me tell you about the study in more detail.

Go over consent form with participants at this point.

Would you like us to mail you a copy of the consent form? We can mail it, fax it or email it to you.

Before you participate in the study we would like to make sure that you meet the criteria for participation. So let me go through some questions with you to see if you meet the criteria. Please answer the questions to the best of your knowledge.

Question 1.

Have you ever had any speech/language or hearing problems? Yes No

If the answer is yes,

Could you please tell me more about it?

Have you ever received treatment for the condition? Yes No

If the answer is yes,

Could you please tell me more about it?

Does it affect your speech, language or communication? Yes No

Question 2.

Have you had any head injuries? Yes No

If the answer is yes

Did you at the time of the injury have any problems speaking or remembering? Yes No

Question 3.

Do you currently have any conditions that affect your speech, language, communication or learning? Yes No

If the answer is yes

Could you please tell me more about it?

Question 4.

Are you being treated for depression, head injury, stroke or any other problems? Yes No

If the answer is yes

Could you please tell me more about it?

Question 5.

Do you have normal or corrected to normal vision? Yes No

Question 6.

Can you hear well in a quiet room? Yes No

Question 7.

Do you have a history of stuttering? Yes No

If the answer is NO skip to question 12.

If the answer is YES

How old were you when you began to stutter?

Question 8.

Was the diagnosis made by a professional? Yes No

If the answer is YES

Could you tell me who it was?

Question 9.

Do you still stutter now? Yes No

If the answer is yes skip to question 10.

If the answer is NO

At what age did you stop?

Question 10.

Have you ever received therapy for you stutter? Yes No

If the answer is NO skip to question 11.

If the answer is yes

At what age did you start receiving therapy?

Are you still receiving therapy for stuttering? Yes No

Question 11.

How would you rate your severity in everyday speaking situations? In general, would you say it is mild, moderate or severe?

Question 12.

Will you be able to identify a person/partner that you would like to have participate in the study with you? Yes No

Question 13.

How old are you?

Question 14.

What is your highest level of education?

Question 15.

What is your self-declared ethnic status?

Question 16.

What is your dominant language?

What is your mother tongue or native language?

If you have any questions, please let me know. Thank you very much for your time. We will contact you shortly to let you know if you meet the eligibility criteria.

APPENDIX C: PRIMARY PARTICIPANT INFORMED CONSENT FORM

Project Title: Examining Fluency Practices: An Interactional Study of Stuttering

Principal Investigator: Julie A. Hengst, Ph.D., Associate Professor in the Department of Speech & Hearing Science, University of Illinois at Urbana-Champaign (phone: 244-6149; hengst@illinois.edu)

Purpose of this Research Project

This research study looks at how stuttering interacts with the everyday repetition of words and sounds that speakers use when they talk.

Length of Participation

Participants will be asked to come to 5 research sessions within 2-3 weeks. We will arrange sessions at times that fit participants' schedules.

What you will be asked to do

- Pick a partner to complete the study with you.
- Attend, with your partner, a total of five 60-90 minute sessions:
  - Barrier Task Sessions—during four sessions, you and your partner will work together to complete 6 trials game by matching playing cards on a game board.
  - Interview Session—during the last session, you and your partner will be shown video clips of you playing the barrier game; asked about how about you played the games; and be given standard speech, hearing, language and communication screenings.
- Provide your own transportation, to and from sessions all of which will be held at the Speech & Hearing Science Department or Clinic at the University of Illinois (parking costs during sessions will be covered by the project).
- Agree to allow all sessions to be video and audio recorded for data analysis, and if you agree, to also allow video clips to be used in research reports.

Your Participation is Voluntary

Participation in this project is voluntary, and you may withdraw from this project at any time. If you are employed by, receive services from, or linked to the University of Illinois your decision to participate, decline, or withdraw from this study will have not an effect on your status at, or future relations with the University of Illinois.

Benefits and risks of participation

- Participantion in this study is not physically demanding and most participants report enjoying playing the card game used.
- Because we will be videotaping there is a slight risk that participants may be recognized from video clips when the research in presented. The researchers will make every effort to minimize this risk by using paricipant identification numbers and/or pseudonyms, and participants will have the choice of how their video is used (i.e., used in analysis only; used fully with video clips and/or images potentially included in presentations and publications).
- There are no immediate benefits to the participants. This research may help us find new treatments for stuttering.

Compensation

As token compensation for your effort and time, you will receive $10 for each session. A lump sum payment will be made at the end of the study, after sessions have been completed.

Confidentiality

The project is designed to minimize your risk of being identified. Specifically:

- For research sessions held at the Speech Language Pathology Clinical Building (Oak Street) the closed-circuit video system will be used to record sessions; these recordings will be automatically discarded from the system within two weeks. Data collection at SHS Sixth Street location will use free-standing digital video and audio equipment. Only DVD recordings will be kept for this research study.
- All data from your session (e.g., researcher notes and digital recordings) will be labeled with a participant identification number and/or a pseudonym.
- Data excerpts used in professional workshops will be edited to assure that, other than your image, any identifying information (e.g., your name) is excluded.

How the results of the data from this project will be used:

The results of this research will be presented in professional publications and at professional conferences or other educational and professional settings (e.g., lectures to university students). These reports may be in both written and oral form and will include examples from the data collected. These examples may include written transcripts and/or audio samples of the speech of participants as well as still and/or video images of the participant during these sessions.

****

Written Consent to Participate as Described above:

I have read the above information about this project and have received a copy of this consent form for my records. A member of the research team has discussed the details of this project with me and answered my questions about the procedures, benefits and risks involved. I assert that:

- I am 18 years of age or older;
- I voluntarily agree to participate in this study;
- I agree to have all sessions video recorded for analysis;
- I also agree to have audio and video clips used in the following way (check one):
  - □ audio & video clips may be used in research reports (as described above)
  - □ audio and video clips may be used only in analysis, NOT in research reports

____________________	____________________	____________________
Print Participant's Name	Participant Signature	Date
____________________	____________________	____________________
Print Researcher's Name	Signature of Researcher	Date

For Further Information:

Please contact the researcher listed above at (217) 819 2090 or Dr. Julie Hengst, Principal Investigator, at (217) 244-6149 if you have any questions, or concerns about this research. If you have any questions about your rights as a participant in this study, please contact the University of Illinois Institutional Review Board at 217-333-2670 or via email at irb@uiuc.edu .

