COMMUNICATION BEHAVIOUR IN ADULTS WITH STUTTERING

A thesis submitted in fulfilment of the requirements

for the degree of Doctor of Philosophy in Speech and Language Sciences

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And Mary Said:

My Soul Proclaims the Greatness of the Lord,

my Spirit Rejoices in God my Savior;

for He has Looked with Favor on His Lowly Servant.

From this Day all Generations will Call me Blessed:

the Almighty has Done Great Things for me,

and Holy is His Name.

– Luke 1:46-49, ICEL

ABSTRACT

Purpose: Adults with stuttering (AWS) commonly demonstrate verbal avoidance behaviours as a result of speech-related anxiety. This can result in an experience of 'communication restriction'. By nature, verbal avoidance and communication restriction are difficult to evaluate objectively, and existing evidence consists primarily of self-report data from qualitative interviews. However, recent preliminary evidence indicates the potential utility of systemic functional linguistics (SFL; Halliday, 1985) to this area of research. The SFL framework provides quantitative analyses for the objective examination of language use in sociolinguistic contexts. Recent data also suggest that the confrontation naming paradigm may be a second possible means for quantitatively evaluating aspects of functional linguistic behaviour in AWS. The purpose of the present study was to identify specific patterns of conversational language and confrontation naming behaviour in AWS using an objective methodology, and to explore these behaviours within the context of stuttering intervention and with reference to the experience of communication restriction.

Method: Twenty AWS (14 males, 6 females) and 20 matched controls (AWNS), aged between 16 and 56 years, were recruited for this study. All participants were native speakers of English with no cognitive, language, motor speech, or hearing impairment (with the exception of stuttering in AWS). All participants completed: (a) self-rating scales of general and communication-related attitudes and anxiety; (b) the UC Picture ID (O'Beirne, 2011) picture naming task, designed to objectively evaluate verbal avoidance behaviour; and (c) 10 minutes of spontaneous conversation with an examiner, loosely structured around a range of set topics. For the AWS participants, these procedures were completed pre- and post-attendance at either the Naturalness Intensive Programme in Christchurch, New Zealand (NZ), or the Intensive Stuttering Clinic (Blomgren, 2009) in Salt Lake City, USA (US). All conversational samples were analysed using both conventional and SFL-based analyses. Specifically, the quantity and complexity of verbal output, as well as the frequency of use of transitivity, modality, appraisal, and thematic resources, were examined.

To identify group differences on all measures between AWNS and AWS at both pre- and post-treatment, two-tailed independent samples *t*-tests and Mann-Whitney *U*-tests were conducted. To compare the performance of AWS between pre- and post-treatment, two-tailed paired *t*-tests and Wilcoxon matched pairs signed ranks tests were used. Group comparisons were conducted for the full participant group, as well as separately for the NZ and US subgroups. Pearson correlation matrices were also constructed, to identify linear relationships between measures. Correlations between conventional and SFL analyses of linguistic behaviour were of particular interest.

Results: Group differences for each subgroup were generally consistent with those for the full participant group. (a) AWS demonstrated higher social anxiety than AWNS at pre-treatment, but self-reported anxiety levels and stuttering impact decreased following treatment. (b) No differences were found across comparisons for confrontation naming performance on the UC Picture ID task. (c) In conversation, AWS produced consistently less language than AWNS, and produced less complex language than AWNS at pre-treatment, as shown by conventional and SFL indices. Specific SFL measures revealed fewer politeness-marking modal operators, more frequent comment adjuncts, and reduced expression of appraisal in the spontaneous language of AWS. Improvements in most of these areas were seen following treatment.

The results of the correlational analyses showed that self-report scale outcomes were not linearly correlated to actual performance on any linguistic measures. However, positive correlations were observed between basic linguistic indices (i.e., language productivity and complexity) from the conventional and SFL approaches. An interesting negative correlation between language productivity and frequency of use of comment adjuncts was also seen.

Conclusions: The current study extends available preliminary evidence on language use in AWS. Linguistic patterns identified in the conversational language of AWS suggest a reduced openness to interpersonal engagement within communication exchanges, which may restrict the experience of such exchanges. The data indicate that conventional and SFL analyses are interchangeable at a basic level, but also exemplify the unique utility of the SFL framework for examining specific aspects of language functionality within social context. Although AWS and AWNS were not found to differ in performance on the UC Picture ID task, the observations provide insight into the conditions under which verbal avoidance behaviours may be prone to occurring. Finally, the lack of straightforward correlations between self-reported anxiety and avoidance on the one hand, and various linguistic-behavioural indicators on the other, highlights the importance of a multidimensional, holistic approach to clinical stuttering evaluation.

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LIST OF ABBREVIATIONS

AWS	adult(s) with stuttering
AWNS	adult(s) with no stuttering
BDI	Beck Depression Inventory
CRH	covert repair hypothesis
CWS	child(ren) with stuttering
CWNS	child(ren) with no stuttering
DCM	demands and capacities model
EXPLAN	execution/planning (theory)
GI	grammatical intricacy
ISC	Intensive Stuttering Clinic (University of Utah)
LCB	Locus of Control of Behavior Scale
LSAS	Liebowitz Social Anxiety Scale
MLUw	mean length of utterance in words
NDWR	number of different word roots
NIP	Naturalness Intensive Programme (University of Canterbury)
NMC	number of major clauses
NmC	number of minor clauses
NPL	neuropsycholinguistic (theory)
OASES	Overall Assessment of the Speaker's Experience of Stuttering: Adult
PPVT	Peabody Picture Vocabulary Test – Third Edition
PSI	Perceptions of Stuttering Inventory
PWS	person(s) with stuttering
PWNS	person(s) with no stuttering
SALT-NZ	Systematic Analysis of Language Transcripts – New Zealand
SI	subordination index
SFL	systemic functional linguistics
SLP	speech-language pathologist
SSI-3	Stuttering Severity Instrument – Third Edition
TNC	total number of clauses
TNMR	total number of modality resources

TNU	total number of utterances
TNW	total number of words
TTR	type-token ratio
T%A	percentage of words expressing total appraisal
VF	verb frequency
%AF	percentage of words expressing affect
%AM	percentage of words expressing amplification
%AP	percentage of words expressing appreciation
%CA	percentage of clauses containing comment adjuncts
%CT	percentage of clauses containing 'clause as theme'
%DM	percentage of naming task responses scored 'dominant match'
%IM	percentage of clauses containing interpersonal metaphor
%INT	percentage of clauses containing interpersonal theme
%J	percentage of words expressing judgment
%MA	percentage of clauses containing mood adjuncts
%MAR	percentage of clauses containing marked theme
%MO	percentage of clauses containing modal operators
%MULT	percentage of clauses containing multiple theme
%NDM	percentage of naming task responses scored 'non-dominant match'
%NM	percentage of naming task responses scored 'no match'
%PB	percentage of behavioural processes
%PC	percentage of causative processes
%PE	percentage of existential processes
%PM	percentage of material processes
%PMe	percentage of mental processes
%PR	percentage of relational processes
%PV	percentage of verbal processes
%SS	percentage of syllables stuttered
%STR	percentage of clauses containing structural theme
%TE	percentage of clauses containing textual theme

PREFACE

This doctoral thesis conforms to the referencing style recommended by the American Psychological Association Publication Manual (6th Ed.).

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Chapter 1. Introduction

Stuttering is a disorder of speech fluency characterised primarily by frequent repetitions and prolongations of sounds or syllables (American Psychiatric Association, 2013; Wingate, 1964). The disorder is not uncommon, affecting approximately 5% of individuals at some point in their lives (Mansson, 2000). In addition to overt speech symptoms, adults with stuttering (AWS) often present with significant communication-related anxiety, in the forms of negative attitudes towards social and speaking situations and behavioural avoidance of speech (e.g., Craig & Tran, in press; Cream, Onslow, Packman, & Llewellyn, 2003; Crichton-Smith, 2002; Mulcahy, Hennessey, Beilby, & Byrnes, 2008). This disorder 'profile' suggests a potential influence of anxiety and avoidance on specific aspects of language use by AWS within everyday communication contexts. Research on systematic patterns of language behaviour in AWS can provide useful insights into the experience of communicating with stuttering, and may also be beneficial for shaping functional treatment outcomes.

1.1. Stuttering, Language, and Communication Restriction

Recognition of the complex interactions that exist between stuttering, language, and communication is not new (e.g., Brown, 1945; Johnson, 1930). Various psycholinguistic theories of stuttering have been proposed by researchers (e.g., Postma & Kolk, 1993; Starkweather, 1987), and much study has been directed to exploring language capability in persons with stuttering (PWS). There is a general consensus that PWS may exhibit poorer receptive and expressive syntactic and lexical abilities than typically fluent speakers (PWNS), as measured using a range of standardised tests and experimental tasks (e.g., Bosshardt, Ballmer, & De Nil, 2002; Newman & Bernstein Ratner, 2007; Ntourou, Conture,

& Lipsey, 2011; Watson et al., 1991). However, alongside language *ability*, there is equally a need to examine language *use* in PWS, as a functional behaviour for constructing meaning within real-world communication exchanges. Self-report data reveal that AWS commonly employ verbal avoidance strategies (e.g., word substitution or omission, verbal run-ups, standard responses to questions) to escape from moments of stuttering, and thus to protect themselves from associated negative emotions (e.g., Cream et al., 2003; Crichton-Smith, 2002). Such strategies develop into habitual (albeit context-dependent) patterns of language behavior, which may persist to some extent following stuttering intervention (Cream et al., 2003). Within qualitative interviews, AWS have described experiencing 'communication restriction' as a consequence of these behaviours, in the forms of miscommunication and reduced opportunities for effective social conversational exchanges (e.g., Cream et al., 2003). There is currently a lack of objective means to evaluate verbal avoidance in AWS. There is also a marked paucity of objective evidence pinpointing specific linguistic patterns that translate into functional language limitations, as experienced by AWS.

1.2. The Androgyne's Patella

Interesting anecdotal evidence from Newman and Bernstein Ratner (2007) suggests a possible methodology for the objective evaluation of verbal avoidance behaviour in AWS. On a confrontation naming task, the authors observed several instances in which AWS participants provided highly unusual word labels in response to common picture stimuli. For example, *boy* was labelled *androgyne*, and *knee* was termed *patella*. No such 'errors' were produced by a control group of fluent speakers (AWNS). The authors postulated that these naming errors might reflect the use of word substitution by AWS, as a strategy to avoid stuttering on difficult sounds or words. Though admittedly contrived, the picture naming paradigm warrants exploration as a potential behavioural tool for the discrete and direct assessment of verbal avoidance in AWS. Such a tool could be of use particularly within clinical settings, as a supplement to existing self-report measures of anxiety and avoidance.

1.3. A Framework for Evaluating Language Use

Systemic functional linguistics (SFL; Halliday, 1985) is an approach to discourse analysis that seeks to explain how people use language as a system of choices for making different types of meaning (Eggins, 1994). The SFL framework views language in relation to three overarching 'ends' (termed 'metafunctions') – that is, as the simultaneous expression of *experience*, *interpersonal* roles, and *textual* structure, within given sociolinguistic contexts (Halliday, 1985). Each metafunction is realised by a specific system of linguistic resources, providing a framework for the systematic and often quantifiable evaluation of language function (Eggins, 1994). The approach has been applied to discourse analysis in numerous communication disordered populations, and, most recently, has been introduced into the field of stuttering research (Spencer, Packman, Onslow, & Ferguson, 2005, 2009).

Data from the preliminary investigations of Spencer et al. (2009) suggest concrete differences in spontaneous communication behaviour between AWS and AWNS, particularly in the use of certain linguistic resources (e.g., politeness markers) for the expression of interpersonal meanings. As discussed by the authors, these patterns of language use reflect, in an objective sense, the tendency for AWS to withhold themselves from social-emotional engagement within conversational interactions. The data from the SFL analyses may be interpreted functionally, in view of underlying disorder characteristics, as concrete manifestations of verbal avoidance in AWS. Previous research employing more conventional analyses of linguistic ability has lacked this integration of objective, quantitative methodology with a fully functional perspective, which is precisely the strength of the SFL approach. Therefore, further study is required to substantiate and extend the exploratory findings of Spencer et al. (2005, 2009), in order to gain a deepened understanding of language use and restriction in AWS with regard to each of Halliday's three metafunctions.

1.4. The Present Study

In light of the above, the present study was designed to contribute objective data to the research on language use in AWS, with reference to verbal avoidance and the experience of communication restriction. The aim was to explore communication behaviour in AWS using both conventional measures of language performance and a comprehensive range of SFL analyses, in order to extend the work initiated by Spencer et al. (2005, 2009). Further, it was the intention of the present study to examine the utility of a confrontation naming paradigm as a behavioural indicator of verbal avoidance, following the observations of Newman and Bernstein Ratner (2007). Possible relationships between verbal-cognitive measures of communication attitudes and anxiety, the confrontation naming data, and the results of the linguistic analyses were also of interest.

Chapter 2. Literature Review

2.1. Stuttering: An Overview

> *The term 'stuttering' means: 1. (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.* (Wingate, 1964, p. 488)

Wingate's (1964) early description corresponds to the recent definition provided by the *Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition* (DSM-V; APA, 2013). According to the DSM-V, the primary symptom of stuttering is a disturbance in normal speech fluency and time patterning, characterised by frequent sound or syllable repetitions or prolongations (APA, 2013). The terms 'repeated movements' and 'fixed postures' have alternatively been used to describe the two major categories of stuttering behaviour (Teesson, Packman, & Onslow, 2003). The DSM-V also makes mention of the associated motor features and speech-related anxiety commonly experienced by PWS.

Stuttering is a developmental communication disorder, that is, one typically diagnosed in childhood or adolescence (APA, 2013). Reports in the literature place stuttering onset between 2 and 5 years of age, with an average of approximately 33 months. Cases of onset as early as 12 months and as late as 13 years have been documented (Bloodstein & Bernstein Ratner, 2008; Reilly et al., 2009; Yairi & Ambrose, 2013). Onset may take place suddenly (within a day or several days) or more gradually, but in the majority of cases, occurs after the emergence of word combinations in children's speech (Bloodstein, 2001; Bloodstein & Bernstein Ratner, 2008; Mansson, 2000; Reilly et al., 2009). Stuttering may also be acquired at any age as a result of stroke, head injury, or neurologic disease, but such presentations are not considered to constitute the same disorder as developmental stuttering (Duffy, 2005).

The prevalence of developmental stuttering is estimated to be 1% of the general population, or slightly lower (Bloodstein & Bernstein Ratner, 2008; Yairi & Ambrose, 2013). There is some variation in the reported figures, which is thought to reflect differences in sample population and study methodology. For example, studies conducted in New South Wales, Australia, have documented stuttering prevalence values ranging from 1.4% of preschool-aged children (Craig, Hancock, Tran, Craig, & Peters, 2002; Craig & Tran, 2005), to 0.33% of primary school-aged children (McKinnon, McLeod, & Reilly, 2007), to 0.72% of the general community (Craig et al., 2002). Across the life span, males are 3 to 6 times more likely to stutter than females (Bloodstein & Bernstein Ratner, 2008; Craig et al., 2002). Researchers have also attempted to determine the overall incidence of stuttering (Craig et al., 2002). Reported stuttering incidence values vary widely, but at approximately 3% to 10%, are significantly higher than the 1% prevalence estimate (Andrews & Harris, 1964; Craig et al., 2002; Mansson, 2000; Reilly et al., 2009).

The discrepancy between stuttering prevalence and incidence figures is typically interpreted to reflect a high natural recovery rate. A relatively large number of individuals stutter in childhood, but only a small portion of these persist into adolescence and adulthood (Bloodstein & Bernstein Ratner, 2008; Mansson, 2000; Yairi & Ambrose, 1999). A recovery rate of approximately 80% by adulthood is widely accepted, with more recently reported values varying from 67% (Craig et al., 2002) to 75% at 4 years post-onset (Yairi, 2004). The data suggest that recovery is most likely to occur within 2 to 3 years post-onset, becoming increasingly less likely with increased age and stuttering duration (Mansson, 2000; Ryan, 2001; Yairi, 2004; Yairi & Ambrose, 1999). Andrews, Craig, Feyer, Hoddinott, Howie, and Neilson (1983) summarised this pattern by concluding that, by age 16 years, recovery would have occurred for 75% of those stuttering at age 4 years, 50% of those stuttering at age 6 years, and 25% of those stuttering at age 10 years. Positive predictors of stuttering recovery include being female (Mansson, 2000; Yairi, 2004) and having no family history of persistent stuttering (Yairi, 2004).

Stuttering is not a disorder that remains static over time. There has been considerable interest in describing its development from early childhood through adolescence, and to differentiate profiles of recovered versus persistent stuttering, and 'incipient' childhood stuttering versus 'developed' stuttering in adults (e.g., Bloodstein, 2001; Howell, Bailey, & Kothari, 2010; Ryan, 2001; Throneburg & Yairi, 2001; Yairi, 2004; Yairi & Ambrose, 1992). Early in its development, stuttering is traditionally viewed as reflecting many of the characteristics of normal disfluency. That is, it tends to be intermittent and to consist primarily of easy whole-word repetitions at the beginning of utterances and phrases, and typically does not involve a high level of speaker awareness or concern (Bloodstein & Bernstein Ratner, 2008; Bloodstein, 2001; Howell, Au-Yeung, & Sackin, 1999; Ward, 2013). However, there are recent data to suggest that stuttering can be severe at onset (e.g., Yairi, 2004), and that even very young children with stuttering (CWS) may show some awareness of their stuttering (Bajaj, Hodson, & Westby, 2005; Boey, Van de Heyning, Wuyts, Heylen, Stoop, & De Bodt, 2009; Vanryckeghem, Brutten, & Hernandez, 2005). Still, it is generally agreed that qualitative differences do exist between the early and later stages of stuttering.

Stuttering has been observed to shift proportionally from function words (e.g., *the*, *she*, *in*) to content words (e.g., *cat*, *run*, *red*) with age (Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981), and older CWS have been found to exhibit significantly higher levels of awareness and negative evaluation of their stuttering than younger CWS (Ezrati-Vinacour, Platzky, & Yairi, 2001). The profiles of CWS who recover from stuttering and those who persist are initially indistinguishable, but diverge by 12 to 20 months post-onset (Howell, 2007; Ryan, 2001; Yairi, 2004; Yairi & Ambrose, 1992). Regardless of severity, CWS who recover demonstrate a steady decline in stuttering frequency and an increasing tendency towards whole-word rather than part-word disfluency (i.e., towards normal rather than stuttered disfluency). However, the stuttering frequency and distribution of CWS who persist with stuttering remain relatively stable, with part-word disfluency as the dominant disfluency type (Throneburg & Yairi, 2001). In its fully developed form, stuttering that persists into adolescence and adulthood is chronic, situation-dependent, and more likely to involve tension and associated movements. It is characterised by anticipatory struggle, fearfulness, and speech avoidance (Bloodstein, 1960, 2001; Howell, 2007).

Attempts to describe the developmental progression of stuttering have been accompanied by investigations into the wide range of factors associated with its onset, development, and eventual recovery or persistence. Although stuttering is still described as idiopathic, or having no known cause (Buchel & Sommer, 2004), numerous variables have been found to play some influential or predictive role in the course of the disorder. As mentioned above, stuttering occurs more frequently in males than females (Bloodstein & Bernstein Ratner, 2008; Craig et al., 2002), and males have a lower likelihood of spontaneous recovery (Mansson, 2000; Yairi, 2004; Yairi & Ambrose, 1999). These observations provide some evidence for a genetic link, further supported by findings concerning the familial incidence of stuttering (Buchel & Sommer, 2004; Packman, Code, & Onslow, 2007), and the incidence of stuttering in sets of monozygotic and dizygotic twins (Dworzynski, Remington, Rijsdijk, Howell, & Plomin, 2007; Felsenfeld, Kirk, Zhu, Statham, Neale, & Martin, 2000; Rautakoski, Hannus, Simberg, Sandnabba, & Santtila, 2012). Family history of anxiety and obsessive-compulsive disorders has also been associated with stuttering incidence (Ajdacic-Gross et al., 2009). Howell (2007) and Rautakoski et al. suggest that 70 to 85% of stuttering liability is genetically determined.

Developmental factors such as premature birth, structural brain anomalies, attention difficulties, reduced intelligence, left handedness, and personality and temperament differences have also been implicated in stuttering onset, although the relative role of each remains unclear (e.g., Ajdacic-Gross et al., 2009; Howell, 2007; Kefalianos, Onslow, Block, Menzies, & Reilly, 2012; Packman et al., 2007; Reilly et al., 2009). The interaction between temperament and stuttering is one of particular interest, with the data indicating that PWS may be less adaptable and more behaviourally inhibited than PWNS (e.g., Anderson, Pellowski, Conture, & Kelly, 2003; Eggers, De Nil, & Van den Bergh, 2013; Kefalianos et al., 2012). In addition to these developmental factors, environmental variables including parental disability, higher parental education level, and the presence of other specific stressors within the family, have been identified as potential contributors (Ajdacic-Gross et al., 2009; Howell, 2007; Mansson, 2000; Reilly et al., 2009). It must be noted that researchers have qualified their findings in this area, cautioning that individual risk factors only explain variation in stuttering onset to a small degree (Reilly et al., 2009). In other words, there is no single, overwhelmingly strong risk factor for stuttering (Ajdacic-Gross et al., 2009).