APPENDIX D: SEEKING PARTICIPANTS FOR RESEARCH

Seeking Participants for Research on:

Examining Fluency Practices: An Interactional Study of Stuttering

- Goal of the study: To look at how stuttering interacts with the everyday repetition of words and sounds that speakers use during conversations

- As a participant:
  - You will be asked to pick a familiar partner to complete the study with you;
  - You and your partner will attend five 60-90 min sessions;
  - During the first four sessions, you will complete six trials of a card game;
  - During the fifth session, you and your partner will talk with the researcher about how you played the game and will complete basic language and speech tests.
  - You and your partner will each be paid $10 for every session you attend.

- When: The study will be conducted during the Fall 2011 and Spring 2012 semesters. All five sessions will be scheduled within 2-3 weeks.

- Who is eligible: We are recruiting both participants who stutter and who don't stutter. All participants must be native (or near-native) speakers of English; be 18 years old, or older; have no history of speech, language, hearing or learning problems (other than stuttering); and no history of brain damage.

- If you want to learn more: Contact
  - Ai Leen Choo (email: **choo1@illinois.edu** or tel: **217-819-2090**) or Julie Hengst (email: **hengst@illinois.edu**).
  - We will set up a phone or face-to-face interview (your preference) to determine your eligibility and answer any questions about participation in the project.

APPENDIX E: BARRIER GAME INSTRUCTIONS

Examining Fluency Practices: An Interactional Study of Stuttering

Barrier Game Instructions

General Protocol for Barrier Game:

- There will be 12 tangram cards for each participant.
- The barrier game is played six times each session over four sessions.
- The matcher/director roles alternate for each trial. The target participant (adult who stutter or normally fluent adult) will begin as the director.
- A final interview will be conducted at the end of each session to determine current agreed-upon-target-label for each card.
- Measures include:
  - correct number of card placements
  - appropriate labels for each card (said by both director & matcher)
  - time to complete each trial

****

All Sessions/Trials Barrier Game Set-Up

<u>Set-up and Materials</u>: Subjects are sitting at a table, facing each other. Researcher is on the side. Cameras are in a fixed location on each side of the table so as to make both the participants' faces and the matcher's board visible. Playing boards, cards, and barrier are not in place.

I. At the beginning of each session—Give the following instructions (note that in later sessions, you will need to say less—briefly reviewing the game more than explaining it):

<u>1. Game Instructions:</u>

"I want you to play this matching game; we're going to call it the barrier game. Each session you will play the game six times. And, I will record you playing the game together. It should be fun, kind of like Solitaire or a puzzle. Today, I will teach you how to play the game, it is very easy and there are very few rules."

<u>2. Playing Boards:</u>

"You each have a playing board in front of you." (*Place board in front of each player*) The two boards are identical. They each have 12 spots on them, 6 in the first row and 6 in the second row. Each spot is numbered 1 though 12.

3. Playing Cards:

"You each have a set of 12 pictures. Both sets are identical." (*fan out the two sets of cards but don't allow for discussion of pictures*) "See how there is just enough room for all 12 cards (*Pick up cards again to decrease likelihood of discussion of the pictures*).

4. Director and Matcher:

"To play this game, one person is the director and one person is the matcher. You will take turns being the director and the matcher. The director starts with his/her picture cards already on the playing board. Then the director tells the matcher which picture card to put in each numbered spot, starting with spot 1 (*point to each spot as mentioned*) then spot 2, spot 3, through spot 12. At the end, we check to see if the matcher's board looks like the director's board."

5. Barrier

"However, to make sure that the matcher doesn't just look at the order of cards on the director's board, I will put this barrier between you." (*place barrier*) "Now, can you see each other okay?"

6. Full Communication

"There is only one rule in this game and that is that you can't move or look around the barrier. Other than that, anything goes! Be creative! You can use the cards in any way that you want to. You can use gestures, facial expressions, and you can both talk as much as you want to. The only thing you can't do is move the barrier and look at the order of the cards on the director's playing board."

II. At the beginning of each trial—Assign Roles, Set Up Cards, & Review Rules:

1. Assigning Roles

"Each time we play, you will take turns being the director. Since we are playing six times, (participant name) you will the director 3 times and (partner name) you will be the director 3 times. (Participant name-*target participant**), you will be the director for this first trial. (*For this second trial*—" (Participant name) you directed last time, so this time (partner name) will direct and you will be matcher. … *continue to alternate*) . **target participant is always selected as the director at the start of each session.*

2. Setting up Cards

So, MATCHER, we will set up your cards so that you can easily see all of them." *Stand cards up against barrier in one long row, above the playing board.* "Can you reach all of these?"

"DIRECTOR, we are going to set your cards on the playing board in this order" (*show DIRECTOR the master sheet and start placing cards on playing board. Encourage participant to help if he/she shows any inclination to do so, saying thinks like thank you, yep that's right, let's check, etc.)*

3. Reviewing the Rules:

"Remember there are only *four* rules."

"*First*, the matcher must put the cards on the grid where the director tells you to. The director can start with spot number one, then spot two, then three, and so on until all 12 are done."

"*Second*, for each card you need to work together to come up with an accurate label or name for the card."

"*Third*, you can talk together as much as you want to and use any gestures you want to both to help you place the cards and to help you name the cards."

"*Fourth*, you cannot look at the order of the cards on each other's boards, so you cannot remove the barrier."

Finally, I will leave the room while you are playing the game. I'll be in the observation room on the other side of the glass. So, tell me when you are done with each trial and I'll come back in the room and check your cards.

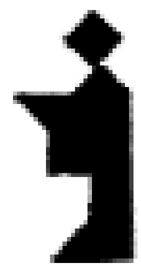
APPENDIX F: CARD LABELS FORM

Please write down your labels for each of the figures.

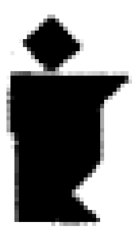
1.___________________________

2.______ ______________________

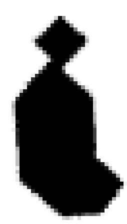
3.__________________________



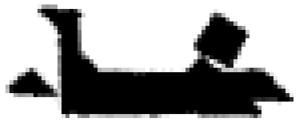
4._____________________________



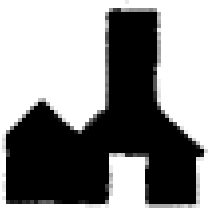
5.___________________________



6.____________________________



7.______________________________ **8.**____________________________



9.______________________________ **10.**____________________________

11.______________________________ **12.**____________________________

APPENDIX G: FINAL INTERVIEW OUTLINE (ADAPTED FROM HENGST, 2001)

I. General questions

2. So what are your thoughts on the barrier game?
3. Was the game easy or difficult? Fun or boring?
4. What made it successful? How did you reach your goals?
5. Were you surprised by the game and how you played it?
6. If you could change the game, what would you change?

II. Review of playing cards

1. Do you remember if your names for the cards changed? Why did you change the names of some of your cards?
2. Do any of these cards seem to go together? Was it harder to or easier to talk about cards when that seemed to go together?
3. Were there some cards that seemed harder than others? Why were they harder?
4. Were there some cards that seemed easier than others? Why were they easier?

III. Patterns of talking

1. Can you tell me if and how your partners' speech changed over the course of the barrier game, from one trial to the next and from one session to the next?
2. Have you had to change your way of talking during the game? If you did, what were the changes?
3. Did you notice these changes while you were playing the barrier game? What were they?
4. How was your fluency or disfluency during the game compare to your everyday communication?
5. On a scale of 0 to 7 how would you rate your fluency (0=*not fluent* and 7=*very fluent*) and disfluency (0=*no stutter* and 7=*very severe stutter*) during the game and during your everyday communication?

IV. Review videotape of the Barrier game

While you are watching this tape, I want you to talk about how you worked together to play the game. Just let me know and I can pause the tape at anytime so you can talk. In general, I am interested in the decisions you made minute by minute.

1. What were your goals and how did they change during the game?
2. Why did you describe the cards the way you did and why did the references change?
3. Were there any particular successes or problems that you would like to share?

APPENDIX H: CONTACT AND HISTORY FORM

Examining Fluency Practices: An Interactional Study of Stuttering

Contact/History Form

Today's Date:________________

Interviewer:_______________________________

Name: _________________________ __________________________________

Last First

Date of Birth (month/day/year): ____________________ Age: ______________

Address

Street: ____

City: _________________________________

State: ______________ Zip: ______________

Tel: (_____)____________________

email:_____________________________

Preferred method of contact: _____phone ______email _____other (specify): ______

Circle all that apply

Sex: Male Female

Ethnicity: American Indian/Alaska Native African American Asian Hispanic

Caucasian Native Hawaiian/Pacific Islander International Other (specify): ___________

Highest Level of Education: ______High School _____College (some college of Bachelor's degree) ______Graduate (master's or doctorate degree)

Dominant Language: _________________________ Mother tongue: ____________________

Speech and Language History

1. Have you ever had any speech/language or hearing problems? Yes No

If yes please specify: ____

Have you ever received treatment for the condition? Yes No

Do you still currently suffer from the condition? Yes No

2. Have you had any head injuries? Yes No

If yes, please specify: ____

Did you at the time of the injury have any problems speaking or remembering? Yes No

3. Do you currently have any conditions that affect your communication? Yes No

If yes please specify:

____

4. Are you being treated for depression, head injury, stroke or any other problems? Yes No

5. Do you have normal or corrected to normal vision? Yes No

6. Do you have a history of stuttering? Yes No

If Yes, please answer questions 7 to 17

If No, skip to question 15

7. Do you know of any other members of your immediate and extended family members who stutter? Yes No

If yes, please list them: ____

8. How old were you when you began to stutter? ____________________

9. Was the diagnosis made by a professional?

_____speech language pathologist _____physician _____teacher

_____Other (specify):__________________ _____no formal diagnosis

10. Have you ever received therapy for you stutter? Yes No

If so at what age? __________________

Are you still receiving therapy for stuttering? Yes No

11. Please check any of the following behaviors that were or are typical of your stuttering.

____ repetition of part words ____ repetition of whole words ____blocks

____ prolonging sounds ____ tension ____others (specify): __________________

12. Do you still stutter now?

____frequently ____ sometimes ____ rarely ____feel that I will but I don’t

____worry that I might ____never and not concerned

13. If you no longer stutter, how old were you when your stuttering stopped? ______________

14. Please indicate the level of severity of stuttering at different times in your life, to the best of your recollection.

Severity/ Age	2-5 yrs	Elementary school	Middle school	High school	Adult	Within the past few months
Severe						
Moderate						
Mild						
None						

15. Do you have normal or corrected to normal vision? Yes No

16. Can you hear well in a quiet room? Yes No

17. Please pick a pseudonym that will be used as your ID:

____

APPENDIX I: POTENTIAL QUESTIONS FOR INTERVIEW

1. Are you from the Champaign-Urbana area?
2. How long have you lived here/there?
3. What do you typically do during your time off? What are your hobbies?
4. Are you planning to go anywhere for the holidays?
5. What is your major?
6. Do you have any siblings?
7. Tell me about your family.
8. What made you decide to participate in the study?
9. Do you enjoy travelling?
10. What are some of your favorite places you have visited?

APPENDIX J: 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.