Two further related areas of study that have received considerable attention are the development of motor and language abilities in PWS. Findings concerning the overall manual skills of PWS remain inconclusive (Bloodstein & Bernstein Ratner, 2008), but there is evidence that their speech motor abilities differ significantly from those of PWNS. Specifically, there are reports of slowness, lateness, incoordination, and increased variability in the motor speech performance of PWS, particularly in response to increased processing demands (e.g., Bosshardt et al., 2002; Kleinow & Smith, 2000; Logan, 2003; Smith, Sadagopan, Walsh, & Weber-Fox, 2010; Watson et al., 1991). These observations lend support to models of stuttering that view underlying motor involvement as key to the occurrence of stuttering moments (e.g., Howell et al., 2004). Further, the presence of a relationship between stuttering and linguistic performance is strongly substantiated, although its exact nature is not entirely clear. The consensus is that PWS have language abilities that are within normal limits, but lower than those of PWNS (e.g., Anderson, Pellowski, & Conture, 2005; Prins, Main, & Wampler, 1997; Wagovich & Bernstein Ratner, 2007). There is also a tendency for stuttering to co-occur with language and/or phonological impairment (e.g., Arndt & Healey, 2001; Clark, Conture, Walden, & Lambert, 2013; Wolk, Edwards, & Conture, 1993). Related research has shown that linguistic ability may predict stuttering onset (Reilly et al., 2009), recovery or persistence (Yairi, Ambrose, Paden, & Throneburg, 1996), and response to treatment (Rousseau, Packman, Onslow, Harrison, & Jones, 2007).

To summarise, stuttering is a disorder of speech fluency characterised by a combination of speech disruption, secondary movements, and associated negative emotions. The condition is relatively high in incidence but low in prevalence, indicating that natural recovery occurs in a majority of PWS. In cases that persist, stuttered disfluency is distinct from normal disfluency in its chronicity, tendency towards part-word involvement, and accompanying tension, anxiety, and avoidance behaviours. The evidence suggests a complex interaction among genetic, developmental, and environmental factors in precipitating and maintaining the disorder. In particular, there are substantial data indicating atypical speech motor and language performance in PWS. The specific role of these various factors in stuttering onset and development remains to be clarified.

2.2. Social-Emotional Consequences of Stuttering

> *Stuttering may be likened to an iceberg, with the major portion below the surface. What people see and hear is the smaller portion; much greater is that which lies below the surface, experienced as fear, guilt, and anticipation of shame.* (Sheehan, 1970, p. 13)

Sheehan's analogy categorises the features of stuttering as either overt (i.e., the portion of the iceberg above the surface of the water) or covert (i.e., the submerged portion of the iceberg). The covert features of stuttering, though invisible, are recognised as central to the presentation of the disorder. In particular, the role of anxiety in stuttering has been a frequent focus of the literature. Johnson (1933, 1942; Steer & Johnson, 1936), Van Riper (1937, 1982), and Sheehan (1970) all viewed anxiety as a key factor in persistent stuttering. Anxiety is typically defined in terms of its state and trait variants. State anxiety is a transitory experience of tension and apprehension in response to a specific situation, whereas trait anxiety refers to the level of anxiety inherent in one's personality (Menzies, Onslow, & Packman, 1999; Spielberger, Gorssuch, Lushene, Vagg, & Jacobs, 1983). Further, anxiety is thought to have behavioural (e.g., escape and avoidance strategies), verbal-cognitive (e.g., subjective reports of emotion), and physiological (e.g., changes in heart rate, respiration rate, or saliva cortisol levels) manifestations, which are interrelated but may occur independently of one another (Menzies et al., 1999; Peters & Hulstijn, 1984). Research indicates that AWS demonstrate elevated levels of both state and trait anxiety (Blumgart, Tran, & Craig, 2010; Craig, Hancock, Tran, & Craig, 2003; Craig & Tran, in press; Iverach & Rapee, in press), although the data are not without inconsistencies. Menzies et al. suggest that the lack of clarity is due at least in part to methodological variations and limitations, relating particularly to how the construct of anxiety is viewed, and thus, how it is measured.

With regard to state anxiety, studies employing verbal-cognitive measures such as the *State-Trait Anxiety Inventory* (STAI; Spielberger et al., 1983) have generally documented significantly higher levels of state anxiety in PWS than PWNS (Davis, Shisca, & Howell, 2007; Menzies et al., 1999; Mulcahy et al., 2008; Peters & Hulstijn, 1984). However, studies assessing sympathetic arousal related to state anxiety through the use of physiological measures have yielded less consistent results (Blood, Blood, Bennett, Simpson, & Susman, 1994; Dietrich & Roaman, 2001; Ortega & Ambrose, 2011; Peters & Hulstijn, 1984; Van der Merwe, Robb, Lewis, & Ormond, 2011; Weber & Smith, 1990). Weber and Smith found that both AWS and AWNS exhibited increases in physiological arousal when speaking, as measured by skin conductance response, heart rate, and blood flow. However, there were no significant differences between the two groups. Peters and Hulstijn documented higher self-reported anxiety in AWS than AWNS after a speech-related task, but did not observe corresponding changes in physiological arousal. Likewise, Dietrich and Roaman found no correlation between self-perceived state anxiety and actual physiological arousal in a group of AWS within specific speaking situations. These data suggest that the subjective experience of anxiety may occur in the absence of any associated physiological response (Blood et al., 1994). Physiological measures of sympathetic arousal should therefore be interpreted in combination with verbal-cognitive and behavioural data (Iverach, Menzies, O'Brian, Packman, & Onslow, 2011; Menzies et al. 1999).

The literature examining trait anxiety in PWS reflects a similar pattern. Self-report measures have generally shown significantly higher trait anxiety in PWS than PWNS (Blood, Blood, Maloney, Meyer, & Qualls, 2007; Blumgart et al., 2010; Craig et al., 2003; Craig & Tran, in press; Davis et al., 2007; Ezrati-Vinacour & Levin, 2004; Mulcahy et al., 2008). However, significant differences between the two groups have not been observed on indices of sympathetic arousal in baseline or resting conditions, indicating comparable levels of trait anxiety as determined by physiological measures (Blood et al., 1994; Peters & Hulstijn, 1994; Weber & Smith, 1990). The relationship between both trait and state variants of anxiety and stuttering severity has also been the subject of interest. Ezrati-Vinacour and Levin observed that adults with severe stuttering demonstrated significantly higher state anxiety than both adults with mild stuttering and AWNS, as measured using a subjective rating scale. Anxiety levels did not differ between the latter two groups. However, other studies have reported no significant association between state anxiety and stuttering severity (Blood et al., 1994; Mulcahy et al., 2008). Further replication of the research is required to clarify the nature of this relationship. In contrast to state anxiety, existing data generally suggest that trait anxiety is not correlated to stuttering severity in PWS (Blumgart et al., 2010; Craig et al., 2003; Ezrati-Vinacour & Levin, 2004; Menzies et al., 2008).

Research has also questioned the specific nature of trait anxiety differences between AWS and AWNS. It has been suggested that "reliance on instruments like the STAI (Spielberger et al., 1970), which treat trait anxiety as a single construct, has masked the possibility that persons who stutter and those who do not differ on particular components of trait anxiety" (Menzies et al., 1999, p. 7). Comparison between AWS and AWNS on the *Endler Multidimensional Anxiety Scales – Trait* (Endler, Parker, Bagby, & Cox, 1991) revealed that AWS exhibited higher scores only on those subscales relating directly to social interaction (Messenger, Onslow, Packman, & Menzies, 2004). Similarly, Blumgart et al. (2010) found that AWS were at significantly higher risk of social phobia symptoms, but not generalised anxiety disorder symptoms, than AWNS. These findings indicate that increased trait anxiety in AWS reflects a specific expectancy of social harm (Menzies et al., 1999).

Behaviourally, communication apprehension in PWS commonly manifests in the form of verbal escape and avoidance strategies (e.g., Cream et al., 2003; Plexico, Manning, & Levitt, 2009; Vanryckeghem, Brutten, Uddin, & Van Borsel, 2004). The close associations among stuttering behaviour, social and speech-related anxiety, and avoidance are not difficult to perceive. The term 'avoidance' has its origins in the literature on behavioural learning (Guitar, 2006). In relation to stuttering, it refers to learnt behaviours arising from anticipation of disfluency and associated negative experiences, which allow escape from such moments or experiences (Guitar, 2006). These strategies have been described as coping responses (Vanryckeghem et al., 2004), or means of protecting oneself from the emotional harm of stuttering (Cream et al., 2003; Plexico et al., 2009). Avoidance behaviours may pertain to specific sounds, words, topics, or speaking situations (Cream et al., 2003; Guitar, 2006). Because they provide initial relief from the negative consequences of stuttering, they are reinforced and become habitual patterns of behaviour (Guitar, 2006). Van Riper (1982) proposed that the word avoidance strategies of PWS may be grouped into categories such as 'substitution', 'circumlocution', 'postponement', and use of 'anti-expectancy devices'. Specific avoidance behaviours may include word substitution or omission, use of pauses, interjections, or verbal run-ups, use of standard responses to deflect questions, overall reduction of spontaneous speech, and modification of speaking manner or loudness (Cream et al., 2003; Crichton-Smith, 2002; Vanryckeghem et al., 2004).

Research into avoidance behaviour in stuttering has primarily taken the form of qualitative, structured or semi-structured interviews (Cream et al., 2003; Cream, Packman, & Llewellyn, 2004; Crichton-Smith, 2002; Plexico et al., 2009) and behavioural checklists (Blomgren, Roy, Callister, & Merrill, 2005; Vanryckeghem et al., 2004). Results of these studies show that verbal avoidance strategies occur significantly more frequently in AWS than their fluent peers. In discussing their use of these strategies, AWS have emphasised their need for emotional protection (Cream et al., 2003). Studies have found that the coping responses used by these individuals vary according to the familiarity and formality of the speaking situation, perceived status of their communication partner, their own physical and emotional state, and their past experiences (Crichton-Smith, 2002; Plexico et al., 2009). Importantly, AWS have acknowledged that such strategies can come at a substantial cost, sometimes resulting in miscommunication, restricted opportunities, and reduced capacity to communicate for social purposes (Cream et al., 2003; Plexico et al., 2009).

There is some evidence that comprehensive stuttering interventions can result in significantly decreased avoidance in AWS (Blomgren et al., 2005; Menzies, O'Brian, Onslow, Packman, & Block, 2008). This evidence is based on self-report measures such as the 'Avoidance' subscale of the *Perceptions of Stuttering Inventory* (Woolf, 1967). However, analyses of qualitative interviews with AWS also indicate that behavioural avoidance may persist to some extent following treatment (Cream et al., 2003, 2004). Some AWS have reported using verbal avoidance strategies in conjunction with speech control measures post-treatment, in order to manage the dynamic demands of conversational interactions (Cream et al., 2004). These individuals describe their struggle to simultaneously plan the content of their speech, make appropriate lexico-grammatical choices, turn-take, and apply their speech control techniques (Cream et al., 2003, 2004).

There are few reports in the literature relating to avoidance behaviour in CWS, which is unsurprising given the lack of clarity around levels of speech-related awareness and anxiety in this population. Speech awareness and negative evaluation in CWS increase with age and time since onset of stuttering (Ambrose & Yairi, 1994; Boey et al., 2009; Ezrati-Vinacour et al., 2001; Vanryckeghem, Hylebos, Brutten, & Peleman, 2001). These observations suggest that the use of avoidance strategies might develop in parallel. Boey et al. documented the frequency and types of awareness behaviours in a large group of CWS aged between 2 and 7 years. The authors reported that over 70% of CWS displayed some degree of awareness of their stuttering. Relevant behaviours included discontinuing speech and leaving the situation, which decreased with age, and becoming upset and asking for help, which increased with age. Awareness was found to correlate positively with stuttering severity. Boey et al. suggested that the responses of CWS were shaped over time by their increasing maturity as well as the reactions of their conversational partners. For example, the observed reductions in more drastic avoidance responses (e.g., leaving the situation) in older CWS might reflect a developing reliance on subtler verbal avoidance behaviours. Within semi-structured interviews, AWS have recalled their use of specific avoidance behaviours as children, in order to cope with classroom speaking situations (Daniels, Gabel, & Hughes, 2012). Subjective data suggest that treatment can facilitate decreased use of word avoidance techniques in school-aged children and adolescents who stutter (Laiho & Klippi, 2007).

At present, dependence on self-report (or parent-report) measures is a clear limitation of the research concerning verbal avoidance in PWS. Although avoidance is a behavioural phenomenon, it is considerably difficult to document objectively. The only necessary evidence of word substitution is the speaker's awareness of selecting an alternative vocabulary item to the originally intended target. This process is not apparent to external observation. In examining the confrontation naming abilities of AWS, Newman and Bernstein Ratner (2007) made the interesting observation that, on several occasions, AWS provided highly unusual word labels in response to common picture stimuli. For example, *boy* was labelled *androgyne*, and *knee* was termed *patella*. The authors suggested that these naming 'errors' might reflect participants' use of word substitution to avoid difficult sounds or words. Though the incidence of such errors was very low and did not significantly influence the findings of the study, these observations provide some insight into potential future methodologies for the objective assessment of verbal avoidance in PWS.

In summary, the literature indicates a close association between stuttering, anxiety, and avoidance. Generally, AWS have been found to exhibit elevated levels of anxiety and apprehension relating to negative social evaluation. Verbal avoidance is a common manifestation of speech-related anxiety in these individuals. Such behaviours may take various forms, and are used as a means of protection from the emotional harm of stuttering. However, the use of verbal avoidance strategies may also restrict the communicative freedom and effectiveness of AWS, and may persist to some degree following treatment. The role of avoidance behaviour in stuttering has important implications for assessment and treatment. At present there is a lack of objective evidence to substantiate existing qualitative and self-report data concerning verbal avoidance in AWS. As such, there is a need for the development of quantitative, behavioural methodologies in this area.

2.3. Stuttering Treatment Approaches

> *Stuttering is more than a riddle. It is at least a complicated, multidimensioned jigsaw puzzle, with many pieces still missing... it has challenged men of many lands and times to find its solution, for riddles and puzzles and problems are always viewed as being potentially soluble.* (Van Riper, 1982, p. 1)

Van Riper's statement exemplifies the complexity relating to the successful treatment of stuttering, and the wide variation in intervention approaches that have been investigated over the years. Attempts to find a 'solution' for stuttering have led to the development of two major behavioural treatment approaches: the stuttering modification and fluency shaping approaches (Prins & Ingham, 2009). More recently, a 'comprehensive' approach combining stuttering modification and fluency shaping components has also emerged (Guitar, 2006).

Modern stuttering modification therapy had its origins at the University of Iowa (e.g., Van Riper, 1937, 1973), and is sometimes referred to as the 'Iowa way' (Zebrowski & Arenas, 2011). The approach encourages acceptance of stuttering, and seeks to teach easy stuttering through reduction of speech-associated tension and avoidance (Prins & Ingham, 2009; Venkatagiri, 2009). The focus of stuttering modification is remediation of the covert features of the disorder, rather than elimination of stuttering behaviour. Its goal is not fluency, but freedom from the need to be fluent (Venkatagiri, 2009). Stuttering modification therapies typically involve the use of pseudostuttering, cancellations and pullouts from stuttering moments, cognitive-behavioural and self-monitoring strategies, individual or group counselling, and related techniques (Blomgren et al., 2005; Laiho & Klippi, 2007; Van Riper, 1937, 1973; Venkatagiri, 2009). A key strength of this approach is its attention to the feelings, attitudes, and behaviours that underlie overt stuttering. However, this requires clinician proficiency in interpersonal counselling processes, which can be significantly more complex than technical speech instruction (Cooper, 1997).

In contrast to stuttering modification, fluency shaping is a speech-based approach that aims to reduce or eliminate instances of stuttering (Guitar, 2006; Prins & Ingham, 2009; Venkatagiri, 2009). This approach was originally founded on the principles of operant-learning theory, and began with a number of early studies examining the use of response contingencies to control speech behaviour in stuttering treatment (e.g., Flanagan, Goldiamond, & Azrin, 1958; Goldiamond, 1965). Fluency shaping views stuttering as manipulable learnt behaviour, and its goal is stutter-free speech (Goldiamond, 1965; Prins & Ingham, 2009; Shames & Florence, 1980). While the strength of fluency shaping lies in its potential to facilitate significant, often rapid fluency improvement, this approach does not directly address covert features of stuttering. Advocates of the approach argue that these maladaptive attitudes and behaviours should naturally diminish following fluency enhancement (Guitar & Peters, 1980). The literature contains references to a wide variety of fluency shaping interventions, including choral speaking, delayed auditory feedback, video self-modelling, response-contingency treatments, and prolonged speech variants (Bloodstein & Bernstein Ratner, 2008; Bothe, Davidow, Bramlett, & Ingham, 2006).

At present, the stuttering modification approach to intervention with PWS is supported by substantially less empirical evidence than the fluency shaping approach (Bothe et al., 2006). Prins and Ingham (2009) assert that this is not surprising because stuttering modification is by nature theory-driven, whereas fluency shaping is outcomes-driven. They suggest that stuttering modification is logically more concerned with providing a descriptive account of stutter events, than producing objective evidence of treatment effects. However, there are data that provide an indication of the effectiveness of stuttering modification therapies for PWS (e.g., Blomgren et al., 2005; Eichstadt, Watt, & Girson, 1998; Laiho & Klippi, 2007; Menzies, O'Brian, Onslow, Packman, St Clare, & Block, 2008). For example, Laiho and Klippi observed that intensive stuttering modification treatment resulted in decreased tension, struggle, and avoidance in a group of stuttering children and adolescents, which was maintained at 9-month follow-up. The authors also reported significant reductions in stuttering frequency and severity. However, these data are difficult to interpret due to the low pre-treatment stuttering frequency (below 1% syllables stuttered) of a large proportion of the participants, as well as the study's reliance on subjective report measures of stuttering behaviour at follow-up. Blomgren et al. reported that the Successful Stuttering Management Program (Breitenfeldt & Lorenz, 1989) resulted in significant, maintained reductions in avoidance, expectancy, and anxiety in a group of AWS. No changes in stuttering frequency were observed. Blomgren et al. concluded that the treatment programme met its primary aims of assisting PWS to modify maladaptive cognitive-behavioural responses to stuttering, but had no lasting effect on the severity of stuttering behaviour. The validity of stuttering modification therapy has been defended despite this lack of quantifiable speech data, on the grounds that the success of the approach is measured chiefly in terms of covert rather than observable change (Prins & Ingham, 2009; Reitzes & Snyder, 2006).

Currently, the outcomes-driven fluency shaping approach is the best-researched and most prevalent approach to stuttering treatment (Bothe et al., 2006; Herder, Howard, Nye, & Vanryckeghem, 2006; Prins & Ingham, 2009). Specific fluency shaping interventions and programmes have been substantiated to varying degrees. Some speech control techniques, including choral reading and whispering, have been found to be ineffective in improving fluency in PWS (Bothe et al., 2006). Other interventions, such as Gradual Increase in Length and Complexity of Utterance (e.g., Ryan & Van Kirk Ryan, 1995), syllable-timed speech (e.g., Trajkovski, Andrews, Onslow, Packman, O'Brian, & Menzies, 2009), altered auditory feedback (e.g., Gallop & Runyan, 2012; Lincoln, Packman, Onslow, & Jones, 2010; Ryan & Van Kirk Ryan, 1995), video self-modelling (e.g., Webber, Packman, & Onslow, 2004), time-out (e.g., Franklin, Taylor, Hennessey, & Beilby, 2008; Hewat, Onslow, Packman, & O'Brian, 2006), and token economy (e.g., Ingham & Andrews, 1973), typically result in some reduction in stuttering frequency (Bloodstein & Bernstein Ratner, 2008; Bothe et al., 2006). However, there are limited data to demonstrate the long-term benefits of these interventions, including social, emotional, and cognitive benefits (Bothe et al., 2006).

Based on the current literature, verbal response-contingency interventions and smooth speech or prolonged speech training appear to be two of the most effective fluency shaping treatments for PWS (Bothe et al., 2006). Verbal contingency treatment is most commonly used with young CWS, and in recent years has been extensively investigated in the form of the Lidcombe Program of early stuttering intervention (Packman, Webber, Harrison, & Onslow, 2008). The Lidcombe Program is one of the few stuttering treatment programmes to have undergone a formal clinical trial (Jones et al., 2008). It is a parent-delivered behavioural treatment that involves the use of positive verbal contingencies to reward fluent speech in preschool-aged CWS (Packman et al., 2008). The treatment reflects the view that stuttering in young children is fully remediable (Guitar, 2006). Research has shown that CWS generally demonstrate normal levels of fluency following Lidcombe Program intervention, and that up to 80% of these children remain fluent several years post-treatment (e.g., Harris, Onslow, Packman, Harrison, & Menzies, 2002; Jones et al., 2008; Latterman, Euler, & Neumann, 2008; Nye, Vanryckeghem, Schwartz, Herder, Turner, & Howard, 2013). There is also evidence for the effectiveness of a Lidcombe Program telehealth adaptation (Lewis, Packman, Onslow, Simpson, & Jones, 2008; Wilson, Onslow, & Lincoln, 2004), and for the use of the programme with older school-aged CWS (Koushik, Shenker, & Onslow, 2009). Some concern has been raised around the fact that the underlying causal mechanism of the

Lidcombe Program is unknown (Bernstein Ratner, 2005; Harrison, Onslow, & Menzies, 2004). However, current data suggest that the intervention is safe, and does not result in negative behavioural, psychological, or linguistic consequences for CWS (Latterman, 2005; Woods, Shearsby, Onslow, & Burnham, 2002).

Prolonged speech training is a speech restructuring intervention widely used with AWS, and is associated with specific speaking techniques such as gentle onsets, soft articulatory contacts, and continuous phonation (Craig et al., 1996). Due to the nature of advanced stuttering, this intervention does not often result in spontaneous fluency. Rather, AWS achieve fluency through an ongoing, conscious use of speech control techniques (Guitar, 2006). Prolonged speech has been taught in a variety of programmed formats, typically involving short but intensive courses of therapy (Bloodstein & Bernstein Ratner, 2008). Intensive treatment delivery is thought to facilitate better skill acquisition and transfer in AWS (Andrews et al., 1983; Langevin, Kully, Teshima, Hagler, & Narasimha Prasad, 2010), and many therapy programmes are therefore conducted in this format (e.g., Blomgren et al., 2005; Langevin et al., 2010). Prolonged speech interventions such as the Camperdown Program (O'Brian, Carey, Onslow, Packman, & Cream, 2009) can facilitate significantly improved fluency in AWS, and successful generalisation and maintenance of speech gains often occurs (e.g., Block, Onslow, Packman, Gray, & Dacakis, 2005; O'Brian, Onslow, Cream, & Packman, 2003; Packman, Onslow, & Menzies, 2000).

Although the Camperdown Program is primarily a non-intensive intervention, it involves a 1-day group intensive session, during which participants develop their speech control ability (O'Brian et al., 2003). The treatment has been found to result in acceptable post-treatment speech naturalness and speaking rate (O'Brian et al., 2003). Similar outcomes have been obtained for adolescents who stutter (Craig et al., 1996; Hancock et al., 1998; Hearne, Packman, Onslow, & O'Brian, 2008). Perhaps due to its emphasis on physical speech production and fluency, data on the social-emotional effects of prolonged speech training are limited. O'Brian et al. reported improved self-perceived speech satisfaction and control in AWS post-treatment. Nonetheless, there is also evidence that individuals continue to feel different from typically fluent speakers following treatment. Self-report data suggest that AWS may struggle to use their new fluency skills in everyday speaking situations, and persist with familiar escape and avoidance behaviours post-treatment (Cream et al., 2003). There is a need for the development of quantitative methodologies to substantiate existing subjective data on post-treatment avoidance behaviour in PWS, and thus to shed light on the persisting experience of communication restriction for these individuals.

Despite the fact that stuttering modification and fluency shaping treatments are viewed by some to be incompatible (Guitar, 2006; Venkatagiri, 2009), recognition of the benefits and drawbacks of each has seen the development of comprehensive interventions, which attempt to integrate the two approaches (e.g., Boburg & Kully, 1994; Irani, Gabel, Daniels, & Hughes, 2012; Langevin et al., 2010; Menzies et al., 2008). For example, the Comprehensive Stuttering Program (Langevin et al., 2010) combines prolonged-speech intervention with cognitive-behavioural, self-management, and self-monitoring training. Data suggest that the program can improve both physical and covert stuttering behaviour in AWS (Langevin et al., 2010). Decreased stuttering frequency, avoidance, struggle, and expectancy, and increased speech rate and confidence, were observed and maintained 5 years after treatment. Similarly, Menzies et al. found that AWS who received speech restructuring treatment following cognitive-behaviour therapy demonstrated sustained improvements in both speech fluency and psychological functioning. Based on findings such as these, Blomgren (2010) argued that the comprehensive approach is the best approach to treatment for PWS.

In a review of the experimental trials conducted for different behavioural interventions used with PWS, Herder et al. (2006) concluded that behavioural treatment does result in positive and significant change for these individuals. However, the authors also noted that outcomes were roughly comparable across treatments. Treatment was better than no treatment, but no single treatment programme consistently produced significantly better outcomes than other treatments (Nye et al., 2013; Zebrowski and Arenas, 2011). Zebrowski and Arenas called attention to the variation in presentation and responsiveness to specific treatments of individual PWS, and highlighted the need to avoid approaching stuttering intervention with a one-size-fits-all mind set. The authors stated that, “it will not be the techniques of behavioral change that will be the deciding factor... it will be factors like the characteristics and life situations that the client brings to the endeavor, and the strength of the client-clinician relationship, that will have the most influence on therapy outcome” (p. 10). Successful stuttering therapy should internalise locus of control (Craig, Franklin, & Andrews, 1984), increasingly allowing PWS to assume personal power over their speaking behaviour, and thus to fill the role of ‘expert’ on their own stuttering (Blomgren et al., 2005; Botterill, 2011). There is increasing awareness of the importance of a PWS-centred approach to stuttering therapy, and of the need to appraise best therapy fit based on the individual profiles of PWS (Bloodstein & Bernstein Ratner, 2008; Floyd, Zebrowski, & Flamme, 2007).

In summary, the stuttering treatment literature contains references to a wide variety of interventions for PWS. At present, the fluency shaping approach to therapy appears to be best supported by empirical evidence. The data suggest that verbal contingency treatments are effective for CWS, while speech restructuring training results in positive outcomes for AWS. Comprehensive interventions have also been shown to produce significant improvements in PWS, in terms of both overt stuttering behaviour, and cognitive, emotional, and social functioning. For AWS, stuttering treatment does not typically result in spontaneous normal fluency, but fluency that is consciously maintained through ongoing speech monitoring and control. Changes to the verbal escape and avoidance behaviours of AWS following treatment are not fully understood, because only self-report and qualitative data are available in this area to date. Objective evidence concerning post-treatment persistence of overt aspects of stuttering, and thus the associated experience of communication restriction, is required. Finally, there is increasing recognition that the individual characteristics of PWS are potentially as influential as therapeutic method in determining the outcomes of intervention.

2.4. Psycholinguistic Theories of Stuttering

> *I have done something that is of absolute significance. I have stripped from my speech defect its ominous mystery. Mystery is always a breeder of fright and terror and despair... The study of psychology, of anatomy and neurology... has all but destroyed the dread grip that stuttering had on me.* (Johnson, 1930, p. 102)

Over the decades, the fundamental cause of stuttering has remained a subject of much study and extensive discussion, and theoretical accounts of the cause of stuttering abound in the speech-language pathology literature. Bloodstein and Bernstein Ratner (2008) made the distinction between theories of etiology, which are concerned with initial onset of stuttering, and concepts of the moment of stuttering, which attempt to explain specific instances of disfluency. Theoretical perspectives emphasising the role of anxiety and negative expectancy, cerebral, physiological, or psycholinguistic functioning, and environmental influences have all been described in the research (Bloodstein & Bernstein Ratner, 2008; Guitar, 2006).

Many of the early theories of stuttering focused on the roles of anxiety, expectancy, and avoidance in the onset and development of the disorder (e.g., Bloodstein, 1972; Johnson, 1933, 1942; Sheehan, 1970; Steer & Johnson, 1936; Van Riper, 1982). Anxiety and avoidance are still currently recognised as core features of stuttering (e.g., Blumgart et al., 2010; Craig et al., 2003; Cream et al., 2003), but there is no strong evidence to suggest a causal link between heightened negative emotion and the onset of stuttering in young children (e.g., Ezrati-Vinacour et al., 2001). Rather, psycholinguistic perspectives on the cause of stuttering have gained prominence. These accounts suggest that the processes of syntactic, lexical, phonological, or suprasegmental encoding for speech production are involved with the occurrence of speech disfluency in PWS (Bloodstein & Bernstein Ratner, 2008). Key psycholinguistic theories of stuttering that have received attention in the recent literature include the demands and capacities model (Starkweather, 1987; Starkweather & Gottwald, 1990), neuropsycholinguistic theory (Perkins, Kent, & Curlee, 1991), covert repair hypothesis (Postma & Kolk, 1993), and EXPLAN theory (Howell, 2004).

2.4.1. Demands and Capacities Model (DCM)

The DCM developed out of observations concerning the relationship between disfluency and language in CWS (Starkweather, 1987; Starkweather & Gottwald, 1990). The authors observed seemingly contradictory reports of both inferior and superior language performance in CWS, as compared to their fluent peers (e.g., Watkins, Yairi, & Ambrose, 1999; Westby, 1979). Citing these data as well as findings that stuttering onset often occurred during periods of rapid language growth, Starkweather and Gottwald suggested that the common factor in each instance was a linguistically demanding environment. Building on this concept of 'demands', the authors described the potential contributions to stuttering onset and development of factors relating to speech motor control, language formulation, social-emotional maturity, and cognitive skills (Manning, 2000b; Siegel, 2000; Starkweather, 1987). The DCM asserts that stuttering occurs when these environmental or intrinsic demands exceed the individual's corresponding capacities (Starkweather, 1987). This implies no abnormality in either demands or capacities, but simply a mismatch between the two (Adams, 1990). For example, children whose parents use or expect highly complex language or rapid speech might exhibit disfluency if they lack the linguistic or motor speech abilities to cope with these expectations, regardless of whether they demonstrate typically developing skills in these areas. This model emphasises the complexity and dynamic nature of demands, capacities, and their interactions (Starkweather & Gottwald, 1990, 2000; Kelly, 2000).

Researchers have criticised the DCM's emphasis on environmental demands, such as parental speaking rate and conversational style, and its relative disregard for internal or intangible demands (Bernstein Ratner, 2000; Curlee, 2000; Manning, 2000a). These less tangible demands include the past experiences and communication attitudes of CWS, and parental willingness to discuss disfluency (Bernstein Ratner, 2000). Such factors are highly relevant in light of Sheehan's (1970) iceberg model of stuttering, and related evidence concerning anxiety and avoidance in PWS. There are also limited data to indicate that parental speech and language characteristics prior to onset contribute to stuttering in CWS (e.g., Kloth, Janssen, Kraaimaat, & Brutten, 1995), or that parents of CWS speak differently to those of typically fluent children (CWNS) (e.g., Kelly & Conture, 1992; Miles & Ratner, 2001; Nippold & Rudzinski, 1995; Weiss & Zebrowski, 1991). Although targeted changes to some aspects of parent-child interaction may improve fluency in CWS (e.g., Millard, Nicholas, & Cook, 2008; Millard, Edwards, & Cook, 2009), this must be countered against evidence that richness of language input is conducive to early language development (Bernstein Ratner, 2000). Nevertheless, the DCM does provide a practical direction for stuttering assessment and treatment. Gottwald and Starkweather (1995) recommended a naturalistic multidimensional assessment of capacities and demands, followed by interventions to reduce demands and increase capacities as needed. The authors cited practices such as parent education and counselling to facilitate appropriate parental expectations, and fluency shaping and stuttering modification strategies to enhance the child's capacity for fluent speech. The strength of the DCM is in its inclusive, multifactorial approach, which renders it applicable to both research and clinical settings (Curlee, 2000; Kelly, 2000). Clinically, the model is a useful framework for explaining stuttering to parents of CWS, and subsequently for setting and targeting specific goals in treatment (Curlee, 2000; Manning, 2000a; Starkweather & Gottwald, 1990).

2.4.2. Neuropsycholinguistic (NPL) Theory

The NPL theory (Perkins et al., 1991) is a multifactorial explanation for moments of both normal and stuttered disfluency, which draws from the disciplines of speech-language pathology, psycholinguistics, cognitive and neuroscience, and evolutionary science. The theory is based on the concept of linguistic and paralinguistic systems in speech-language production, which must operate synchronously for spoken output to be fluent (Perkins et al., 1991). The linguistic system constitutes the conventional symbol-system of syntax, semantics, and phonology, while the paralinguistic system is a social-emotional signal-system (Guitar, 2006; Perkins et al., 1991). Perkins et al. conceptualised the signal-system as having evolutionary roots in primitive non-linguistic human communication, and persisting in its self-expressive prosodic functions even following the development of language. The theory draws on the slot-filler model of speech production (Shattuck Hufnagel, 1979), describing the self-expressive signal as the frame into which symbolic content is inserted (Perkins et al., 1991). Delays in the arrival of either the prosodic frame or linguistic segments, resulting from factors such as neural processing inefficiency and communicative uncertainty, produce speech disfluency (Perkins et al., 1991).

Stuttered disfluency results when slot-filler asynchrony occurs under two additional conditions: lack of awareness of the cause of speech disruption, and abnormal time pressure to continue speaking in the face of this interference (Perkins et al., 1991; Robb, 2010). For example, symbol-system delay resulting from lexical selection or retrieval difficulty would result in normal disfluency, because linguistic system processes are relatively available to speaker awareness. Under sufficient time pressure, such disruptions of known cause might result in filled pauses, interjections, and revisions (Perkins et al., 1991). In contrast, signal-system delay arising from self-expressive conflict or uncertainty, in combination with abnormal time pressure to continue, would produce stuttered disfluency. Signal-system processes are largely automatic and therefore unavailable to speaker awareness, generating disruptions of unknown cause. Sound and syllable repetitions, prolongations, and hesitations would result, accompanied by the feeling of ‘loss of control’. This feeling is the central distinguishing characteristic of stuttered disfluency (Perkins et al., 1991).

Critics of NPL theory have questioned the notion of a paralinguistic system evolving from primitive human communication, asserting that such a concept cannot be proved by scientific evidence, and is therefore invalid (Christensen, 1992). The theory also does not identify practical directions for stuttering treatment, in terms of the mechanisms by which fluency might be expected to improve. However, the variables and interactions that constitute NPL theory allow for specific predictions around the nature and development of stuttering, some of which have been substantiated by experimental evidence. Firstly, the theory suggests that stuttering is most likely to occur at the initiation of an utterance (Perkins et al., 1991). The utterance is viewed as the basic unit of self-expression, and its initiation requires particular synchronisation of linguistic and paralinguistic processing. Research has shown that stuttering occurs more on words in utterance-initial position than in any other position (e.g., Au-Yeung, Howell, & Pilgrim, 1998; Brown, 1945; Hubbard, 1998). However, Perkins et al.’s theory also implies relationships between stuttered disfluency, articulatory rate, and syllabic stress, for which there is little supporting evidence (e.g., Hubbard, 1998; Logan & Conture, 1995; Sawyer, Chon, & Ambrose, 2008).

Secondly, NPL theory makes an assertion regarding the central role of covert features of stuttering in the presentation of the disorder. It is possible to relate the concept of internal time pressure arising from emotionality to the construct of state anxiety. There is qualitative evidence that frustration and helplessness, described by Perkins et al. as varying degrees of loss of control, are core experiences for PWS (e.g., Cream et al., 2003). Finally, the reference NPL theory makes to the role of linguistic processing inefficiency in producing speech disruption suggests some disparity in the language abilities of PWS, which may be a predisposing factor to stuttering onset and development (Perkins et al., 1991). This possibility has been extensively investigated, and the data generally indicate that PWS may demonstrate poorer performance than PWNS on a range of linguistic tasks (e.g., Newman & Bernstein Ratner, 2007; Ntourou et al., 2011; Spencer et al., 2009).

2.4.3. Covert Repair Hypothesis (CRH)

The CRH (Postma & Kolk, 1993) was developed as an explanation for instances of both normal and stuttered disfluency. It is based on Levelt's (1983) model of speech production, which proposes that syntactic and phonological encoding processes for speech-language production are subject to an internal monitor. Levelt conceptualised this monitor to be sensitive to errors such as inaccurate sequencing of linguistic units, inappropriate lexical selection, and phonemic slips, in both the pre-articulatory speech programme and post-articulatory output. Postma and Kolk asserted that speakers possess the ability not only to detect speech errors prior to their overt production, but also to perform covert repairs to prevent their occurrence. Experimental data demonstrating that speech errors such as spoonerisms were more likely to generate real words than non-words were taken as evidence of this pre-articulatory correction process (e.g., Motley, Camden, & Baars, 1982). The central tenet of the CRH is that covert repair processes interfere with the forward flow of speech, producing instances of disfluency. The CRH also posits a relationship between the features of a given covert error, the speaker's repair response, and the form of the resulting disfluency (Postma & Kolk, 1990, 1993). For example, a phrase repetition might be expected to occur in the case of a covert error in syntactic sequencing, where the speaker's response was to restart the linguistic segment preceding the error. In contrast, a covert phonological encoding error involving a syllabic rime unit (e.g., the *ish* in *fish*) would produce either onset sound prolongation (e.g., *fffish*) or intrasyllabic blocking (e.g., *f...ish*). This would serve to postpone production of subsequent units. Based on observations that the stuttered disfluencies of PWS consist largely of part-word disfluencies, Postma and Kolk hypothesised that chronic stuttering arises from an underlying deficit in phonological encoding ability. The authors suggested that such a deficit would manifest in a higher frequency of covert errors, leading to more frequent opportunities for covert repairs, and thus to increased disfluency.

The literature contains some evidence to support the existence of a phonological encoding deficit in PWS. Brocklehurst and Corley (2011) found that PWS report a higher rate of inner speech errors than PWNS during silent reading, which appears to support this notion. However, the same study also observed a lack of correlation between overt and covert speech error rates and frequency of disfluency in PWS, which is contrary to the predictions of the CRH. Data demonstrating a significant relationship between linguistic factors and speech motor performance or stuttering frequency in PWS are generally interpreted in favour of a linguistic encoding deficit in these individuals (e.g., Buhr & Zebrowski, 2009; Howell, Au-Yeung, Yaruss, & Eldridge, 2006; Kleinow & Smith, 2000; Zackheim & Conture, 2003). There is also evidence of significantly delayed speech onset latencies in AWS, which suggests slowed phonological encoding (e.g., Logan, 2003; Watson et al., 1991). It must be noted that the findings in this area are not without inconsistencies. For example, Tsiamtsiouris and Cairns (2009) did not observe significantly elevated verbal response times in PWS, except in response to increased cognitive processing demands. In a summary of the available data, Brocklehurst (2008) acknowledged that phonological encoding ability may be poorly developed in some PWS, but concluded that the existing evidence does not strongly indicate the presence of a deficit sufficient to independently cause the onset of stuttering.

In response to the lack of empirical support for a fundamental phonological encoding deficit in PWS, several alternative explanations for chronic speech disfluency within a general error monitoring framework have been proposed. Of these accounts, Vasic and Wijnen's (2001) Vicious Circle Hypothesis is one of the most recent and extensively cited. In contrast to the CRH, the Vicious Circle Hypothesis posits that the underlying cause of chronic stuttering is a discrepancy in speakers' internal monitoring ability. The theory asserts that hypervigilant internal monitoring in PWS leads to the rejection of otherwise acceptable speech programmes, resulting in excessive repair activity, and thus increased frequency and severity of disfluency (Vasic & Wijnen, 2001). This hypothesis is supported by preliminary data demonstrating heightened action-monitoring neural activity in PWS, regardless of actual error occurrence (Arnstein, Lakey, Compton, & Kleinow, 2011). Further empirical testing of the Vicious Circle Hypothesis would be of interest in future.

2.4.4. EXPLAN Theory

Howell (2004) developed EXPLAN (*ex*ecution and *plan*ning) theory to explain spontaneous speech production and speech disfluency in both fluent and stuttering speakers, in terms of the interaction between cognitive-linguistic planning and motor execution mechanisms. The theory is based on an autonomous model of speech production, in which production processes do not rely on information from perceptual feedback. Howell's account focuses on the issue of timing, or, more specifically, the synchronisation of planning and execution levels of the speech production system. According to EXPLAN theory, plans for linguistic segments are generated sequentially, and execution of any part of a segment cannot take place until its plan has been completed. Responsibility for detecting and signalling planning-execution asynchrony belongs to an external timekeeper mechanism located in the region of the cerebellum. The theory states that instances of asynchrony occur when motor execution rate exceeds linguistic planning capacity, and this manifests as speech disfluency. Data showing a positive association between increased syntactic and phonological complexity and normal or stuttered disfluency rates (Howell et al., 2006; Silverman & Bernstein Ratner, 1997) appear consistent with this notion. However, there is little evidence of a similar relationship between increased speech rate and frequency of stuttering in PWS (e.g., Logan & Conture, 1995; Sawyer et al., 2008).

According to EXPLAN theory, the nature of an asynchronous event is reflected in the characteristics of the resulting disfluency. Normal disfluency occurs when execution for one linguistic segment has been completed, but no part of the plan for the subsequent segment has become available. Hesitations or whole-word (or phrase) repetitions result. Where execution for one linguistic segment has been completed, and a portion of the plan for the subsequent segment is available, part-word or stuttered disfluency may be observed. The shift from whole- to part-word disfluency that often characterises stuttering development may be attributed to speakers' increasing maladaptive tendency to begin executing partially planned linguistic segments (Howell, 2004). Data demonstrating the shift from whole-word repetition to part-word stuttering with age in PWS (e.g., Au-Yeung et al., 1998) are presented as evidence to support this hypothesis. Howell also proposes that chronic stuttering occurs due to a failure in effective functioning of the timekeeper mechanism, such that planning-execution synchronisation cannot be maintained or recovered.