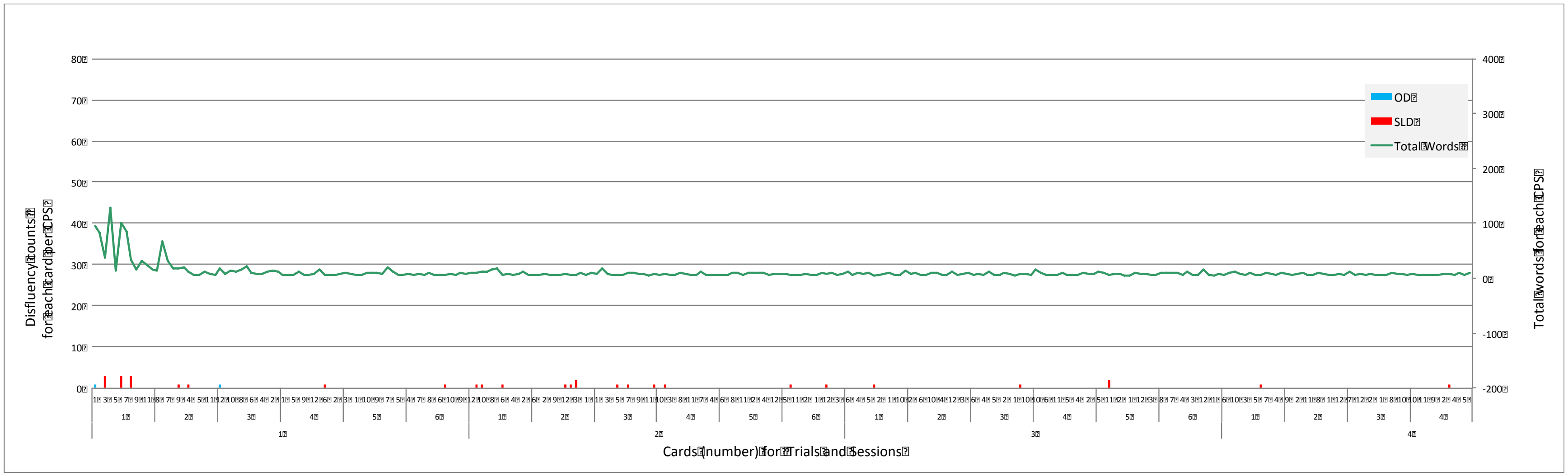
APPENDIX K: TRANSCRIPTION CODES AND EXAMPLES

Transcription codes and examples

PW	Part word repetition; Example: mo-mo-mommy → ([PW2] mommy)
SS	Single-syllable repetition; Example: I- I - I → ([SS2] I)
WW	Whole word repetition; Example: went-went-went → ([WW2] went)
BL	Block; Example: ([BL…3…] architect) denotes block on the word *architect.*
PO	Prolongation; Example: fffffirst → ([PO] first] or ([PO..2..] semesters] denotes that the word *semester* was prolonged for two seconds.
ML	Multi-syllable repetition; Example: busi-busi-business → ([WW2] business)
P	Phrase repetition; Example: I want to I want to go → (I want to [P1]) I want to go.
R	Revisions; Example: I went we went to the store → (I went [R]) we went to the store.
I	Interjection; Example: Uhm → ([I2] Uhm) denotes that *Uhm* was uttered twice.
AC	Activity without vocalizations; Example: 3 seconds of activity → [AC…3…]
DA	Dead Air; Example: 4 seconds of dead air → [DA….4….]
E	Emphasis; Example: extremely → ([E] **ex**-tremely) denotes that the emphasis was placed on the first syllable, *ex*- of the word
F	Foreign words; gracias → ([FW3]/gracias/) denotes that there were 3 syllables to the word.
IW	Incomplete word; Example: p→ ([IW1] /p/) denotes that only *p* was uttered but then abandoned before the word was completed.
S+/2	At that point temporally in transcript, matcher correctly selected card number 2
S-/9	At that point temporally in transcript, matcher incorrectly selected card number 9
P+/4	At that point temporally in transcript, matcher correctly placed selected card on number 4
P-/7	At that point temporally in transcript, matcher incorrectly placed selected card number 7

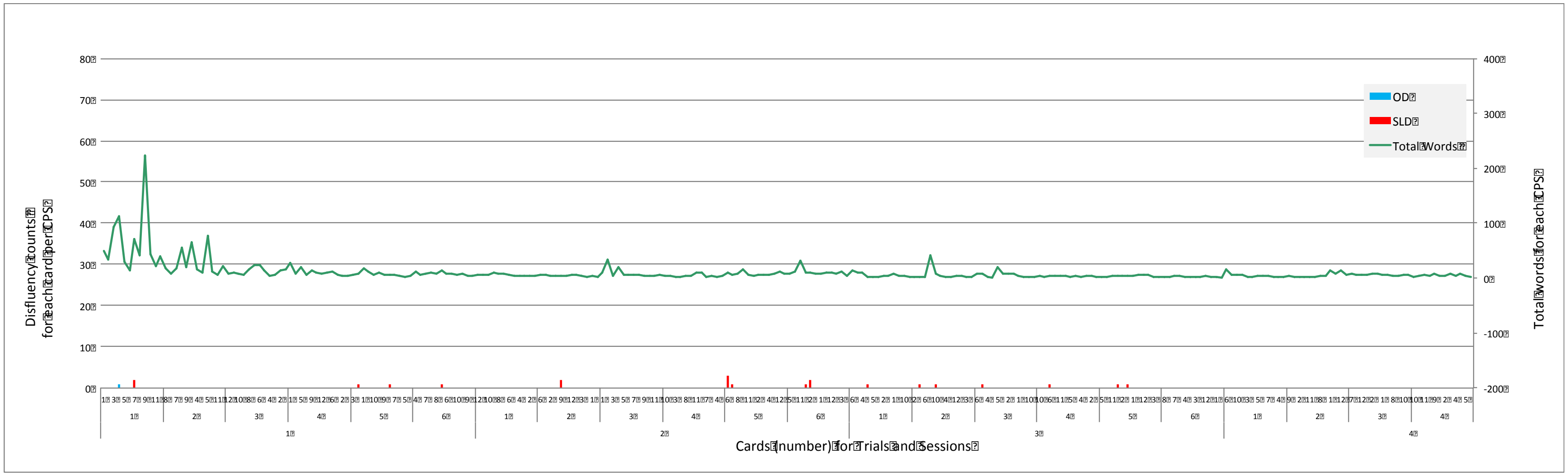
APPENDIX L: NUMBER OF DISFLUENCIES PER CARD PLACEMENT SEQUENCE (CPS) FOR EACH PARTICIPANT PAIR

Carol and Girl (target pair)