Further, EXPLAN theory gives consideration to potential mechanisms of change underlying common forms of stuttering treatment. Howell (2002, 2004) suggested that the fluency-enhancing effect of altered auditory feedback might arise from interference with the external timekeeper, leading to an overall reduction in motor execution rate. Presumably, this would allow for the re-synchronisation of planning and execution processes, thus improving speech fluency. Although there are some data to support the use of feedback devices by PWS as a means of fluency enhancement (e.g., Lincoln et al., 2010), the research relating to such treatments has yielded conflicting findings. Additional study would strengthen and facilitate further discussion around Howell's propositions on this topic. Finally, EXPLAN theory also offers a basic explanation for the effects of operant conditioning treatments on stuttering, stating that these therapies encourage a reversion to more adaptive, normal speech disfluency behaviours (Howell, 2002). When applied to young children, this may prevent loss of timekeeper effectiveness or sensitivity, thus averting the development of chronic stuttering.

To summarise, psycholinguistic accounts of stuttering suggest an interaction between linguistic processes and speech disfluency in PWS. The theories differ in terms of the specific linguistic processes implicated as causal mechanisms of stuttering. Importantly, some of these theories (e.g., the DCM and NPL theory) give consideration to speech-related emotional factors and attitudes, including the feeling of loss of control frequently associated with stuttering. However, psycholinguistic theories of stuttering do not generally include discussion around conscious, intentional aspects of language use, such as situational speech avoidance or vocabulary selection based on anticipated disfluency. Specific hypotheses relating to the processes of change underlying effective stuttering treatment are also lacking. Nevertheless, psycholinguistic perspectives on stuttering have led to increasing interest in the associations between stuttering, linguistic ability, and language behaviour in PWS.

2.5. Stuttering and Language

> *There has been built up by articulate man an intricate system of language, which has a peculiar capacity for fine shadings and blendings of meaning... [Language] is used by man for the purpose of translating muscle and nerve into business agreements and theatrical elegance, into last wills and sonnets... It is the greatest man-made power*

under the heavens, and without a mastery of it, one proceeds at the risk of all good things. (Johnson, 1930, p.1)

The relationship between stuttering and various aspects of language behaviour in PWS has been the subject of great interest in the literature. Much of the research concerning stuttering and language relates broadly to two major themes: the influence of linguistic factors on stuttering behaviour, and the linguistic abilities of PWS compared to fluent speakers. These have been explored extensively with regards to both CWS and AWS. Two further areas that have received attention in recent years are the use of language by PWS for functional communication, and linguistic changes in PWS after stuttering treatment.

2.5.1. Linguistic Influences on Stuttering Behaviour

Brown (1945) was one of the first to examine the specific relationships between linguistic variables and stuttering behaviour, in his well-known description of the loci of stuttering events (see also Brown, 1937, 1938; Brown & Moren, 1942). Brown's 'four factors' refer to the tendency of stuttering to occur in sentence-initial position and on consonant-initial words, long words, and content words. Since the time of this early research, a wide range of linguistic factors, including but not limited to Brown's four factors, has been explored in relation to stuttering behaviour. The evidence relating to some of these variables is discussed below.

Utterance length and complexity. The disfluent utterances of PWS in spontaneous conversation are significantly longer and more complex than their fluent utterances (Buhr & Zebrowski, 2009; Melnick & Conture, 2000; Robb, Sargent, & O'Beirne, 2009; Ryan, 2000; Sawyer et al., 2008; Wagovich, Hall, & Clifford, 2009; Watson, Byrd, & Carlo, 2011; Weiss & Zebrowski, 1992; Zackheim & Conture, 2003). The data concerning CWS are fairly consistent on this topic, but studies relating to AWS have yielded mixed results (e.g., Logan, 2001; Robb et al., 2009; Silverman & Bernstein Ratner, 1997; Tsiamtsiouris & Cairns, 2013). For example, Logan failed to find a significant relationship between stuttering frequency and utterance complexity within the length-matched utterances of AWS. These observations have also highlighted the need to differentiate the effects on stuttering behaviour of utterance length and utterance complexity. It has been suggested that utterance complexity exerts a significant influence on speech fluency only for young children in whom language acquisition processes are ongoing, and that this influence diminishes with age (Silverman & Bernstein Ratner, 1997; Starkweather & Gottwald, 1990). With regard to disfluency type, there is evidence that normal disfluencies (e.g., revisions) are equally distributed over utterance length, while stuttered disfluencies (e.g., stalls and disfluency clusters) tend to occur more on longer utterances (Robb et al., 2009; Wagovich et al., 2009).

Word class. The effect of word class on speech disfluency is of particular interest with regard to the development of stuttering over time (cf. Bloodstein & Gantwerk, 1967). Content words carry full lexical meaning and include nouns, main verbs, and adjectives, whereas function words carry grammatical significance, and include articles, pronouns, and prepositions (Hartmann & Stork, 1972). It is well documented that CWS stutter more on function words than content words, especially in utterance-initial position (Au-Yeung et al., 1998; Buhr & Zebrowski, 2009; Richels, Buhr, Conture, & Ntourou, 2010). However, the opposite is true for AWS, who demonstrate increased stuttering on content words (Au-Yeung et al., 1998; Brown, 1945; Dayalu, Kalinowski, Stuart, Holbert, & Rastatter, 2002). In a group of PWS of varying ages, Howell et al. (2004) documented a tendency towards increased stuttering on content words with age. Dayalu et al. suggested that the decreased tendency of AWS to stutter on function words might result from a generalised adaptation effect, due to the higher frequency, phonological and semantic simplicity, and predictable nature of these words. Alternatively, EXPLAN theory (Howell, 2004) proposes that the shift from function to content word stuttering in PWS reflects speakers' changing and increasingly maladaptive responses to instances of planning-execution asynchrony.

Word frequency and phonological neighbourhood. Word frequency data for both CWS and AWS have consistently shown that stuttering is more likely to occur on low frequency words. That is, words that occur less commonly in a language are more likely to be stuttered than more frequently occurring words (Anderson, 2007; Dayalu et al., 2002; Hubbard & Prins, 1994; Newman & Bernstein Ratner, 2007). For example, Anderson observed increased part-word disfluency on low frequency words in a group of CWS. There is less evidence to indicate an effect of phonological neighbourhood density or frequency on stuttering behaviour. Phonological neighbourhood density is defined as the number of words that differ by a single phoneme from a target word (i.e., the number of its 'neighbours') (Luce & Pisoni, 1998). Phonological neighbourhood frequency refers to the frequency of occurrence of a target word's neighbours (Anderson, 2007). Newman and Bernstein Ratner found no relationship between either of these factors and stuttering frequency, whereas Anderson reported an effect of neighbourhood frequency, but not density. Further study may clarify the findings in this area.

Phonological complexity. Several studies have reported that PWS exhibit increased disfluency on phonologically difficult words (Brown, 1945; Dworzynski, Howell, & Natke, 2003; Howell et al., 2006). Phonological difficulty is typically calculated based on several different factors, including word length in syllables, and the presence of late-emerging consonants and consonant strings (Howell et al., 2006). Howell, Au-Yeung, and Sackin (2000) observed that the presence of late-emerging consonants alone was not positively correlated with frequency of disfluency in AWS. However, words containing both late-emerging consonants and consonant strings in initial position were significantly more likely to be stuttered. In contrast, increased disfluency has been found to be associated with phonologically easier words in CWS (Dworzynski et al., 2003). This observation might relate to the tendency for CWS to stutter more on function words, which are generally shorter and phonologically less complex than content words.

Speech rate. There is little evidence to suggest a significant relationship between speech rate and the occurrence of disfluency in PWS (Logan & Conture, 1995; Sawyer et al., 2008). Data show no differences in articulation rate between the fluent and disfluent utterances of CWS (Logan & Conture, 1995). Although treatments such as altered auditory feedback and prolonged speech were initially believed to induce fluency through reduced speech rate, there are now data to refute this notion (Hudock, Dayalu, Saltuklaroglu, Stuart, Zhang, & Kalinowski, 2011; Kalinowski, Armson, Roland-Mieszkowski, Stuart, & Gracco, 1993; Macleod, Kalinowski, Stuart, & Armson, 1994; Onslow, Costa, Andrews, Harrison, & Packman, 1996). For example, Kalinowski et al. found that the fluency-enhancing effects of altered auditory feedback occurred for a group of AWS, irrespective of the speech rate of the speakers. Ryan (2000) reported comparable rates of speech in CWS and CWNS, but noted that high maternal speech rate was a strong predictor of stuttering in CWS. This latter observation is relevant to the principles of the DCM account of stuttering (Starkweather, 1987). Ryan concluded that the data relating to speech rate and stuttering remain difficult to interpret, due to the wide variation in methodologies employed by studies in this area. As with speaking rate, the relationship between syllabic stress and stuttering behaviour is also poorly supported (Hubbard, 1998; Hubbard & Prins, 1994).

Communicative intent. Much of the research relating stuttering frequency to communicative intent is based on the spontaneous conversation of CWS. Generally, the findings suggest that CWS stutter more on assertive utterances (e.g., statements, commands, and questions) than on responsive utterances (e.g., answers to questions) (Ryan, 2000; Weiss & Zebrowski, 1992). However, Byrd, Coalson, and Bush (2010) found that when utterances were matched for length and complexity, disfluency rates no longer differed on the basis of broad communicative intent. More detailed analyses revealed significant differences in stuttering frequency for specific utterance subtypes, where more complex, less tangible concepts were associated with increased disfluency. Byrd et al. concluded that communicative intent may influence stuttering behaviour in PWS, but to a lesser extent than previously reported. Existing evidence also indicates that PWS stutter more in unstructured communication contexts, such as spontaneous conversation, than in structured speech situations (Logan, 2001; Weiss, 2004).

Bilingualism. The frequency and severity of stuttering tends to occur differentially across the languages of bilingual PWS. Most of the research in this area indicates a higher rate of stuttering in the less proficient language (Ardila, Ramos, & Barrocas, 2011; Lim, Lincoln, Chan, & Onslow, 2008; Schäfer & Robb, 2012). For example, Lim et al. reported a higher frequency of stuttering in the less proficient language for 19 speakers of English and Mandarin (15 English-Mandarin and 4 Mandarin-English bilinguals). The authors found no differences in proportions of stutter types between languages. Likewise, Schäfer and Robb observed more frequent stuttering in the less proficient language for a group of 15 German-English bilingual AWS. The authors suggested that the greater cognitive and linguistic demands associated with the use of the less proficient language might place additional strain on the speech motor system, thus increasing the frequency of occurrence of speech disfluencies in that language. Schäfer and Robb also noted differences in the percentages of stuttering on function and content words across the languages of their bilingual speakers, and interpreted this as evidence of a less mature form of stuttering in the less proficient language. That is, there was a pattern of disfluency in the less proficient language characteristic of young children who stutter, rather than stuttering that persists into adulthood. However, the opposite pattern of stuttering frequency distribution across the languages of bilingual PWS has also been observed, albeit less frequently (Howell et al., 2004; Lee, Robb, Ormond, & Blomgren, in press). Howell et al. observed both a lower frequency and less developed pattern of stuttering in the less proficient language of a Spanish-English bilingual AWS. In commenting on the discrepancies among the findings in this area, Ardila et al. highlighted the importance of both language-based and individual idiosyncrasies in determining patterns of stuttering behaviour in bilingual PWS.

Cognitive-linguistic processing. The relationship between processing load and aspects of speech production in PWS has received some attention in the recent literature. Bosshardt (2002) reported that PWS demonstrated increased disfluency under dual task conditions, whereas the speech of PWNS was not significantly affected by the increased processing requirements. In a different experiment involving sentence generation, Bosshardt et al. (2002) found that dual-tasking did not generate increased stuttering in PWS, but did result in a deterioration of task performance as compared to PWNS. Bosshardt et al. presented their findings as evidence of a balancing relationship or trade-off between fluency and other cognitive-linguistic capacities in PWS. In a general sense, this concept provides a broad explanation for many other linguistic influences on stuttering behaviour (e.g., utterance length and complexity, word frequency, phonological complexity), which may be viewed in terms of relative processing demands. Such a relationship conforms to the general principles of psycholinguistic theories of stuttering such as the DCM (Starkweather, 1987) and NPL theory (Perkins et al., 1991).

2.5.2. Linguistic Abilities of PWS

General language ability. Numerous studies have examined the receptive and expressive language abilities of both CWS (Anderson & Conture, 2000, 2004; Bajaj, Hodson, & Schommer-Aikins, 2004; Coulter, Anderson, & Conture, 2009; Ntourou et al., 2011; Ryan, 2000) and AWS (e.g., Cuadrado & Weber-Fox, 2003; Kleinow & Smith, 2000; Smith et al., 2010; Spencer et al., 2009; Tsiamtsiouris & Cairns, 2009; Weber-Fox, Spencer, Spruill, & Smith, 2004). These studies have utilised a variety of standardised, criterion-based, and conversational language measures. Generally, the receptive and expressive language skills of PWS are thought to be within normal limits, but slightly reduced compared to PWNS.

Lower scores have been reported for CWS than CWNS on the *Test of Early Language Development – Third Edition* (Hresko, Reid, & Hammill, 1999) (Anderson & Conture, 2004; Pellowski & Conture, 2005; Coulter et al., 2009). Data show that CWS may also perform more poorly on syntactic and semantic judgment tasks (Bajaj et al., 2004), and produce shorter utterances in spontaneous parent-child interactions (Wagovich & Bernstein Ratner, 2007). In a study involving preschool-aged CWS, Rousseau et al. (2007) observed interesting correlations between expressive and receptive language ability and time taken to complete Stage 1 of the Lidcombe Program (Australian Stuttering Research Centre, 2004). Higher mean length of utterance was associated with shorter treatment duration, whereas higher receptive language scores were associated with longer treatment duration. The findings suggest predictive relationships between different aspects of language ability and treatment responsiveness, which have practical implications for the assessment and treatment of stuttering in CWS. In spite of the available data, Nippold (2012) questioned the existence of systematic linguistic ‘deficits’ for CWS, suggesting rather that CWS as a group simply demonstrate the same variation in language ability (encompassing individuals with low, average, and high abilities) as CWNS. The author suggested that sampling and measurement factors may partially account for apparent differences between groups of CWS and CWNS.

Existing data also suggest that AWS may exhibit reduced receptive and expressive language abilities (e.g., Spencer et al., 2009; Weber-Fox et al., 2004), though the findings relating to this population are less consistent. Spencer et al. observed reduced verbal productivity and complexity in the spontaneous monologues of AWS, compared to AWNS.

However, Weber-Fox (2001) observed that AWS and AWNS performed comparably on a semantic judgment task, and Tsiamtsiouris and Cairns (2009) found no differences between the two speaker groups on the *Test of Adolescent and Adult Language – Third Edition* (TOAL-3; Hammill, Brown, Larsen, & Wiederholt, 1994). It is important to note that the validity of the latter result in particular is questionable, because the mean age of the AWS and AWNS in that study (29 years) exceeded the upper age limit for which TOAL-3 standardisation is available (up to 24 years, 11 months). Overall, the evidence in this area is difficult to consolidate and interpret due to the wide variation in linguistic measures and sampling contexts. Future replication of the data is required to provide clarification.

Lexical ability. Studies examining the vocabulary knowledge and diversity of PWS have yielded similar findings to those for general language ability. The consensus is that receptive and expressive vocabulary skills remain within normal limits, but may be slightly reduced, for both CWS (e.g., Anderson & Conture, 2000; Bernstein Ratner & Silverman, 2000; Coulter et al., 2009; Silverman & Bernstein Ratner, 2002; Ntourou et al., 2011) and AWS (e.g., Newman & Bernstein Ratner, 2007; Prins et al., 1997). The evidence indicates that CWS tend to achieve lower scores than CWNS on standardised instruments such as the *Peabody Picture Vocabulary Test – Revised* (PPVT-R; Dunn & Dunn, 1981) (Anderson & Conture, 2000; Anderson et al., 2005; Coulter et al., 2009; Pellowski & Conture, 2005). Ryan (2001) suggested that lower PPVT-R scores among CWS might predict stuttering persistence as opposed to recovery. There is also evidence that CWS may perform more poorly on multisyllabic non-word repetition tasks (Anderson, Wagovich, & Hall, 2006; Hakim & Bernstein Ratner, 2004), and produce fewer verbs in spontaneous conversation (Wagovich & Bernstein Ratner, 2007). Interestingly, Davies (2010) observed that CWS were more likely to use verbs with lower word frequency values than their typically fluent peers. It is possible that this pattern reflects the early emergence of word substitution behaviours in CWS, arising from anticipation and avoidance of disfluency.

The evidence relating to lexical ability in AWS is relatively sparse. Some data suggest that the skills of AWS in this area are equivalent to those of AWNS (Bosshardt et al., 2002; Hennessey, Nang, & Beilby, 2008; Smith et al., 2010). However, AWS have also been found to produce significantly fewer accurate responses in response to picture stimuli within a confrontation naming context (Newman & Bernstein Ratner, 2007). This was particularly the case for target words with lower word frequency values. Newman and Bernstein Ratner's observations imply that AWS may differ from AWNS on some aspects of lexical processing. Further research is required to verify the findings and determine the specific nature of lexical differences characterising AWS speakers.

Linguistic and hemispheric processing. The linguistic processing capabilities of AWS have also received considerable attention in the literature. Electrophysiological evidence indicates the existence of language processing differences between AWS and AWNS (e.g., Blomgren, McCormick Richburg, Rhodehouse, & Redmond, 2012; Blomgren, Nagarajan, Lee, Li, & Alvord, 2003; Cuadrado & Weber-Fox, 2003; Weber-Fox, 2001; Weber-Fox et al., 2004). Increased right hemisphere activation on linguistic tasks has been observed for AWS, as compared to AWNS (e.g., De Nil, 2000). Language functions are known to be predominantly left hemisphere-controlled in typically developing individuals (Love & Webb, 2001). Further, Robb, Lynn, and O'Beirne (2013) observed that AWNS demonstrated a significantly stronger right ear advantage than AWS on a dichotic listening task, involving the simultaneous presentation of different auditory stimuli to the right and left ears. Since the central auditory nervous system primarily involves contralateral pathways (Love & Webb, 2001), the finding suggests reduced left hemisphere dominance for speech-language processing in PWS. This is in agreement with available electrophysiological observations. However, it is not yet clear whether these hemispheric differences represent a causal factor or the effects of chronic speech disfluency (Blomgren et al., 2003).

Behaviourally, researchers have observed that increases in processing requirements affect the performance of AWS to a significantly greater extent than that of AWNS, on various speech-related measures (Cuadrado & Weber-Fox, 2003; Weber-Fox et al., 2004; Bosshardt, 2006). For example, reduced length, accuracy, and rate of linguistic responses have been reported in AWS under dual task or complex task conditions (Bosshardt, 2006; Bosshardt et al., 2002). The evidence also suggests a significant positive relationship between cognitive-linguistic processing load and frequency of disfluency in PWS. It is interesting that both NPL theory (Perkins et al., 1991) and the CRH (Postma & Kolk, 1993) assert that disfluency in PWS is at least partially attributable to a processing inefficiency or deficit of some nature. Future research examining the linguistic processing abilities of CWS would be useful, especially considering the clinical implications of findings in this area.

Speech motor performance. Research relating to motor speech ability has generally documented delayed speech onset times and increased motor variability in PWS, during the performance of various speech tasks (e.g., Kleinow & Smith, 2000; Logan, 2003; Prins et al., 1997; Smith et al., 2010; Smith, Goffman, Sasisekaran, & Weber-Fox, 2012; Tsiamtsiouris & Cairns, 2013). For example, Kleinow and Smith observed that AWS demonstrated higher spatiotemporal variation in speech motor movements across repetitions of a target phrase, than a group of fluent controls. Similarly, Smith et al. found higher lip aperture variability in CWS than CWNS on a non-word repetition task. These data suggest that PWS show reduced consistency in the motor planning and execution processes involved in speech production. In addition, there is evidence of a greater effect of increased linguistic processing demands (e.g., increased sentence length and complexity, lower word frequency) on the speech motor performance of AWS, as compared to AWNS (Bosshardt et al., 2002; Hennessey et al., 2008;

Newman & Bernstein Ratner, 2007; Smith et al., 2010; Tsiamtsiouris & Cairns, 2009; Watson et al., 1991; Weber-Fox et al., 2004).

2.5.3. Language Use by PWS

Whereas levels of language ability or competence in PWS have been well investigated, there are significantly less data relating to the use of spoken language resources by PWS for the purposes of functional communication. The distinction between language *ability* and *use* is especially pertinent in considering this speaker group, because verbal avoidance behaviour is known to occur commonly in PWS (e.g., Cream et al., 2003; Plexico et al., 2009; Vanryckeghem et al., 2004). Such verbal avoidance behaviours imply specific differences in the linguistic choices and functions of PWS within everyday discourse, which can contribute to a certain restriction of communication experience. For example, PWS may substitute or omit feared words, use verbal run-ups and interjections, use standard responses to deflect questions, or avoid speech altogether (Cream et al., 2003; Crichton-Smith, 2002; Vanryckeghem et al., 2004). To date, studies in this area have tended to rely on structured interview formats or self-report checklists. There is little objective, quantitative evidence to demonstrate how the specific verbal behaviours of PWS might influence or be reflected in different aspects of their conversational language.

In preliminary investigations involving AWS, Spencer et al. (2005, 2009) employed linguistic analyses from the SFL approach (Halliday, 1985) to quantitatively examine spontaneous language use in AWS. Within the field of speech-language pathology, SFL has been used to evaluate functional discourse behaviour in a number of clinical populations, including autism spectrum disorders (e.g., Fine, Bartolucci, Szatmari, & Ginsberg, 1994), traumatic brain injury (e.g., Togher & Hand, 1998), and aphasia (e.g., Armstrong, 2001). Spencer et al.'s (2009) findings revealed that AWS were less verbally productive, used less complex language, and used fewer modality resources in 5-minute monologues than a group of fluent controls. Modality resources allow speakers to produce subtle variations in meanings and expressions, functioning as 'politeness markers' within conversational interactions. The authors suggested that the observed differences in the language of AWS might reduce opportunities for conversational partner engagement, and thus enable AWS to minimise or avoid further verbal communication. Indeed, AWS have stated that they experience miscommunication, restricted opportunities, and reduced capacity to communicate for social purposes, as a result of their verbal avoidance behaviours (Cream et al., 2003; Plexico et al., 2009). Spencer et al.'s (2009) data highlight the potential of SFL analyses to mitigate the current lack of objective, quantitative evidence relating to language use in PWS. Further exploration of the linguistic features typical of conversational language in PWS, their relationship to verbal avoidance behaviours, and the associated restriction of communicative effectiveness, is required. Findings in this area have significant practical implications for the assessment and treatment of stuttering.

2.5.4. Linguistic Changes with Stuttering Treatment

Few studies have explored the effects of stuttering treatment on language behaviour in PWS, despite the fact that there are clear links between speech disfluency and various linguistic variables. Bonelli, Dixon, and Bernstein Ratner (2000) and Latterman (2005) examined changes in levels of language performance in CWS following Lidcombe Program treatment, with conflicting results. Latterman observed significantly increased length and complexity of utterances in 4 CWS post-treatment, but reported that all participants' scores on a measure of vocabulary diversity remained below age-appropriate levels. Word processing restrictions and word avoidance were proposed as explanations for the latter observation. In contrast, Bonelli et al. reported no significant change in the linguistic performance of 9 CWS following Lidcombe Program participation. However, the CWS as a group failed to meet developmental expectations for linguistic growth across the intervention period. Bonelli et al. suggested that the pre-treatment language status of CWS (i.e., above, at, or below average) might be a key factor in determining changes in linguistic performance over the course of treatment. The authors discussed the concept of a trade-off or balancing relationship, in which CWS gain improved fluency at some cost to language development (cf. DCM, Starkweather, 1987). Further research is necessary to clarify the linguistic effects of treatment for CWS and to determine the underlying mechanisms of change.

With regard to AWS, there are some self-report data to indicate reductions in verbal avoidance behaviour following stuttering treatments incorporating cognitive-behavioural procedures (Blomgren et al., 2005; Menzies et al., 2008). Presumably, reduced verbal avoidance might be reflected in specific patterns of linguistic behaviour. However, neither Blomgren et al. nor Menzies et al. obtained objective measures of participants' pre- and post-treatment conversational language. Spencer et al. (2005) conducted a study comparing pre- and post-treatment spontaneous conversational language in AWS, using quantitative analyses from the SFL approach (Halliday, 1985). The authors presented exploratory data from case studies involving 2 AWS who participated in a prolonged speech stuttering intervention. The findings revealed a tendency to greater use of politeness-marking modality resources in both AWS participants at post-treatment. Spencer et al. suggested that this might reflect an increasing openness to conversational engagement, resulting from improved speech fluency. Several individual differences between pre- and post-treatment language behaviour were also noted. Though preliminary, the data imply systemic changes in the language use of PWS following stuttering intervention, which currently are not well defined or understood. There is a need for additional research to objectively examine the relationships between stuttering, language behaviour, intervention, and the associated communication experiences of AWS. These have significant implications for clinical practice in areas such as goal setting, treatment progression, and outcomes evaluation.

Overall, past research suggests a number of complex interactions between stuttering and language behaviour in PWS. Although inconsistencies in existing data are apparent, the findings generally show an influence of various linguistic factors on stuttering frequency in PWS, as well as linguistic, motor speech, and related processing differences between PWS and PWNS. Preliminary evidence indicates that PWS may differ from PWNS in their use of the language resources available to them for functional communication. This may reflect an influence of verbal avoidance behaviour, and may contribute to the experience of communication restriction described by PWS (Cream et al., 2003; Plexico et al., 2009). Finally, interactions have also been observed between aspects of linguistic performance and stuttering intervention, although specific effects and mechanisms of change are at present poorly understood. The findings in each of these areas have significant clinical implications, and further research is warranted to corroborate and supplement the available evidence.

2.6. Systemic Functional Linguistics (SFL)

> *What is distinctive about systemic linguistics is that it seeks to develop both a theory about language as a social process AND an analytical methodology which permits the detailed and systematic description of language patterns.* (Eggins, 1994, p. 23)

SFL is an approach to language and discourse analysis that developed out of Halliday's (1985) systemic description of functional grammar. The approach is primarily concerned with the semantics of spoken and written language. It seeks to explain how people use language to make meanings in different social and linguistic contexts, and how people structure language for use as a system of choices and meanings (Eggins, 1994). In recent years, SFL has become increasingly popular within a number of language-related fields because it offers both a functional theoretical perspective on language use and a rigorous, systematic methodology for language analysis (Eggins, 1994; Ferguson & Thomson, 2008).

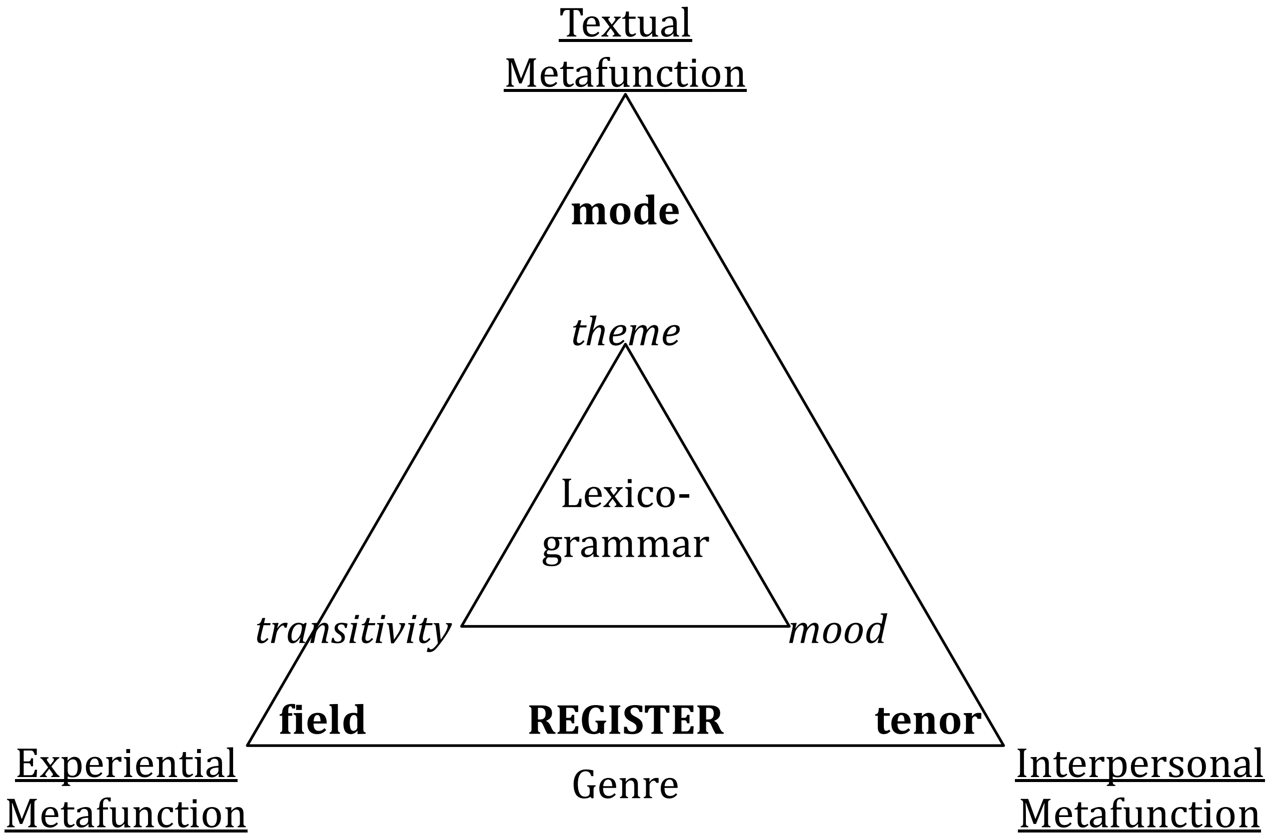
Whereas other approaches to discourse analysis are primarily descriptive in nature, SFL allows for the quantification of various language features. Due to its emphasis on communication functionality within social contexts, SFL is compatible with the World Health Organization's *International Classification of Functioning, Disability, and Health* (2001), and well suited to clinical speech-language pathology research (Armstrong, 2005a; Ferguson & Thomson, 2008; Togher, 2001).

2.6.1. SFL Framework

A diagrammatic overview of Halliday's (1985, 1994) framework is presented in Figure 1. The SFL approach perceives language as the simultaneous expression of three overarching types of meaning, or 'metafunctions'. These are termed 'experiential', 'interpersonal', and 'textual'. Each metafunction reflects the influence of a particular contextual dimension, or 'register variable', which is in turn realised by specific aspects of the linguistic system (Armstrong, 2005a; Eggins, 1994). According to SFL, linguistic realisations of the metafunctions and register variables may be observed at the levels of discourse-semantics, lexicogrammar, and phonology. Of the three, the level of the lexicogrammar lends itself most readily to quantitative analyses, which examine specific uses of discrete linguistic structures (i.e., words and phrases) towards the expression of each metafunction. As such, the lexicogrammatical analyses of transitivity, mood, and theme are particularly relevant to the study of language behaviour in PWS. The metafunctions and corresponding linguistic analyses are described in greater detail below.

The experiential metafunction. The first metafunction described by Halliday (1985, 1994) is the experiential metafunction, or the use of language to symbolise experience. The experiential metafunction reflects the register variable of field, which refers to the content, topic, or focus of the language (Eggins, 1994; Ferguson & Thomson, 2008). At the level of the lexicogrammar, field is realised through a system of choices determining clausal

Figure 1. A diagrammatic overview of the SFL framework: the metafunctions (experiential, interpersonal, and textual), register variables (field, tenor, and mode), and corresponding linguistic systems at the level of the lexicogrammar (transitivity, mood, and theme) (adapted from Eggins, 1994).



participants, processes, and circumstances (i.e., the *who*, *what*, and *where*/*when*/*why*/*how* of experience, respectively). This is known as the transitivity system. Analyses of transitivity most commonly involve the examination of verb process type, frequency, and variety. Transitivity processes expressed through lexical verbs may be material (e.g., *eat*, *throw*), mental (e.g., *feel*, *think*), verbal (e.g., *say*, *tell*), behavioural (e.g., *laugh*, *sleep*), existential (e.g., *happen, last*), or relational (e.g., *become, seem*), with each having a characteristic clausal configuration (Eggins, 1994). The use of non-material process types is thought to enable more complex communication functions, such as the expression of thoughts, feelings, and opinions (Armstrong, 2005b).

The interpersonal metafunction. The second metafunction is the interpersonal metafunction, or the use of language to symbolise speaker and listener roles, relationships, and attitudes (Halliday, 1994). Interpersonal meanings reflect the register variable of tenor, and, at the level of the lexicogrammar, are realised through the mood system (Armstrong, 2005a; Eggins, 1994; Halliday, 1994). This system is concerned with how clause type, or mood, is used to fulfil a given speech function (e.g., declarative mood to express a statement, imperative mood to express a command), and how this reflects the relative roles of the discourse partners. The mood system also comprises modality and modulation resources, and resources of appraisal. Modality and modulation resources collectively function as linguistic politeness markers, determining degrees of probability, usuality, obligation, and necessity (Armstrong, 2005a; Eggins, 1994). Both the closed class of modal auxiliary verbs (e.g., *can*, *will, shall*) and modal adjuncts (e.g., *possibly*, *probably*, *honestly*, *unfortunately*) are categories of politeness markers. Appraisal resources allow the communication of attitudes and emotions through the use of evaluative language, and may express appreciation (e.g., *fun*, *boring*), affect (e.g., *happy, sad*), judgment (e.g., *skilled, incompetent*), or amplification (e.g., *very, a little*) (Ferguson & Thomson, 2008; Sherratt, 2007). Analyses relating to the interpersonal metafunction typically consider the type, frequency, and variety of modality and appraisal resources used within samples of language. These measures provide information on speaker communicative behaviour, in terms of social appropriateness, interaction, and engagement within conversational exchanges (Spencer et al., 2009; Togher & Hand, 1998).

The textual metafunction. The third and last metafunction is the textual metafunction, or the organisational use of language to create linguistic cohesion and context (Eggins, 1994; Halliday, 1994). This metafunction reflects the register variable of mode, which refers to factors such as language medium, and the physical distance and degree of shared information between discourse partners (Armstrong, 2005a; Eggins, 1994). At the level of the lexicogrammar, mode is realised through a system of choices concerned with the organisation of clause elements, based on the relative contextual importance of the information they carry. In SFL, the term 'theme' is used to refer to the clause-initial element (e.g., *John played rugby at the park yesterday*). This element occupies the position of greatest salience and functions as the point of departure of the clause (Halliday, 1994). Theme analyses involve the examination of types of theme (see **Section 3.7.3. Language Analyses, Table 5**), atypical or marked theme (e.g., *Yesterday, John played rugby at the park*), multiple theme (e.g., *And so yesterday John played rugby at the park*), and discourse thematic progression (Eggins, 1994). Mode-based analyses also include cohesion analysis, which relates to the linguistic level of discourse-semantics. Cohesion analysis is concerned with the relationships between separate clauses, and the resources that contribute to cohesive text formation. Resources of reference (e.g., *here*/*there*, *him*/*her*), ellipsis (e.g., *No, it wasn't (his cat)*), conjunction (e.g., *although*, *therefore*), and lexical cohesion (e.g., *cat – kitten*, *cat – purr*) are examined in cohesion analysis (Martin, 2002). Theme and cohesion analyses provide information on the cohesive development of discourse, and are particularly useful in the analysis of narratives and other structured text types (e.g., Thomson, 2005).

2.6.2. Clinical Applications of SFL

Recent applications of the SFL framework range from foreign language instruction, to bilingual code-switching research, to the evaluation of language performance in speakers with both developmental and acquired communication disorders. Clinical populations for which SFL data are available include specific language impairment (Thomson, 2005), autism spectrum disorders (de Villiers, 2005; Fine et al., 1994), attention deficit hyperactivity disorder (Mathers, 2005, 2006), traumatic brain injury (TBI) (Mortensen, 2005; Sherratt, 2007; Togher & Hand, 1998; Togher, Hand, & Code, 1997), aphasia (Armstrong, 2001, 2005b; Mortensen, 2005), and dementia (Müller & Mok, 2012; Müller & Wilson, 2008).

Armstrong (2001, 2005b) examined the experiential content of clausal processes produced by speakers with fluent aphasia, within the context of semi-structured interviews. From the SFL perspective, the symbolic content of language is expressed through the transitivity system, comprising clausal participants, processes, and circumstances (Halliday, 1994; Eggins, 1994). Armstrong's (2001) findings revealed a tendency for some speakers with aphasia to express proportionately less non-material content, in the form of relational and mental verb processes conveying evaluations and opinions, than controls. Participants with aphasia also used less varied, less specific, and more commonly occurring verbs than controls (Armstrong, 2005b). The SFL analyses in this case illustrated how speakers with aphasia use language to inform listeners about material events while communicating fewer personal aspects of their experiences, thereby reducing the richness of the linguistic content.

Togher and Hand (1998) and Sherratt (2007) examined the use of politeness markers and appraisal by individuals with brain injury, as linguistic resources for developing interpersonal roles and relationships within discourse. Compared to controls, speakers with

TBI were observed to use fewer politeness markers within telephone conversations, and to do so consistently even in response to differing interpersonal variables (Togher & Hand, 1998). Sherratt reported that the personal narratives of speakers with right hemisphere brain damage resulting from stroke may be characterised by reduced expression of appraisal, a linguistic system for the explicit communication of opinion, emotion, and judgment. It is recognised that individuals with brain injury may exhibit poor conversational skills or socially inappropriate communication behavior (Love & Webb, 2001). In the above examples, the SFL analyses of modality and appraisal yield insights into specific uses (and limitations in use) of language towards social conversational engagement in speakers with brain injury. The analyses provide functional and clinically relevant information that may not be available from more traditional analyses (Togher & Hand, 1998).

Thomson (2005) analysed the textual organization of narratives produced by children with specific language impairment, using theme analysis. Thomson observed that these children produced similar proportions of marked theme as controls, but used less advanced forms of thematic progression, creating a simpler, less mature discourse structure. Differences in textual cohesion have also been found to distinguish individuals with autism spectrum disorders from typical speakers. Despite using similar numbers of cohesive devices as controls, speakers with high functioning autism produced more environmental (i.e., relating to the physical world) and fewer text-based (i.e., relating to the verbal world) references in spontaneous conversation (Fine et al., 1994). De Villiers (2005) suggested that the ‘pedantic’ speech style characteristic of these speakers might directly reflect aspects of cohesion, such as the excessive use of full reference, where pronouns are not appropriately used in place of proper nouns. Finally, Mathers (2006) found that children with attention deficit hyperactivity disorder used fewer linguistic organization strategies and produced more tangential meanings in a variety of text types, in comparison to typically developing children.

It is noteworthy that conventional measures of language quantity and lexical diversity failed to differentiate the two groups, demonstrating the increased sensitivity of functional context-based analyses to differences in language use for the purpose of textual organization.

In each of the above examples, the SFL approach enabled the objective identification of patterns of functional language behaviour in communication disordered populations. More thorough and comprehensive analyses are needed to develop and clarify 'profiles' of language use in these speaker groups. Subtle patterns of communication difference may hinder information sharing, interpersonal engagement, and communicative cohesion and clarity within conversational interactions. Armstrong (2010) stressed the clinical relevance of viewing language as a context-based resource for making multiple kinds of meaning, rather than a set of decontextualised grammatical and lexical constructs. When interpreted in light of underlying disorder characteristics, these data contribute to a deepened understanding of disordered discourse in its various forms. The SFL framework allows clinical researchers to examine the repertoire of linguistic resources available to speakers with communication disorders (what *language* can do), and, further, the ways in which these resources are used to construct meaning appropriately within sociolinguistic contexts (what the *speaker* can do) (cf. Halliday, 2005). Improved understanding in this regard would facilitate the advancement of clinical procedures capable of bringing about positive functional change.

2.6.3. SFL and Stuttering

Analyses based on the SFL framework are particularly well suited to the exploration of language performance in PWS, whose linguistic choices and use of spoken language resources are uniquely influenced by specific characteristics of the disorder. It is well documented that stuttering is susceptible to situational and environmental influences (Guitar, 2006), and that PWS often use a range of verbal avoidance strategies in their speech (e.g., Cream et al., 2003; Plexico et al., 2009; Vanryckeghem et al., 2004). Currently, there is a lack of objective, quantitative data to demonstrate how verbal avoidance behaviours might impact different aspects of conversational language in PWS. Whereas other approaches to functional language analysis primarily yield descriptive data, SFL allows for the quantification of specific language behaviours with subsequent interpretative discussion (Eggins, 1994; Wilkinson, 2009).

Analyses from the SFL framework were first applied to the spontaneous language of AWS by Spencer et al. (2005). Spencer et al. reported on two case studies involving AWS, who participated in prolonged speech treatment programmes. Post-treatment, both AWS demonstrated increased use of modality resources during telephone conversations with familiar individuals. No inter-subject patterns were observed for transitivity or theme, although an increased frequency of continuative theme (i.e., filler words such as *well* and *oh)* was seen for one AWS. These preliminary data suggest a particular link between stuttering and the linguistic expression of interpersonal meanings, namely, those concerned with the communication and regulation of social relationships and attitudes. This is not unexpected in view of the known cognitive-emotional consequences of stuttering. The findings were interpreted as evidence of increased opinion-sharing, politeness, and thus openness to conversational engagement, in the AWS following treatment.

Subsequently, Spencer et al. (2009) conducted a more thorough SFL investigation of language use in AWS. The spontaneous monologues of 10 AWS who had received no prior stuttering treatment were compared to those of 10 AWNS. Measures of speech volubility, complexity, modality, and theme were included in the analyses. The AWS group showed lower verbal output and complexity than AWNS. With regard to modality analysis, both groups used the full range of modality subtypes, but the AWS exhibited a lower overall percentage of clauses expressing modality (as a percentage of total clauses). In addition, the AWS were found to use different proportions of certain modality subtypes to the AWNS.

These results indicate no deficiency in the resources available to AWS for the expression of interpersonal meanings, but rather a difference in use of linguistic structures. As Spencer et al. suggest, the data may reflect the tendency for AWS to withhold themselves from conversational interactions, as a means of coping with any negative emotional responses associated with such exchanges. Spencer et al. also observed differences in marked theme usage between AWS and AWNS, but cautioned that text type factors may have influenced this result. Nevertheless, it is clear from these initial investigations that SFL analyses hold value as an objective lens for understanding the functional restriction that characterises communication experience for AWS.