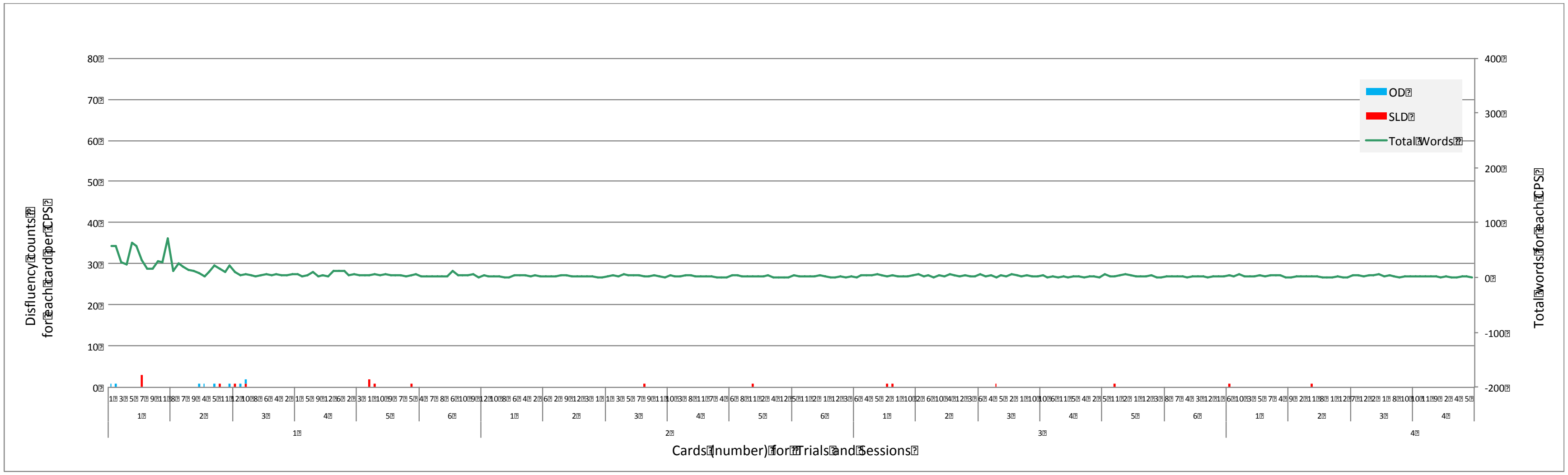
Note: The blue and red bars denote the types and number of disfluencies per card placement sequence (CPS). The blue bars indicate other disfluencies (OD) comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies (SLD) comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

Tebow and Cameron (target pair)



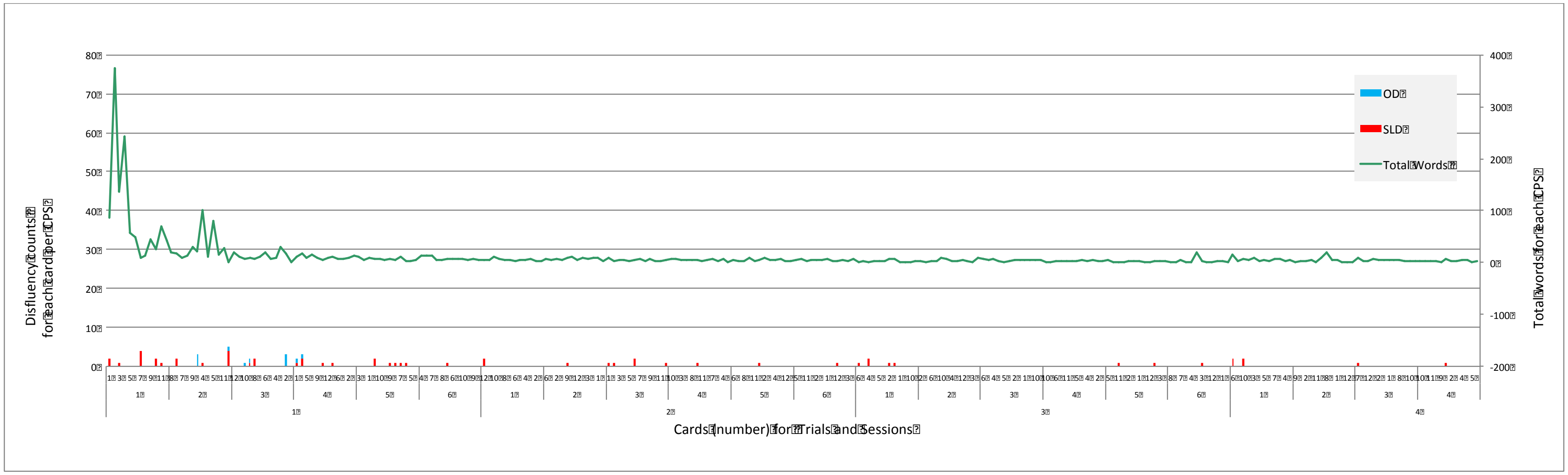
Note: The blue and red bars denote the types and number of disfluencies per card placement sequence (CPS). The blue bars indicate other disfluencies (OD) comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies (SLD) comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

Tom and Pat (target pair)