Spencer et al. (2005, 2009) provide valuable preliminary data on SFL and stuttering, but the studies are characterised by methodological limitations. For example, both studies are based on relatively small sample sizes, and employ a limited range of SFL analyses. Further research involving larger participant numbers, samples of spontaneous dialogue rather than monologue, and a fuller range of SFL analyses is required to extend the existing evidence. Specifically, the use of appraisal and cohesion resources by PWS has yet to be examined. Targeted exploration of the relationships between verbal avoidance behaviours and conversational language performance in PWS also necessitates the use of a comprehensive range of outcomes measures. Such research would benefit from the inclusion of conventional indices of language ability and verbal-cognitive and behavioural measures of anxiety and avoidance, in addition to SFL analyses. The outcomes of this research might then be examined within the context of stuttering treatment, to determine treatment effects and associated clinical implications.

2.7. Statement of the Problem

> *Of all the areas where linguistic theory…, has some part to play in the endeavour, that of speech and language disorders probably makes the most stringent demands.* (Halliday, 2005, p. 135)

Stuttering is a disorder of speech fluency, characterised by involuntary repetitions and prolongations of sounds, syllables, or words. Where stuttering persists into adolescence and adulthood, its overt speech features are often accompanied by significant speech-related anxiety and avoidance behaviour. Self-report data indicate that verbal avoidance strategies (e.g., word substitution, circumlocution) are commonly employed by AWS, as a means of coping with the negative emotional consequences of stuttering. These may restrict the communicative freedom and effectiveness of AWS, resulting in miscommunication and reduced opportunities for self-expression and social engagement. Comprehensive stuttering interventions, built on prolonged speech training and delivered intensively, can lead to improved social-emotional (as well as speech fluency) outcomes for AWS, although habitual speech-related anxiety and avoidance may persist to some extent after treatment.

It is well recognised that various differences in language behaviour exist between AWS and AWNS, and that speech fluency and linguistic performance may interact within a complex balancing relationship. Importantly, there is also emerging evidence that AWS differ from typically fluent speakers in their linguistic choices and general *use* of (as opposed to *proficiency* with) spoken language resources within social contexts (Newman & Bernstein Ratner, 2007; Spencer et al., 2005; 2009). This is a significant observation because it suggests a systematic influence of verbal avoidance on aspects of conversational language use in AWS, and potentially, a systematic profile of communication restriction. However, existing data in this area are limited. There is a need for further research integrating a functional behavioural perspective on language use with a rigorous functional methodology, such as that offered by the SFL approach. This framework allows for both quantitative and descriptive analyses of language within sociolinguistic contexts. Analyses from the SFL approach are sensitive to subtle differences in language behaviour, and thus may enable the identification of specific linguistic patterns in the spoken discourse of AWS, which translate into functional restrictions in communication capacity.

The purpose of the present study was to explore aspects of conversational language behaviour in AWS, with reference to the experience of communication restriction in social context. Primarily, this study sought to examine the language behaviours of AWS in comparison to AWNS, within the context of stuttering treatment in the case of AWS, using both conventional measures of language performance and SFL-based analyses. Further, it was the intention of the present study to examine these linguistic data against the backdrop of verbal-cognitive measures of communication attitudes and anxiety, as well as a potential behavioural indicator of verbal avoidance. It was expected that the findings would shed light on the nature of the communication restriction experienced by AWS, and have significant implications for the clinical management of stuttering. The following hypotheses were posed:

1) AWS will differ significantly from AWNS at pre- and post-treatment, and will change significantly between pre- and post-treatment, on:
    a) Self-rating scale measures examining general and communication-related attitudes and anxiety.
    b) A confrontation naming task designed to objectively examine word choice in relation to verbal avoidance behaviour.
    c) Conventional measures of language productivity and complexity.
    d) SFL indices of productivity and complexity, and SFL analyses of transitivity, modality, appraisal, and theme.

2) Significant correlations will be observed between:

   a) Stuttering severity in AWS, and self-rating scale scores, conventional language measures, and SFL measures.

   b) Self-rating scale scores of AWS and AWNS, and conventional and SFL language measures.

   c) Confrontation naming task scores of AWS and AWNS, and self-rating scale scores, conventional language measures, and SFL measures.

   d) Conventional language measures and SFL measures for AWS and AWNS.

Chapter 3. Methods

3.1. Study Design

This study utilised a pre-treatment – post-treatment repeated measures design. Measures were taken twice for an experimental group (AWS) to enable within-group comparisons. The experimental group was also matched to a control group (AWNS) for between-group comparisons. For the AWS group, measures were taken immediately pre-treatment to establish baseline performance, and immediately post-treatment. Treatment consisted of participation in either the 1-week Naturalness Intensive Programme (NIP) at the University of Canterbury in Christchurch, New Zealand, or the 2-week Intensive Stuttering Clinic (ISC; Blomgren, 2009) at the University of Utah in Salt Lake City, USA. Both programmes were broadly based on the prolonged speech approach to stuttering intervention. The programmes combined individual and group therapy sessions, incorporating a range of fluency shaping, stuttering modification, skills transfer, and maintenance planning components. For the AWNS group, measures were taken once only to establish a normative baseline for comparison to the AWS group.

3.2. Participants

The participants were an experimental group of 20 AWS, and a control group of 20 AWNS. The selection criteria for AWS were (a) 16 years or older; (b) history of developmental stuttering by self-report; (c) total overall score of 10 or greater (i.e., stuttering severity of at least *very mild*) on the *Stuttering Severity Instrument – Third Edition* (SSI-3; Riley, 1994); (d) no reported or observed cognitive, language, motor speech, or hearing impairment; and (e) native speaker of American or New Zealand English by self-report. The AWNS participants were matched to the AWS participants according to age, sex, and English language variety, and had (a) no history of stuttering; and (b) no reported or observed cognitive, language, motor speech, or hearing impairment. Participant characteristics are summarised in Table 1. All participants gave verbal and written consent for their participation in the study. The information sheet and consent form provided to participants is shown in Appendix 1. This study was approved by the University of Canterbury Human Ethics Committee.

3.3. Standardised Measures

At the outset of the study, all participants completed Form B of the *Peabody Picture Vocabulary Test – Third Edition* (PPVT; Dunn & Dunn, 1997). The PPVT is a test of receptive vocabulary, which requires the examinee to match a spoken word (presented by the examiner) to the corresponding picture stimulus, from four possible options. The PPVT was administered according to manual instructions, by a qualified speech-language pathologist (SLP). In conjunction with informal observation and participant self-report, the PPVT was used to rule out clinically significant language impairment in AWS and AWNS. All AWS and AWNS participants were required to obtain PPVT scores of 77.5 and above (i.e., no more than 1.5 standard deviations below the mean) for participation in this study, which was taken as a broad indicator of language abilities within (or above) normal limits. PPVT scores for all participants are shown in Table 1.

At each sampling point (i.e., both pre- and post-treatment for AWS; once only for AWNS), all participants independently completed the *Beck Depression Inventory* (BDI; Beck & Steer, 1993; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), *Liebowitz Social Anxiety Scale* (LSAS; Liebowitz, 1987), and *Locus of Control of Behavior Scale* (LCB; Craig et al., 1984). These self-report questionnaires were used as measures of participants' general

Table 1. Descriptive characteristics for New Zealand (NZ) and United States (US) adults with stuttering (AWS) and adults with no stuttering (AWNS) participants. Pre-treatment *Stuttering Severity Instrument – Third Edition* (SSI-3) severity ratings and percentage of syllables stuttered (%SS) scores are shown for AWS. *Peabody Picture Vocabulary Test – Third Edition* (PPVT) scores are also shown for both AWS and AWNS.

AWS	Age	Sex	SSI-3 Severity Rating	%SS	PPVT
NZ 1	21	F	mild	4.5	111
NZ 2	26	M	mild	4.4	101
NZ 3	56	M	very mild	3.7	103
NZ 4	28	M	moderate	19.6	135
NZ 5	32	M	mild	6.3	94
NZ 6	26	F	mild	1.1	91
NZ 7	20	M	very mild	3.6	115
NZ 8	33	F	very mild	1.3	106
NZ 9	42	F	moderate	6.7	88
US 1	16	M	mild	4.0	106
US 2	39	M	severe	10.0	104
US 3	20	F	moderate	2.0	104
US 4	34	M	mild	4.0	88
US 5	23	M	severe	23.0	121
US 6	23	M	moderate	11.6	112
US 7	18	M	moderate	15.0	80
US 8	25	M	moderate	11.8	111
US 9	28	M	moderate	3.0	111
US 10	16	F	severe	13.0	111
US 11	17	M	very mild	13.9	95
Mean	27.2			7.6	104.4
Standard Deviation	9.8			6.2	12.7

AWNS	Age	Sex	PPVT
NZ 1	21	F	124
NZ 2	26	M	114
NZ 3	56	M	109
NZ 4	28	M	131
NZ 5	32	M	113
NZ 6	26	F	125
NZ 7	19	M	129
NZ 8	35	F	129
NZ 9	44	F	137
US 1	16	M	117
US 2	39	M	112
US 3	20	F	103
US 4	37	M	134
US 5	23	M	128
US 6	22	M	114
US 7	18	M	122
US 8	25	M	122
US 9	28	M	147
US 10	16	F	119
US 11	17	M	121
Mean	27.4		122.5
Standard Deviation	10.2		10.5

attitudes, perceptions, and levels of anxiety specific to social situations. These measures were collected and scored as per test manual instructions.

At both pre- and post-treatment, AWS participants also independently completed the *Perceptions of Stuttering Inventory* (PSI; Woolf, 1967), and *Overall Assessment of the Speaker's Experience of Stuttering: Adult* (OASES; Yaruss & Quesal, 2008). The OASES comprises four sections: 'General Information' (Section 1), 'Your Reactions to Stuttering' (Section 2), 'Communication in Daily Situations' (Section 3), and 'Quality of Life' (Section 4). The PSI and OASES were used as measures of stuttering participants' attitudes and perceptions relating to their stuttering, and its overall impact on their lives. These measures were collected and scored as per test manual instructions.

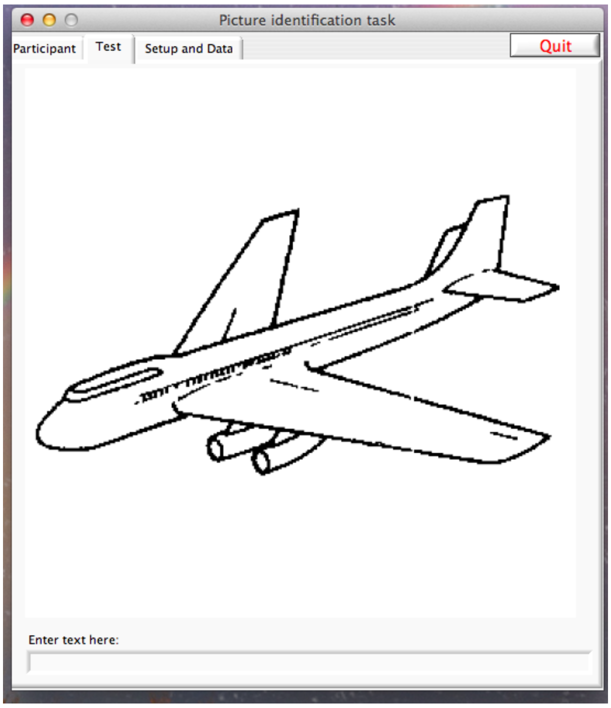
3.4. Naming Task

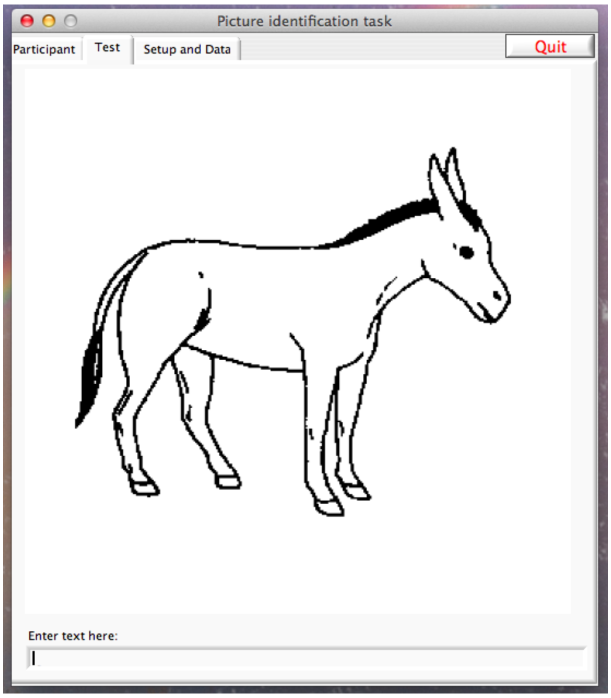
A confrontation naming task (UC Picture ID; O'Beirne, 2011) was designed as part of the current study to objectively examine word choice and verbal avoidance behaviour in the AWS participants. The task was developed from Snodgrass and Vanderwart's (1980) standardised 260-picture set, using normative data from Yoon et al. (2004). Snodgrass and Vanderwart's picture set consists of black-and-white line drawings of everyday objects, and was originally intended for use in experiments investigating picture and word processing. Yoon et al. published updated normative data on name agreement for the full 260-picture set, for younger and older adults in the USA and China. For each age and cultural group, Yoon et al. documented the 'dominant' name (i.e., word most commonly used to name the stimulus) for every picture in the set, as well as all occurrences of 'non-dominant' names (i.e., any alternative word used to name the stimulus).

Based on Yoon et al.'s (2004) data for young American speakers, a subset of 128 pictures was selected for inclusion in the confrontation naming task. The aim of this task was to examine name choices made by AWS and AWNS for everyday objects in comparison to the normative data established by Yoon et al., and thus indirectly to examine verbal avoidance behaviours in AWS. Criteria for picture inclusion in the task were (a) availability of non-dominant names; (b) low visual ambiguity; and (c) low likelihood of naming differences between American and New Zealand English. Selected pictures were then re-sized to fit within a white square measuring 500 x 500 pixels, and randomly assigned to two alternate sets. A total of 64 pictures were designated as ‘Set A’, and the remaining 64 pictures as ‘Set B’. Following stimulus selection and preparation, a computer-based programme was designed for confrontation naming task presentation.

All participants completed the UC Picture ID task (O’Beirne, 2011) at each sampling point (i.e., pre- and post-treatment for AWS; once only for AWNS). Picture stimuli from either Set A or B were individually presented in random order in the centre of a computer screen. Participants were given the instruction, “Give me your best word for each picture”, and were then required to name each picture verbally as it was presented. Screen shots illustrating the computerised task procedure are shown in Figure 2. Movement from one picture to the next was manually controlled by either the examiner or the participant using a computer keyboard, at a comfortable pace. Responses were entered into the programme online, or audio- and video-recorded and transcribed at a later stage. The task was not timed. After all pictures in the set had been presented, task data were automatically saved in spread sheet format for later analysis. Following naming task completion, participants were asked to rate (a) how difficult they found the task, on a scale of 1 (*very easy*) to 5 (*very difficult*); and (b) how much they had to think about their response before naming the picture (termed ‘response consideration’), on a scale of 1 (*not at all*) to 5 (*a lot*).

Figure 2. Examples of picture stimuli displayed using the UC Picture ID naming task software. The dominant names for these pictures are *airplane* (non-dominant alternatives: *plane*, *jetplane*, *747*) and *donkey* (non-dominant alternatives: *horse*, *mule*, *pony*, *ass*, *jackass*).





3.5. Language Sampling

Conversational language samples were obtained from all participants at each sampling point (i.e., pre- and post-treatment for AWS; once only for AWNS). Participants engaged in one-on-one conversation with an examiner for approximately 10 minutes. In all instances, the examiner was either an SLP or SLP student trained in elicitation techniques. For AWS, language samples were obtained by different examiners (unfamiliar to the participant) at pre- and post-treatment, in order to avoid familiarity effects on resulting conversational samples. Conversation was loosely structured around set topics, designed to elicit a variety of language, to draw on a range of practical and emotional experiences, and to elicit new information when subsequently re-presented (e.g., current projects at school or work, last or next weekend's plans, most recent visit to hospital). Follow-up comments and prompts were used to maintain natural conversational flow. Following 10 minutes of conversation, participants were asked to rate (a) their confidence during the conversation, on a scale of 1 (*not confident*) to 5 (*very confident*); and (b) their conversational flexibility, or how much they felt they could say exactly what they meant to say, on a scale of 1 (*not at all*) to 5 (*completely*). Oral reading samples were also obtained from all participants at each sampling point. Participants were given a copy of the first paragraph of *The Rainbow Passage* (Fairbanks, 1960), and asked to read it aloud at a comfortable pace and loudness.

3.6 Data Collection Procedure

Data collection took place in a quiet room and was carried out by the researcher or another trained examiner, as outlined in the preceding section. All self-report questionnaires were independently completed by participants. During data collection, participants were seated in front of a video camera at a distance of about 30 centimetres. All language task procedures were audio- and video-recorded for later analysis. The order of the speaking tasks (conversation, reading, and picture naming) was randomised for each participant at each data collection session. For the naming task, Sets A and B were alternated so that (a) half the participants received each set at each testing point; and (b) AWS participants received the two sets alternately between pre- and post-treatment testing.

In addition, the AWS participants were required to provide two ratings of their self-perceived stuttering severity on a scale of 0 (*none*) to 7 (*very severe*). The first rating concerned the participant's stuttering severity during the 10-minute conversational sampling period (within that particular data collection session). The second rating concerned the participant's overall stuttering severity during the week prior to that data collection session. The purpose of this rating was to obtain an indication of each participant's average stuttering severity in recent beyond-clinic speaking situations.

3.7 Data Analysis

3.7.1. General Measures

Based on the video-recorded conversational speech and reading samples, clinician ratings of stuttering severity (for AWS only, at both pre- and post-treatment) and articulation rate (for all participants) were obtained.

Stuttering severity. Two measures of stuttering severity were used: percentage of syllables stuttered (%SS), and the *Stuttering Severity Instrument – Third Edition* (SSI-3; Riley, 1994). The %SS was calculated by dividing the total number of stuttered syllables by the total number of fluent and stuttered syllables produced by the speaker, during the full length of the conversation. For SSI-3 scoring, AWS participants' stuttering frequency, longest moments of stuttering, and type and severity of secondary behaviours in spontaneous conversation and reading were noted and scored according to the instrument manual. Both the raw %SS values and the SSI-3 scores for each AWS were used as measures of their overall stuttering severity (see **Table 1**).

Articulation rate. The Praat (Version 5.3.41; Boersma & Weenink, 2013) speech analysis software was used to measure articulation rate. The video recording of each spontaneous conversational speech sample was first converted to an audio-only '.wav' file, using an appropriate file conversion software. The resulting audio file was then imported into Praat, and simultaneously displayed as an amplitude-by-time waveform and as a wideband spectrogram. For each speech sample, articulation rate was calculated from approximately 100 syllables, drawn from segments of speech where the following criteria (Flipson, 2002; Hall, Amir, & Yairi, 1999) were met:

1) Speech segments are at least 5 syllables in length and communicate meaningful information.
2) Speech segments contain no pauses of 250 milliseconds or more.
3) Speech segments are perceptually fluent, containing no stuttered syllables, fillers, or non-speech sounds (e.g., *um*, *you know*).
4) Speech segments are not directly adjacent to stuttered syllables.

Based on the amplitude-by-time waveform and wideband spectrogram dual display, a pair of vertical cursors was superimposed at the onset of the first syllable, and the offset of the last syllable of each selected speech segment. The onset was taken to be the point at which acoustic energy was first detected on the spectrogram, and/or the point of the first peak on the waveform (where periodicity was detectable). The offset was taken to be the point where acoustic energy was no longer detected on the spectrogram, and/or the point where the periodic waveform last crossed the zero line (where periodicity was detectable). The time interval between the two vertical cursors was recorded as the duration, in milliseconds, of that speech segment. The durations of individual selected segments, as well as the numbers of syllables contained within the segments, were totalled for each sample. The total number of syllables (approximately 100) was divided by the total duration of selected speech segments for each speech sample, to obtain a measure of articulation rate for that speech sample.

3.7.2. Naming Task

Confrontation naming responses were first transcribed verbatim from the video recordings, and entered into the spread sheets generated by the UC Picture ID programme (O'Beirne, 2011). Responses to a given picture stimulus were scored as (a) 'dominant match' if they corresponded to the dominant name for that stimulus; (b) 'non-dominant match' if they corresponded to any one of the non-dominant names for that stimulus; or (c) 'no match' if they did not correspond to the dominant name or any of the non-dominant names for that stimulus, as listed by Yoon et al. (2004). Scores for each AWS and AWNS participant were recorded as percentages of responses falling into each of the three categories.

3.7.3. Language Analyses

All language sample transcription and anlaysis was completed by the researcher. Initially, samples were orthographically transcribed from the video recordings. Transcripts were created using the Systematic Analysis of Language Transcripts – New Zealand (SALT-NZ; Gillon & Westerveld, 2008) software[1], and segmented into utterances according to C-Units, as detailed in the SALT-NZ user guide (Gillon, Westerveld, Miller, & Nockerts, 2008). Mazes, overlapping speech, and unintelligible speech were coded according to SALT-NZ conventions. Sections of the language samples that were not immediately decipherable were watched and listened to at least three times before being marked as unintelligible. Further coding and preparation included use of SALT-NZ's 'Root Identification Function' to

[1] The New Zealand version of the SALT software was used as this is the version most readily available in Australia and New Zealand. SALT- NZ differs from standard SALT software in that it contains New Zealand reference databases. In the current study, SALT-NZ was only used in data processing, and its reference databases were not utilised at any point. As such, the use of this version of the software had no impact on the data or the outcomes of the study.

identify word roots and bound morphemes, and the assignment of subordination index (SI) codes to subject utterances, according to the clause identification criteria and coding instructions provided in the SALT-NZ user guide. A segment of one AWS participant's pre-treatment transcript is shown in Appendix 2 (Transcript 1) to illustrate SALT-NZ utterance segmentation and coding.

Following transcription and coding, language samples were then separately analysed for conventional language measures and SFL measures (Halliday, 1985), as detailed below. The full 10-minute language samples were used in all analyses (i.e., 'Transcript Cut' was set to 'Beginning of Transcript' to 'End of Transcript'). Analyses did not exclude single word utterances, utterances that were abandoned or interrupted, or utterances containing unintelligible segments (i.e., 'Analysis Set' was set to 'Total Verbal Utterances').

Conventional language measures. Conventional language measures were used to obtain general information on the language ability and performance of AWS compared to AWNS, and to identify any linguistic changes in the AWS participants between pre- and post-treatment. For each language sample, the following measures were obtained using SALT-NZ's automatic 'Standard Measures' analysis function:

1) Total number of utterances (TNU), defined as the number of utterances, segmented according to SALT-NZ's guidelines for identifying C-Units, which were produced within the 10-minute language sample
2) Total number of words (TNW), defined as the number of complete, intelligible words produced within the 10-minute language sample, including words in mazes
3) Number of different word roots (NDWR), defined as the number of different word roots produced within the 10-minute language sample, excluding words in mazes
4) Type-token ratio (TTR), defined as the ratio of different words, or 'types', to total words, or 'tokens'

5) Mean length of utterance in words (MLUw), defined as the mean length of the participant's utterances in words, excluding words in mazes
6) Subordination index (SI), defined as the ratio of the total number of main and subordinate clauses to the number of utterances.

In addition to the above measures, average word frequency values were calculated for each transcript, based on the lexical verbs used by the participant within the language sample. Auxiliary verbs (e.g., *be*) and modal verbs (e.g., *can*, *could*) were not included in this verb set. Lexical verbs were specifically chosen for word frequency analysis as a complement to the SFL analysis of verb process types. There is also evidence that suggests a link between lexical verb use and stuttering. Wagovich and Bernstein Ratner (2007) observed the use of significantly fewer different verbs in the spontaneous play-based conversation of CWS than CWNS (see also Davies, 2010). Word frequency analysis was based on American English word frequency data from the SubtlexUS online database (Brysbaert & New, n.d., 2009), as well as British English word frequency data from the British National Corpus (Univeristy of Oxford, 2010), via the WordCount website (Harris, 2003). All verbs produced within subject utterances were entered into both websites, in order to obtain the corresponding word frequency values. The SubtlexUS database contains the frequency of occurrence of a particular word per one million words, while the WordCount database ranks each of the 86,800 most commonly occurring words by number. Both measures of word frequency were obtained to enable comparison between the two. All verbs and frequency values were then entered into a spread sheet, and average values for each subject were obtained from both databases. Any verb that did not appear in either database was given a SubtlexUS frequency value of zero, or a WordCount rating of 86,800, as applicable.

SFL analyses. All SFL analyses were drawn from Halliday's (1985) systemic description of functional grammar and related works (Eggins, 1994; Ferguson & Thomson, 2008; Martin & White, 2005). These measures were used for more specific analysis of language behaviour in AWS and AWNS. Each transcript was prepared for SFL analysis through additional segmentation and coding. All participant utterances (previously segmented according to SALT-NZ guidelines) were further segmented into individual clauses. For SFL analyses, a 'clause' could fall into one of three categories (Halliday & Matthiessen, 2004):

1) Major clauses, containing a subject (or an ellipsed subject) and predicate
2) Non-finite clauses, containing a non-finite verb (i.e., in the form of '*to*-verb')
3) Minor clauses, containing no verb (e.g., greetings, yes/no or single word responses to questions, exclamatives).

Once segmented, clauses were grouped into clause complexes, consisting of all clauses linked by either co-ordination or sub-ordination. Judgments on clause complex boundaries were made using both syntactic (e.g., coordinating and subordinating conjunctions) and pragmatic markers (e.g., speech intonation) (Halliday & Matthiessen, 2004). As such, it was necessary to simultaneously review the video-recorded conversation samples and language transcripts, in order to identify the clause complex boundaries for each transcript. The completed transcripts, segmented for clauses and clause complexes, were used as the basis for all SFL analyses in the five areas described below.

General SFL analyses. The general SFL analyses involved the following measures of language productivity and complexity:

1) Total number of clauses (TNC), defined as the number of major and non-finite clauses produced within the 10-minute language sample
2) Number of major clauses (NMC) produced within the 10-minute language sample
3) Number of minor clauses (NmC) produced within the 10-minute language sample
4) Grammatical intricacy (GI), defined as the mean number of major and non-finite clauses per clause complex.

A transcript segment coded for the general SFL measures is shown in Appendix 2 (Transcript 2). These measures paralleled the conventional analyses of language productivity and complexity (e.g., TNU, TNW, SI). Both sets of measures were employed to enable examination of the relationship and extent of correspondence between the conventional and SFL analyses.

Verb process analysis. This analysis relates to the experiential metafunction, or use of language to symbolise experience. Verb process analysis was conducted to identify differences between AWS and AWNS in language content and use of certain communicative functions (e.g., stating opinions, quoting or reporting ideas). Each major and non-finite clause within the transcripts was coded for the type of process expressed. Minor clauses were excluded from this analysis as they do not contain verbs. Definitions and examples of the seven process types examined are provided in Table 2, and a transcript segment coded for this analysis is shown in Appendix 2 (Transcript 3). The number of clauses containing each process type was then expressed as a percentage of total processes (i.e., the total number of major and non-finite clauses) within the language sample.

Modality analysis. This analysis relates to the interpersonal metafunction of language, or the use of language to symbolise speaker and listener roles, relationships, and attitudes. Modality analysis was undertaken to identify differences between AWS and AWNS in the use of subtle language features for interpersonal engagement. Each major, non-finite, and minor clause within the transcripts was coded for the numbers and types of modality resources it contained. Clauses containing no expression of modality were not coded. Definitions and examples of the four modality resource types examined are provided in Table 3, and a transcript segment coded for modality analysis is shown in Appendix 2 (Transcript 4). The number of clauses containing each modality resource was expressed as a percentage of the total number of clauses (major, non-finite, and minor) within the language sample. The total number of modality resources used was also calculated.

Appraisal analysis. Appraisal analysis is an extension of the SFL framework of analyses (Martin & White, 2005), which relates closely to the interpersonal metafunction. Appraisal analysis was carried out in the current study to identify differences between AWS and AWNS in their evaluations of and reactions to people and things, and their expression of emotion. Every word within the transcripts expressing appraisal in one of its four categories was coded. Definitions and examples of the four appraisal categories examined are provided in Table 4, and a transcript segment coded for appraisal analysis is shown in Appendix 2 (Transcript 5). The number of words expressing each category of appraisal was expressed as a percentage of the total number of words within the language sample. The total percentage of words expressing appraisal (across all four categories) was also calculated.

Theme analysis. This analysis relates to the textual metafunction of language, which is the organisational use of language to create cohesion and context. Theme analysis was used to identify any differences between AWS and AWNS in the use of language resources to highlight information, create cohesion, and structure discourse. Each major, non-finite, and minor clause was coded for any elements of theme which occurred in addition to topical theme. Topical theme is defined as the first element in a clause that serves a transitivity function (i.e., as the subject, object, or a circumstance of the clause). As topical theme represents an obligatory element found once (and only once) within each major clause, this type of theme was not explicitly coded and analysed for the purposes of the current study. Definitions and examples of the six types of theme examined are provided in Table 5, and a transcript segment coded for theme analysis is shown in Appendix 2 (Transcript 6). The number of clauses containing each type of theme was expressed as a percentage of total clauses (major, non-finite, and minor) within the language sample.

Table 2. Verb process analysis: definitions and examples of verb process types examined (Eggins, 1994; Halliday & Matthiessen, 2004).

Verb Process	Definition	Examples from Transcripts
Material	Processes of 'doing', which represent the outer aspects of our experience, and typically involve an 'actor' and an 'action'	*do*, *eat*, *run*, *kick*, *get*, *make*, *write*, *drive*, *develop*, *increase*, *implement*, *manage*
Mental	Processes of 'sensing', which represent the inner aspects of our experience, and typically express perception, affection, or cognition	*see*, *hear*, *notice*, *like*, *love*, *hate*, *think*, *know*, *remember*, *imagine*, *expect*, *decide*
Relational	Processes of 'being', which relate different aspects of our experience to each other, and typically serve the functions of identifying, attributing, and classifying	*be*, *seem*, *appear*, *look*, *sound*, *mean*, *own*, *consist*, *include*, *involve*
Behavioural	Processes bordering both material and mental processes, which represent the outer manifestations of inner experience, and typically express processes of consciousness and physiological states	*look*, *listen*, *watch*, *learn*, *figure (out)*, *think (about)*, *sleep*, *wake*, *laugh*, *cry*
Verbal	Processes bordering both mental and relational processes, which represent symbolic relationships that come about through human consciousness and are expressed as language	*say*, *tell*, *ask*, *answer*, *suggest*, *explain*, *describe*, *agree*, *call*
Existential	Processes bordering both material and relational processes, which are concerned with existence	*(there)'s*, *happen*, *emerge*, *last*, *spend (time)*, *go (on)*, *come (up)*
Causative	A subcategory of material processes, which are specifically concerned with causation	*make*, *force*, *let*, *allow*, *permit*

Table 3. Modality analysis: definitions and examples of modality resource types examined (Eggins, 1994; Halliday & Matthiessen, 2004; Taverniers, 2003).

Modality Resource	**Definition**	**Examples from Transcripts**
Mood adjunct	Words or phrases that express polarity, probability, usuality, readiness, obligation, time, obviousness, or intensity	Polarity: *yes*/*no* responses to questions, *not* Probability: *probably*, *maybe* Usuality: *always*, *sometimes*, *never* Readiness: *if you will*, *gladly* Obligation: *definitely*, *necessarily* Time: *soon*, *yet*, *still*, *just*, *once*, *already* Obviousness: *of course*, *sure thing* Intensity: *kinda*, *absolutely*, *fairly* Other: *excuse me*, *pardon me*
Comment adjunct	Words or phrases typically occurring at clause boundaries, which express the speaker's attitude towards the utterance; these may include attitudes of admission, desirability, constancy, or validity	Admission: *honestly*, *to tell you the truth* Desirability: *hopefully*, *unfortunately* Constancy: *strangely enough* Validity: *generally*, *apparently* Other: *actually*, *basically*
Modal operator	Modal auxiliary verbs, which function as politeness markers by varying degrees of certainty and directness	*can*/*could*, *will*/*would*, *shall*/*should*, *may*/*might*/*must*, *have*/*had*/*has to*
Interpersonal metaphor	A projecting clause, which varies the certainty of or expresses the speaker's opinion on the utterance	*I think that*, *I feel that*, *I reckon that*, *I suppose that*, *I'm sure that*

Table 4. Appraisal analysis: definitions and examples for appraisal categories examined (Eggins, 1994; Martin & White, 2005).

Appraisal Category	Definition	Examples from Transcripts
Amplification	Words, phrases, and sentences that intensify meanings and/or sharpen or soften the focus of meanings	*Yeah so I spend most of the time sorting through people's recycling and stuff.* *Whitireia's a lot smaller. And they're a lot more flexible about hand in dates.*
Affect	Words, phrases, and sentences expressing feelings and emotions	*But I miss Hawaii because that's my home… I miss all my family and friends.* *I don't like tropical islands.*
Appreciation	Words, phrases, and sentences expressing evaluations of and reactions to the aesthetics and/or value of 'things' and natural phenomena	*…those are all fun places to go and visit.* *Wow it's so poor and third world.*
Judgment	Words, phrases, and sentences expressing evaluations of and reactions to others' (or one's own) behaviour according to a set of social and ethical norms	*And I like how they're creative with the tools that they use to help them.* *But he seemed nice.*

Table 5. Theme analysis: definitions and examples of types of theme examined (Eggins, 1994; Halliday & Matthiessen, 2004).

Type of Theme	**Definition**	**Examples from Transcripts**
Topical*	Basic transitivity elements occurring in the first position of a clause, which, in declarative clauses, typically take the form of nominal groups *Topical theme is obligatory and every clause must contain one (and only one) topical theme; for this reason, topical theme was not explicitly coded and analysed within the current study	*I've been there almost exactly a year.* *All my friends are here.*
Interpersonal	Elements of mood (i.e., mood and comment adjuncts) that occur in the first position of a clause (prior to the first topical element)	*Pretty much I'm here in Christchurch all of this week.* *We think it's got a small hole in the radiator.* *[in response to a yes/no question]* *Yeah I get a lot of time off.*
Textual	Elements important to text cohesion, but with no experiential or interpersonal meaning, which occur in the first position of a clause (prior to the first topical element)	*But I go overseas with work.* *So it gets pretty interesting pretty quickly.*

Structural	A subcategory of textual theme, consisting of subordinating conjunctions	...*because you get quite tired quite easily.* *…even though it's mass produced and stuff.*
Multiple	A sequence of themes consisting of one or more interpersonal or textual themes before the obligatory topical theme	*But obviously if you go to one of the bigger centres…*
Marked	An 'atypical' or 'unusual' choice of topical theme; in a declarative clause, this implies the use of any transitivity element other than the subject as the starting point of the clause	*This weekend I worked.* *On a day to day basis I don't notice it at all.*
'Clause as theme'	An embedded clause that occurs in the first position of a main clause	*What's happened in the last few days is quite interesting.* *Once I graduated, I moved round lots of different jobs.*

3.8. Reliability

Rater reliability was determined for several different measures, for which 5% of the total data set was re-measured. The results of these re-measurements were then evaluated using the intra-class correlation coefficient (ICC). Intra-rater reliability for %SS and the SSI-3 (Riley, 1994) was 0.97 and 1.00, and inter-rater reliability was 0.86 and 0.99, respectively. Intra- and inter-rater reliability for measurement of articulation rate was 0.99 and 0.95, respectively. Rater reliability for linguistic analysis using conventional measures was calculated by re-analysing (a) total number of utterances; (b) total number of words; (c) number of different word roots; (d) type-token ratio; and (e) mean length of utterance in words. These measures were pooled for ICC analysis. Intra-rater reliability was 1.00, and inter-rater reliability was 1.00. Reliability for SFL analysis was calculated by re-analysing measures drawn from across the transitivity, modality, appraisal, and theme domains. The selected measures were (a) percentage of SFL clauses containing mental verb processes; (b) percentage of SFL clauses containing mood adjuncts; (c) percentage of SFL clauses containing comment adjuncts; (d) percentage of words expressing amplification; and (e) percentage of SFL clauses containing structural theme. These measures were pooled for ICC analysis. Intra-rater reliability was 1.00, and inter-rater reliability was 0.95.

To obtain a measure of transcription reliability, 5% of the language samples was re-transcribed. With regards to intra-rater reliability, a total of 3869 words were identified by the researcher at initial transcription, and 3859 words at subsequent transcription. When the researcher's two sets of transcriptions were compared, there was one-to-one correspondence for a total of 3783 words. With regards to inter-rater reliability, 3869 words were initially identified by the researcher, and 3775 words by a second trained transcriber. When the transcriptions of the researcher and second transcriber were compared, there was one-to-one correspondence for a total of 3552 words.

3.9. Statistical Analysis

Statistical analysis of the data was completed using the IBM SPSS Statistics (2010) software package. Group means for AWS between pre- and post-treatment were compared using two-tailed paired *t*-tests. For measures involving ordinal (i.e., Likert-type scale) data, two-tailed Wilcoxon matched pairs signed ranks tests were used. Group means between AWS and AWNS were compared using two-tailed independent samples *t*-tests. For this set of comparisons, the Mann-Whitney *U*-test was used with measures involving ordinal data. Further correlational analyses were then conducted based on those measures for which statistically significant group differences were observed. Pearson correlation matrices were constructed to identify linear relationships between these measures for both AWNS and AWS (pre- and post-treatment).

In the present study, the Benjamini-Yekutieli procedure (Benjamini & Yekutieli, 2001) was used to control for the discovery of false significant results (i.e., Type I error) due to multiple comparisons (R Console for Statistical Computing, 2008). Whereas the Bonferroni correction procedure is designed to control for multiple, independent comparisons (i.e., family-wise error rate) by simply lowering the alpha-level, the Benjamini-Yekutieli procedure is designed to control for dependent variable comparisons (i.e., false discovery rate) by determining the proportion of significant results that are actually false positives (McDonald, 2009). Related issues with the Bonferroni procedure are that it may lead to a very high rate of false negatives and that there may be issues in deciding the 'family' of statistical tests (McDonald, 2009). Using the Benjamini-Yekutieli procedure, the original *p*-values obtained from all *t*-tests, Wilcoxon tests, and Pearson correlations were adjusted based on the total number of tests conducted. These adjusted *p*-values, denoted as 'p^*-values', were then compared to set false discovery rate thresholds. For the analysis of group differences, this threshold was 10% ($p^*=0.1$). That is, up to 10% of adjusted significant comparisons were accepted as being false positives. Any *p**-value that fell below the false discovery rate threshold was indicative of a significant difference for that comparison (*p**<.1). Non-significant *p**-values ranged from *p**=.110 to *p**=1.000. The original *p*-values and *p**-values from all means comparisons are displayed in Appendix 3, Table 1. For the analysis of group correlations, *p**-values were compared to a set false discovery rate threshold of 7.5% (*p**=.075) for AWNS, and 5% (*p**=.05) for AWS (pre- and post-treatment). The original *p*-values and *p**-values from the Pearson correlations are shown in Appendix 4, Tables 12-19. All significant results presented in the subsequent sections are based on correction using the Benjamini-Yekutieli procedure.

Chapter 4. Results

4.1. Group Differences

4.1.1. General Measures

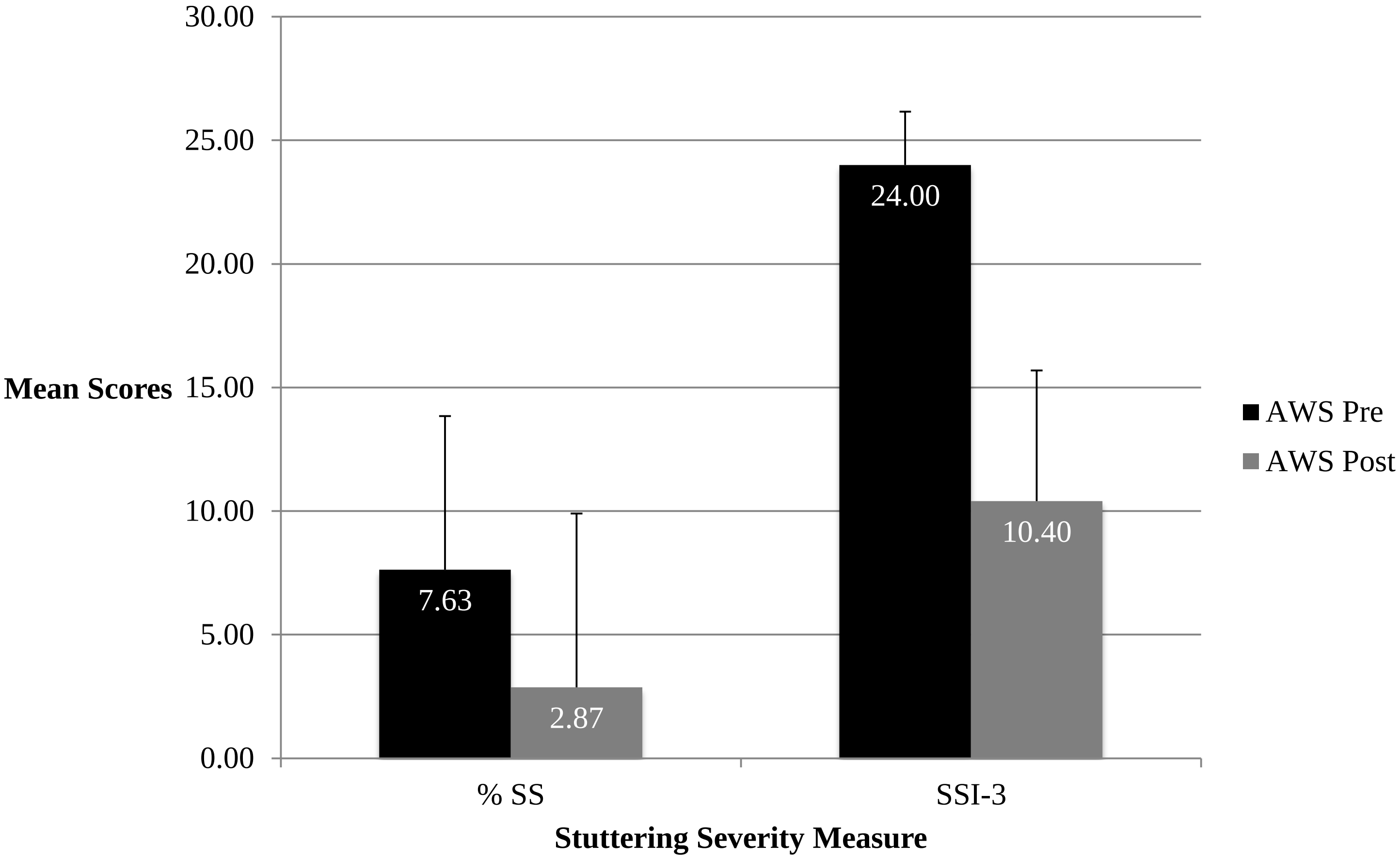
General measures included an assessment of receptive vocabulary, which was used as an overall indicator of participants' language ability, as well as measures of stuttering frequency and severity (for AWS only), and articulation rate. Two-tailed *t*-tests were conducted to compare AWNS controls to AWS participants at both pre- and post-treatment, as well as to identify any differences for AWS between pre- and post-treatment. The general results for AWNS and AWS are displayed in Appendix 3, Tables 2 and 3, respectively.