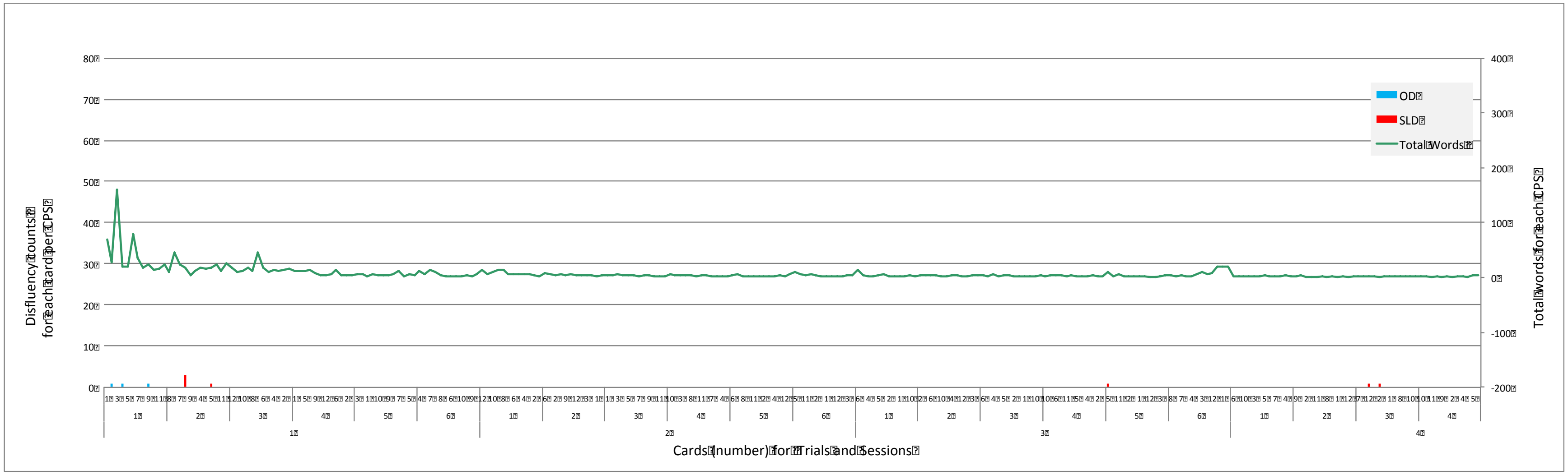
Note: The blue and red bars denote the types and number of disfluencies per card placement sequence (CPS). The blue bars indicate other disfluencies (OD) comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies (SLD) comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

Xavier and Olof (target pair)



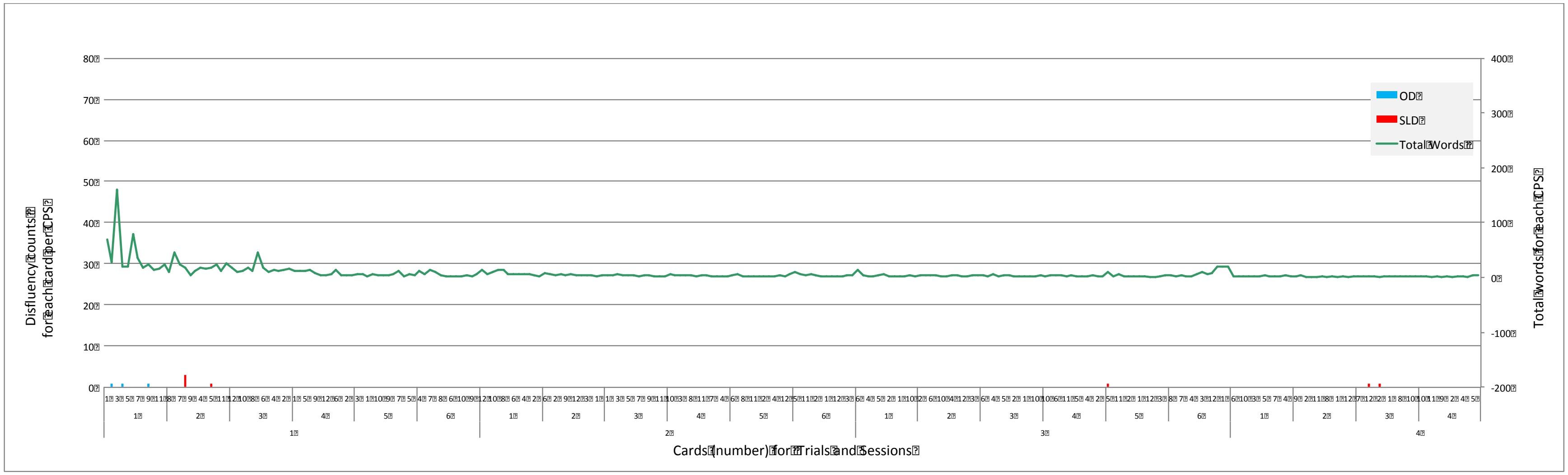
Note: The blue and red bars denote the types and number of disfluencies per card placement sequence (CPS). The blue bars indicate other disfluencies (OD) comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies (SLD) comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

Noj and Tina (target pair)



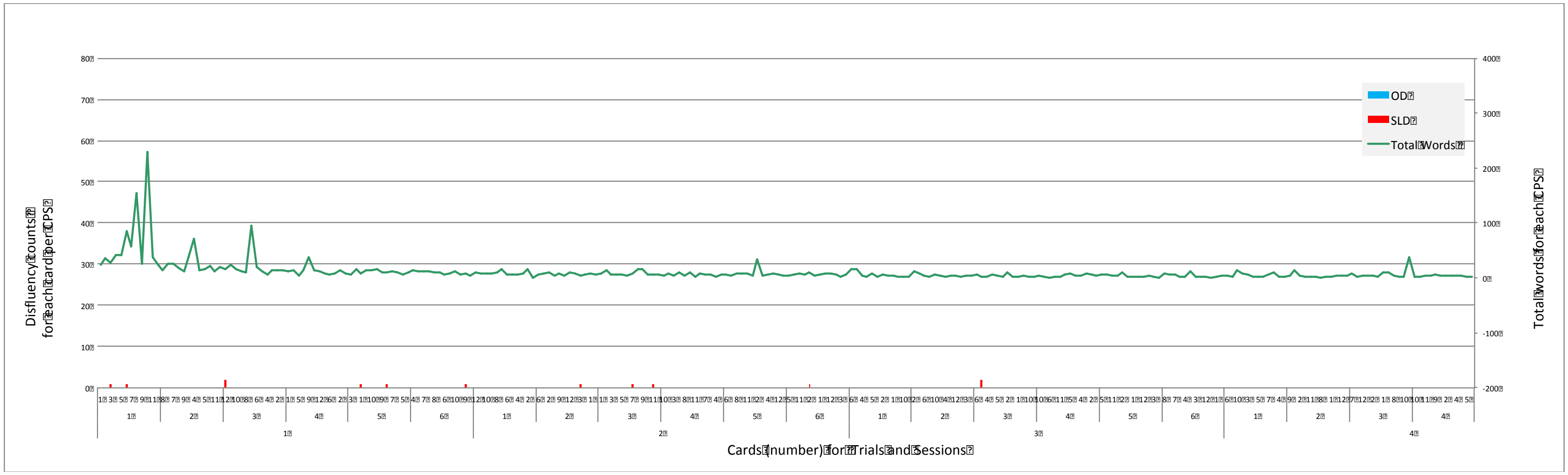
Note: The blue and red bars denote the types and number of disfluencies per card placement sequence (CPS). The blue bars indicate other disfluencies (OD) comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies (SLD) comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

Chelsea and Mary (comparison pair for Carol and Girl)



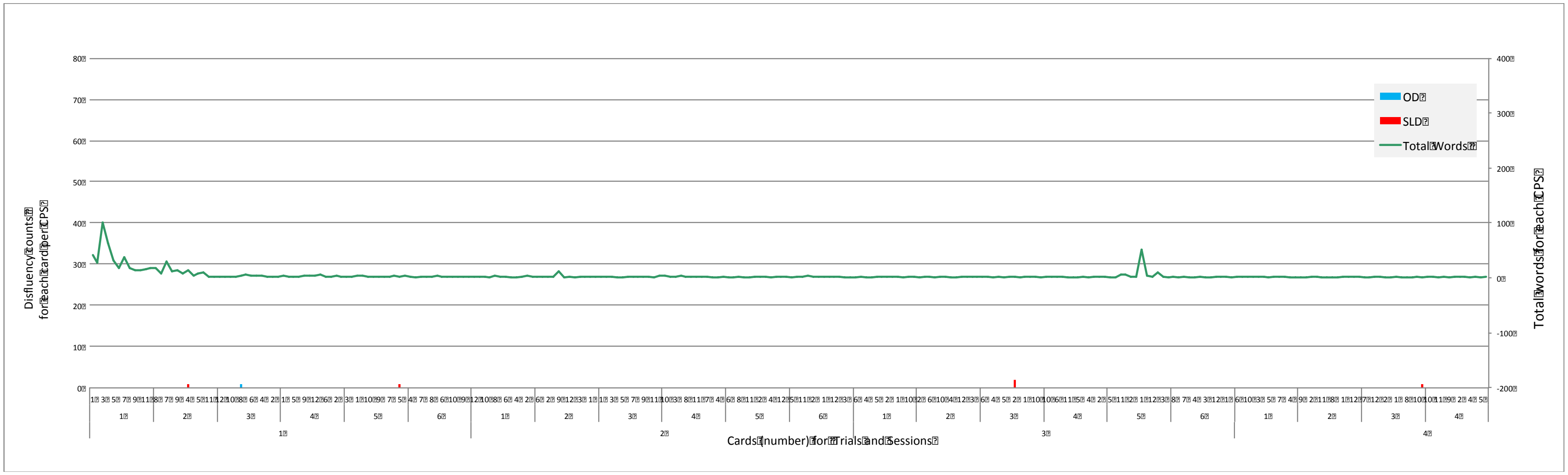
Note: The blue and red bars denote the types and number of disfluencies per card placement sequence (CPS). The blue bars indicate other disfluencies (OD) comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies (SLD) comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

Stella and Danny (comparison pair for Tebow and Cameron)



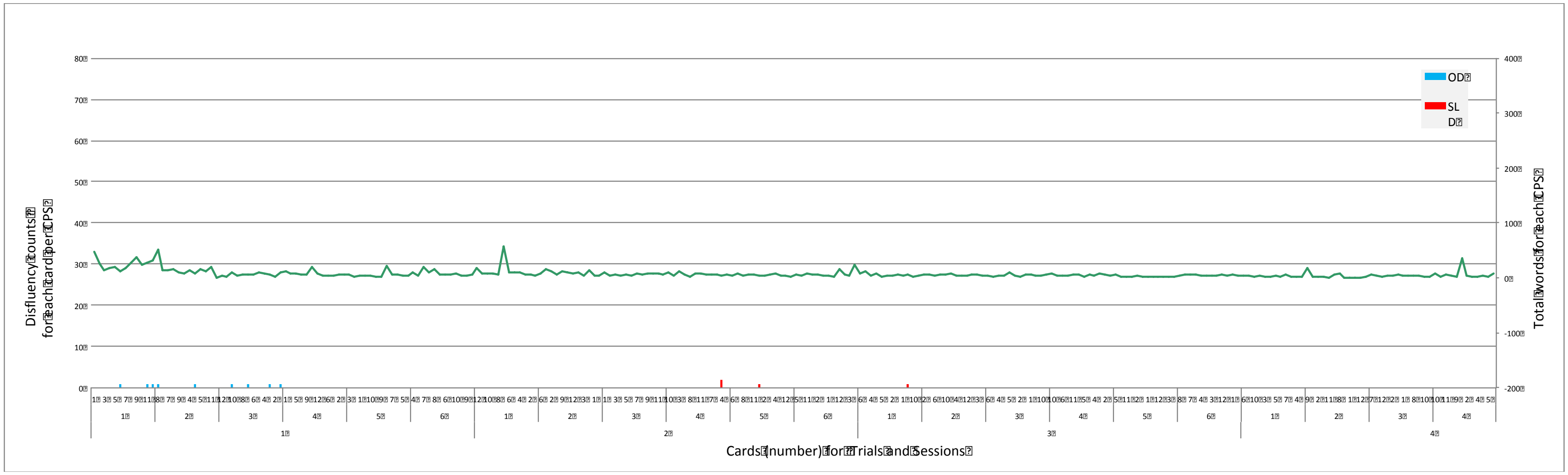
Note: The blue and red bars denote the types and number of disfluencies per CPS. The blue bars indicate other disfluencies comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

Heywood and Andy (comparison pair for Tom and Pat)



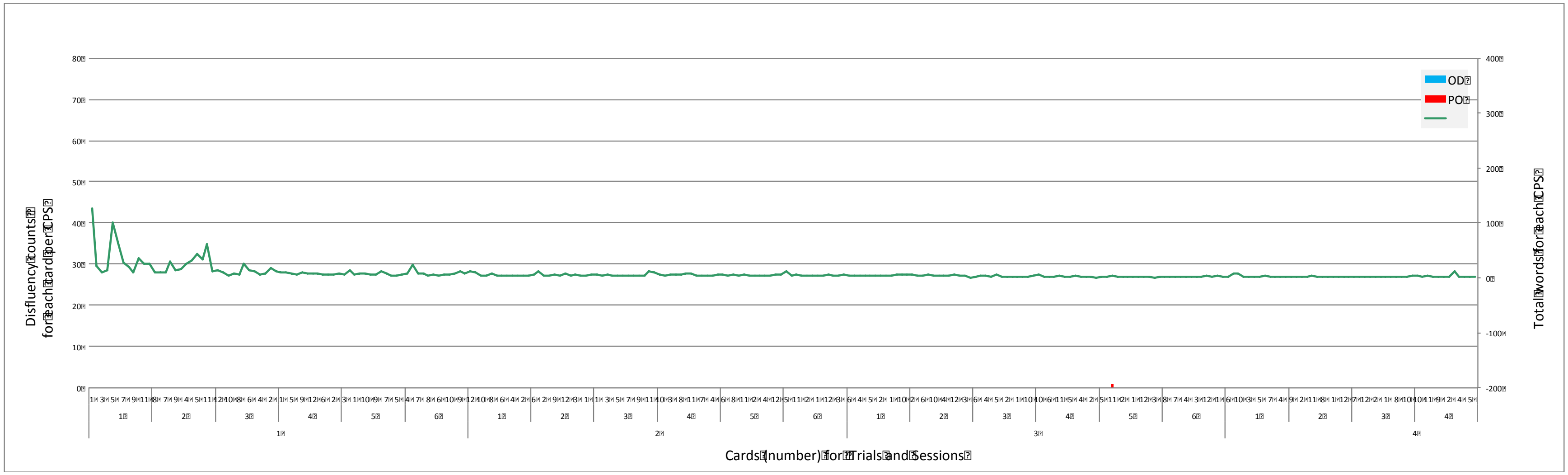
Note: The blue and red bars denote the types and number of disfluencies per card placement sequence (CPS). The blue bars indicate other disfluencies (OD) comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies (SLD) comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

Derrick and Gretchen (comparison pair for Xavier and Olof)



Note: The blue and red bars denote the types and number of disfluencies per card placement sequence (CPS). The blue bars indicate other disfluencies (OD) comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies (SLD) comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

Special K and Dead Lift Diva (comparison pair for Noj and Tina)



Note: The blue and red bars denote the types and number of disfluencies per card placement sequence (CPS). The blue bars indicate other disfluencies (OD) comprising multi-syllabic repetitions, phrase repetitions, revisions and interjections. The red bars indicate stuttering-like disfluencies (SLD) comprising of part-word repetitions, single-syllable repetitions, whole-word repetitions, blocks, and prolongations. The green line denotes the total number of words exchanged during the CPS.

APPENDIX M: TOTAL NUMBER OF DISFLUENCIES PER TEN WORDS FOR EACH PARTICIPANT DURING THE FINAL INDIVIDUAL INTERVIEW SESSION.

Participant Pair	AWS	FCP	Participant Pair	NFA	FCP
1A	0.69	0.19	1B	0.38	0.25
2A	0.89	0.60	2B	1.04	0.96
3A	0.93	0.99	3B	0.44	0.31
4A	1.62	0.66	4B	0.80	0.39
5A	0.80	0.13	5B	0.88	0.28
M	**0.99**	**0.51**	***M***	**0.71**	**0.44**
SD	**0.37**	**0.36**	***SD***	**0.29**	**0.29**

APPENDIX N: PROPORTIONS OF STUTTERING-LIKE DISFLUENCIES (SLD) AND OTHER DISFLUENCIES (OD) FOR ADULTS WHO STUTTER (AWS) AND NORMALLY FLUENT ADULTS (NFA) GROUPS FOR SESSIONS 1, 2, 3 AND 4.

	Session 1											
Trial	1		2		3		4		5		6	
	AWS	NFA	AWS	NFA	AWS	NFA	AWS	NFA	AWS	NFA	AWS	NFA
SLD												
PW	0.115	0.019	0.069	0.061	0.014	0.036	0.077	0	0.034	0	0	0
SS	0.120	0.068	0.127	0.061	0.123	0	0.051	0	0.034	0.080	0	0
WW	0.133	0.078	0.127	0.061	0.123	0.036	0.051	0	0.034	0.080	0	0
BL	0.029	0.029	0.059	0	0.014	0	0	0	0.034	0	0	0
PO	0.050	0.049	0.196	0	0.055	0.143	0.179	0.09	0	0.310	0.316	0
Total	**0.446**	**0.243**	**0.578**	**0.182**	**0.329**	**0.214**	**0.359**	**0.09**	**0.172**	**0.460**	**0.316**	0
OD												
ML	0.016	0.010	0.196	0	0	0.071	0	0	0	0	0	0
P	0.055	0.019	0.010	0	0.096	0.036	0.077	0	0.103	0	0	0
R	0.141	0.194	0.039	0.152	0.068	0.071	0.051	0.270	0	0.080	0.105	0
I	0.342	0.534	0.137	0.067	0.507	0.607**0**	0.513	0.640	0.724**0**	0.460	0.579	1
Total	**0.554**	**0.757**	**0.422**	**0.818**	**0.671**	**.786**	**0.641**	**0.910**	**.828**	**0.540**	**0.684**	1

APPENDIX O: GLOSSARY AND ACRONYMS

Glossary

Common Ground: Mutual knowledge, beliefs and presumptions shared by communication partners.

Developmental Stuttering: A communication disorder that manifest as overt speech disruptions. In the present study, developmental stuttering is referred to as stuttering.

Functional Communication System: An ensemble of various components, including communication partners, context and environment, that operate as a unit to achieve successful communication.

Situated Theories of Communication: Theories of socioculturally situated communicative practices.

Acronyms

AWS: Adults who stutter

CPS: Card placement sequence

CWS: Children who stutter

FCP: Familiar communication partners

ICSSS: Illinois Clinician Stuttering Severity Scale

NFA: Normally fluent adults

OD: Other disfluencies

SLD: Stuttering-like disfluencies

SLP: Speech-language pathologist

TDC: Typically developing children