Peabody Picture Vocabulary Test – Third Edition (PPVT; Dunn & Dunn, 1997). All participants were required to obtain scores of 77.5 and above (i.e., no more than 1.5 standard deviations below the mean) on the PPVT for inclusion in this study. The PPVT scores of AWNS controls (M = 122.50) were significantly higher than those of AWS participants (M = 104.35). This indicates that the receptive vocabulary skills of AWS were poorer than those of AWNS but still within normal limits.

Percentage of syllables stuttered (%SS). The %SS scores of AWS are displayed in Figure 3. The conversational stuttering frequency of AWS participants was significantly higher at pre-treatment (M = 7.63) than at post-treatment (M = 2.87), indicating that AWS demonstrated a decrease in stuttering frequency following treatment.

Stuttering Severity Instrument – Third Edition (SSI-3; Riley, 1994). The SSI-3 scores of AWS are displayed in Figure 3. The SSI-3 overall scores of AWS participants were significantly higher at pre-treatment (M = 24.00) than at post-treatment (M = 10.40), indicating that AWS demonstrated a decrease in overall stuttering severity following treatment.

Figure 3. Mean scores of adults with stuttering (AWS) at pre-treatment versus post-treatment for: percentage of syllables stuttered (%SS) and *Stuttering Severity Instrument – Third Edition* (SSI-3).



Articulation rate (syllables per second). There was no significant difference in articulation rate between AWNS (*M* = 5.63sps) and AWS (*M* = 5.54sps) at pre-treatment. When compared to AWNS, the articulation rate of AWS at post-treatment (*M* = 4.97sps) was lower, and this difference approached significance. A decrease in articulation rate for AWS between pre- and post-treatment was also observed but this difference was not significant.

4.1.2. Self-Rating Scales

A number of questionnaires examining general attitudes, and communication-related attitudes, anxiety, and avoidance behaviour, were administered to the participants. AWNS participants completed the *Beck Depression Inventory* (BDI; Beck et al., 1961), *Liebowitz Social Anxiety Scale* (LSAS; Liebowitz, 1987), *Locus of Control of Behavior Scale* (LCB; Craig et al., 1984), and communication confidence and flexibility self-rating scales. The AWS participants additionally completed the stuttering severity self-rating scale, *Perceptions of Stuttering Inventory* (PSI; Woolf, 1967), and *Overall Assessment of the Speaker's Experience of Stuttering: Adult* (OASES; Yaruss & Quesal, 2008). Comparisons were made between AWNS and AWS at pre- and post-treatment, and for AWS between pre- and post-treatment. The self-rating scale results for AWNS and AWS are displayed in Appendix 3, Tables 4 and 5, respectively.

Self-rating of stuttering severity. The AWS participants rated their stuttering severity on a scale of 0 (*none*) to 7 (*very severe*). Severity ratings for the 10-minute conversational sampling period were significantly higher at pre-treatment (*M* = 3.05) than at post-treatment (*M* = 1.37). The self-ratings of AWS for their overall stuttering severity during the week prior to the data collection session were also significantly higher at pre-treatment (*M* = 3.65) than at post-treatment (*M* = 2.56). These results indicate that AWS perceived a decrease in the severity of their stuttering following treatment, corresponding to the actual decrease in their stuttering frequency and severity identified by the %SS and SSI-3 measures.

PSI. The AWS scored higher on the PSI at pre-treatment (*M* = 44.25) than at post-treatment (*M* = 29.00) but this difference was not significant.

OASES. For Section 1 of the OASES, scores of the AWS participants at pre-treatment (*M* = 3.28) were significantly higher than at post-treatment (*M* = 2.38). For Section 2, scores at pre-treatment (*M* = 3.08) were higher than at post-treatment (*M* = 2.65), but this difference was not significant. For Section 3, scores at pre-treatment (*M* = 3.01) were significantly higher than at post-treatment (*M* = 2.57). For Section 4, scores at pre-treatment (*M* = 2.79) were significantly higher than at post-treatment (*M* = 2.22). Finally, OASES total scores were also significantly higher at pre-treatment (*M* = 2.97) than at post-treatment (*M* = 2.47). These results indicate that AWS perceive a reduced impact of stuttering on various aspects of their daily lives following treatment.

BDI. There were no significant differences in BDI scores between AWNS (*M* = 4.85) and AWS at pre-treatment (*M* = 5.58) or at post-treatment (*M* = 3.20). BDI scores for AWS were higher at pre-treatment than at post-treatment but this difference was not significant.

LSAS. The AWS (*M* = 30.55) scored significantly higher than the AWNS (*M* = 17.05) on the 'Fear/Anxiety' subscale of the LSAS at pre-treatment. For the 'Avoidance' subscale, AWS (M = 29.30) scored significantly higher than AWNS (M = 16.90). The AWS (M = 59.85) also scored significantly higher than the AWNS (M = 33.95) on LSAS total scores. At post-treatment, there were no longer any significant differences between the LSAS scores of AWNS and those of AWS for the 'Fear/Anxiety' subscale (M = 23.43), the 'Avoidance' subscale (M = 17.90), or LSAS total score (M = 41.33). There were significant decreases in the LSAS scores of AWS between pre- and post-treatment for the 'Avoidance' subscale and LSAS total score. There was also a decrease in the 'Fear/Anxiety' subscale score for AWS between pre- and post-treatment but this difference was not significant. These results indicate that AWS experienced higher social anxiety than AWNS prior to treatment but this decreased to a level comparable to AWNS following treatment.

LCB. There were no significant differences in LCB scores between AWNS (*M* = 24.10) and AWS at pre-treatment (*M* = 27.20) or post-treatment (*M* = 26.53), or for AWS between pre- and post-treatment.

Self-ratings of communication confidence and flexibility. For each 10-minute conversation, AWNS and AWS rated (a) how confident they felt, on a scale of 1 (*not confident*) to 5 (*very confident*); and (b) how much they felt they could say what they meant to say, on a scale of 1 (*not at all*) to 5 (*completely*). The confidence ratings provided by AWS at pre-treatment (*M* = 3.40) were significantly lower than those provided by AWNS (*M* = 4.23). The flexibility ratings provided by AWS (*M* = 3.73) were also significantly lower compared to AWNS (*M* = 4.50). There were no significant differences between AWNS and AWS for confidence (*M* = 4.23) or flexibility (*M* = 4.28) at post-treatment. There were also significant increases in the self-ratings of AWS between pre- and post-treatment for both confidence and flexibility. This indicates that AWS experienced lower conversational confidence and flexibility than AWNS prior to stuttering treatment but this increased to a level comparable to AWNS following treatment.

4.1.3 Naming Task

The UC Picture ID naming task (O'Beirne, 2011) was designed to objectively examine word choice. Self-rating scales relating to task difficulty and level of consideration required to produce responses were also administered to participants. Comparisons were made between AWNS and AWS at pre-treatment and post-treatment, and for AWS between pre- and post-treatment.

Task performance. The percentages of task responses scored 'dominant match' (%DM), 'non-dominant match' (%NDM), and 'no match' (%NM) for AWNS and AWS are displayed in Appendix 3, Tables 6 and 7, respectively. For %DM, there were no significant differences between AWNS (*M* = 74.53) and AWS at pre-treatment (*M* = 73.36) or post-treatment (*M* = 73.20), or for AWS between pre- and post-treatment. For %NDM, there were likewise no significant differences between AWNS (*M* = 19.14) and AWS at pre-treatment (*M* = 19.22) or post-treatment (*M* = 20.16), or for AWS between pre- and post-treatment. Finally, for % NM, there were no significant differences between AWNS (*M* = 6.33) and AWS at pre-treatment (*M* = 7.42) or post-treatment (*M* = 6.64), or for AWS between pre- and post-treatment. This indicates that AWS did not differ from AWNS, and did not change following stuttering treatment, in their performance on the naming task.

Self-ratings of task difficulty and response consideration. The naming task self-ratings of AWNS and AWS are displayed in Appendix 3, Tables 6 and 7, respectively. AWNS and AWS rated (a) how difficult they found the task on a scale of 1 (*very easy*) to 5 (*very difficult*); and (b) how much they considered their responses before labeling the pictures on a scale of 1 (*not at all*) to 5 (*a lot*). For the difficulty rating scale, there were no significant differences between AWNS (*M* = 1.58) and AWS at pre-treatment (*M* = 1.85) or post-treatment (*M* = 1.48), or for AWS between pre- and post-treatment. For the response consideration rating scale, there were also no significant differences between AWNS (*M* = 2.10) and AWS at pre-treatment (*M* = 2.30) or post-treatment (*M* = 1.78). A decrease in ratings was observed for AWS between pre- and post-treatment but this difference was not significant. This indicates that AWS did not differ from AWNS, and did not change following stuttering treatment, in their perception of naming task difficulty or required response consideration.

4.1.4. Conventional Language Measures

All conventional language measures, with the exception of verb frequency analysis, were completed using the 'Standard Measures' analysis function of the SALT-NZ (Gillon &

Westerveld, 2008) software. Using two-tailed *t*-tests, comparisons were made between AWNS and AWS at pre- and post-treatment, and for AWS between pre- and post-treatment. All conventional language results for AWNS and AWS are displayed in Appendix 3, Tables 8 and 9, respectively.

Total numbers of utterances (TNU) and words (TNW). The TNU and TNW produced by AWNS and AWS are shown in Figure 4. AWNS (M = 164.10) produced significantly greater TNU than AWS at pre-treatment (M = 125.25) and post-treatment (M = 116.65). AWNS (M = 1426.80) produced significantly greater TNW than AWS at pre-treatment (M = 953.10) and post-treatment (M = 911.00). There was no significant difference for AWS between pre- and post-treatment for TNU or TNW. This shows that AWS consistently produced less language than AWNS, even after treatment.

Number of different word roots (NDWR). The NDWR produced by AWNS and AWS are displayed in Figure 4. AWNS (M = 368.40) produced significantly greater NDWR than AWS at both pre-treatment (M = 253.00) and post-treatment (M = 263.65). There was no significant difference in NDWR of AWS between pre- and post-treatment. These results indicate that AWS consistently produced less and/or less varied language than AWNS, even following stuttering treatment.

Type-token ratio (TTR). A higher TTR indicates greater vocabulary diversity (Templin, 1957). TTR of AWNS (M = 0.29) was lower than that of AWS at pre-treatment (M = 0.34) and post-treatment (M = 0.33), and these differences reached or approached significance. There was no significant difference for AWS between pre- and post-treatment. This suggests that AWS used more diverse language than AWNS, before and after treatment.

Mean length of utterance in words (MLUw). The MLUw of AWNS and AWS are displayed in Figure 5. At pre-treatment, MLUw of AWNS (M = 7.86) was significantly higher than that of AWS (M = 6.56). There was no significant difference in MLUw between

Figure 4. Mean values for adults with no stuttering (AWNS), and adults with stuttering (AWS) at pre- and post-treatment, for: total numbers of utterances (TNU), words (TNW), and different word roots (NDWR).

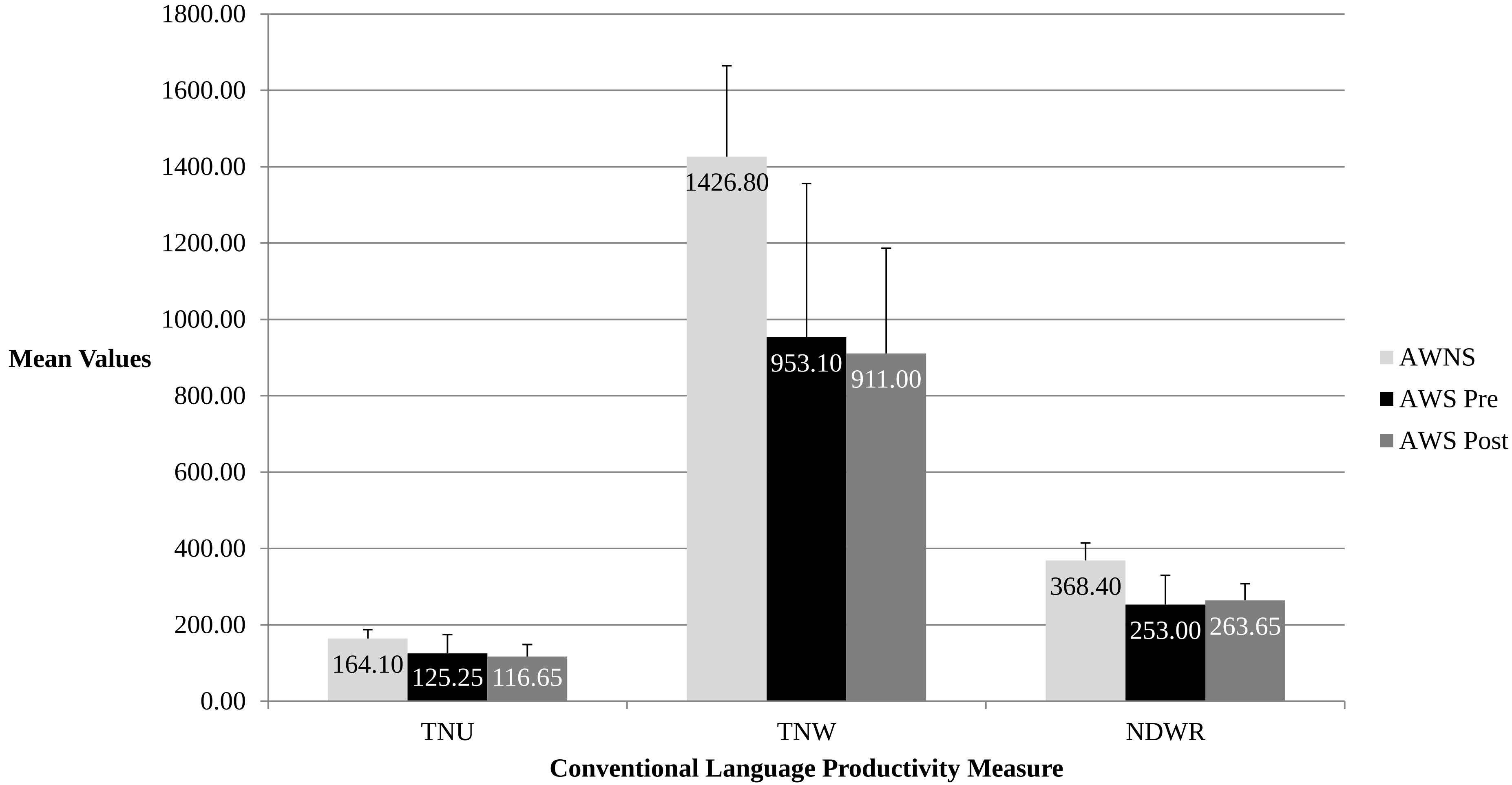
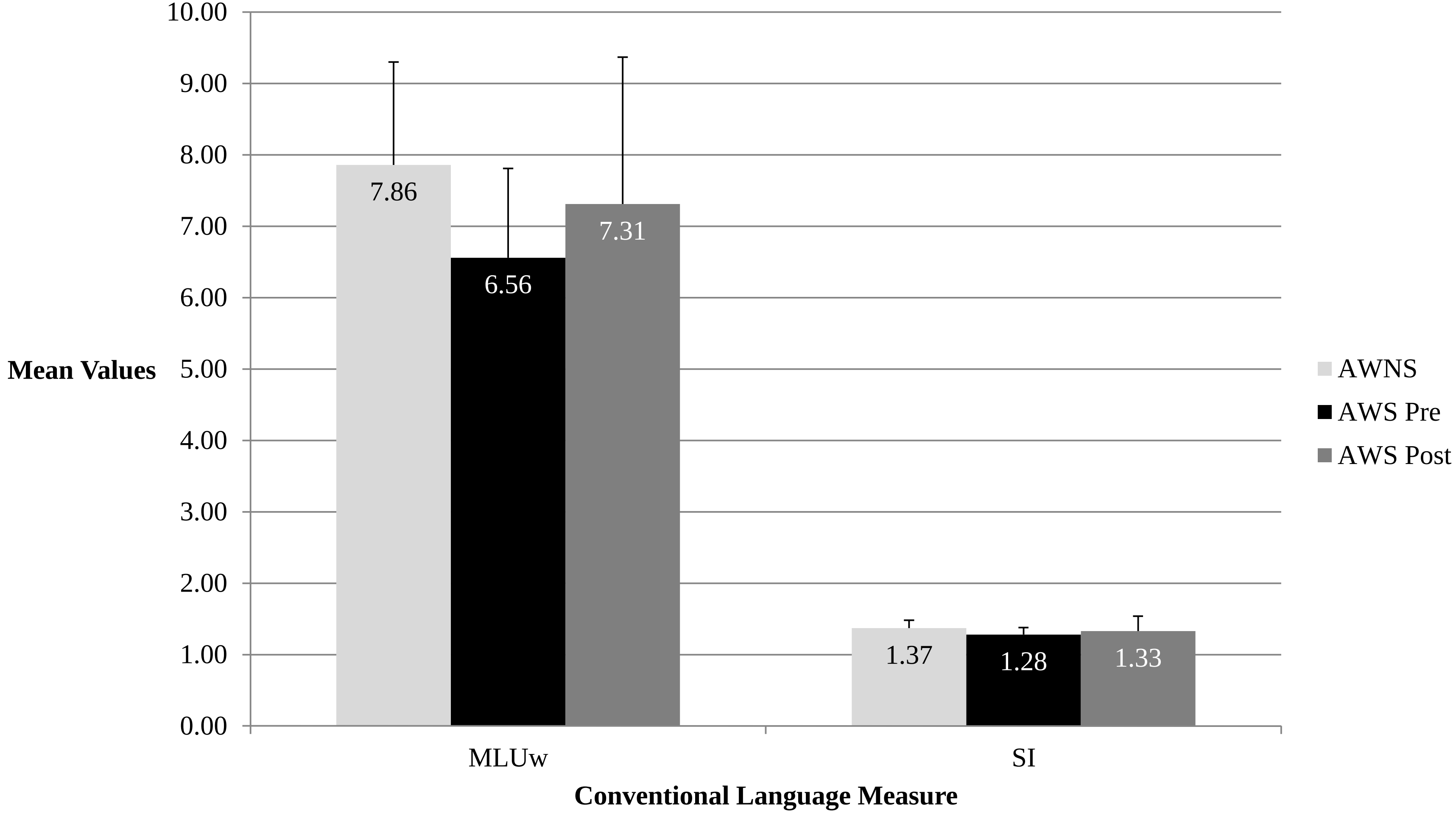


Figure 5. Mean values for adults with no stuttering (AWNS), and adults with stuttering (AWS) at pre- and post-treatment, for: mean length of utterance in words (MLUw) and subordination index (SI).



AWNS and AWS (*M* = 7.31) at post-treatment. There was an increase in MLUw of AWS between pre- and post-treatment but this difference was not significant. This indicates that AWS produced shorter utterances than AWNS before treatment but their utterances may have increased to a length comparable to those of AWNS after treatment.

Subordination index (SI). SI scores for AWNS and AWS are displayed in Figure 5. SI scores for AWNS (*M* = 1.37) were significantly higher than for AWS (*M* = 1.28) at pre-treatment. There was no significant difference between AWNS and AWS (*M* = 1.33) at post-treatment. There was a non-significant increase in SI for AWS between pre- and post-treatment. This indicates that AWS demonstrated lower utterance complexity than AWNS pre-treatment but this may have increased to a level comparable to AWNS after treatment.

Verb frequency (VF). Each lexical verb in each language sample was entered into (a) the SubtlexUS online database (Brysbaert & New, n.d., 2009), to determine its frequency of occurrence per one million words in American English (VF SubtlexUS); and (b) the WordCount website (Harris, 2003) (VF WordCount), to obtain a word frequency ranking based on data from the British National Corpus (University of Oxford, 2010). There were no significant differences between AWNS (*M* = 1853.21) and AWS at pre- (*M* = 1867.74) or post-treatment (*M* = 1890.51), or for AWS between pre- and post-treatment for VF SubtlexUS. Likewise, there were no significant differences between AWNS (*M* = 1213.61) and AWS at pre- (*M* = 1101.23) or post-treatment (*M* = 1170.43), or for AWS between pre- and post-treatment for VF WordCount. This indicates that the VF values of AWS did not differ from those of AWNS and did not change following stuttering treatment.

4.1.5. SFL Analyses

All transcripts were manually coded for SFL analyses, based on Halliday's (1985) systemic description of functional grammar and related works (Eggins, 1994; Ferguson &

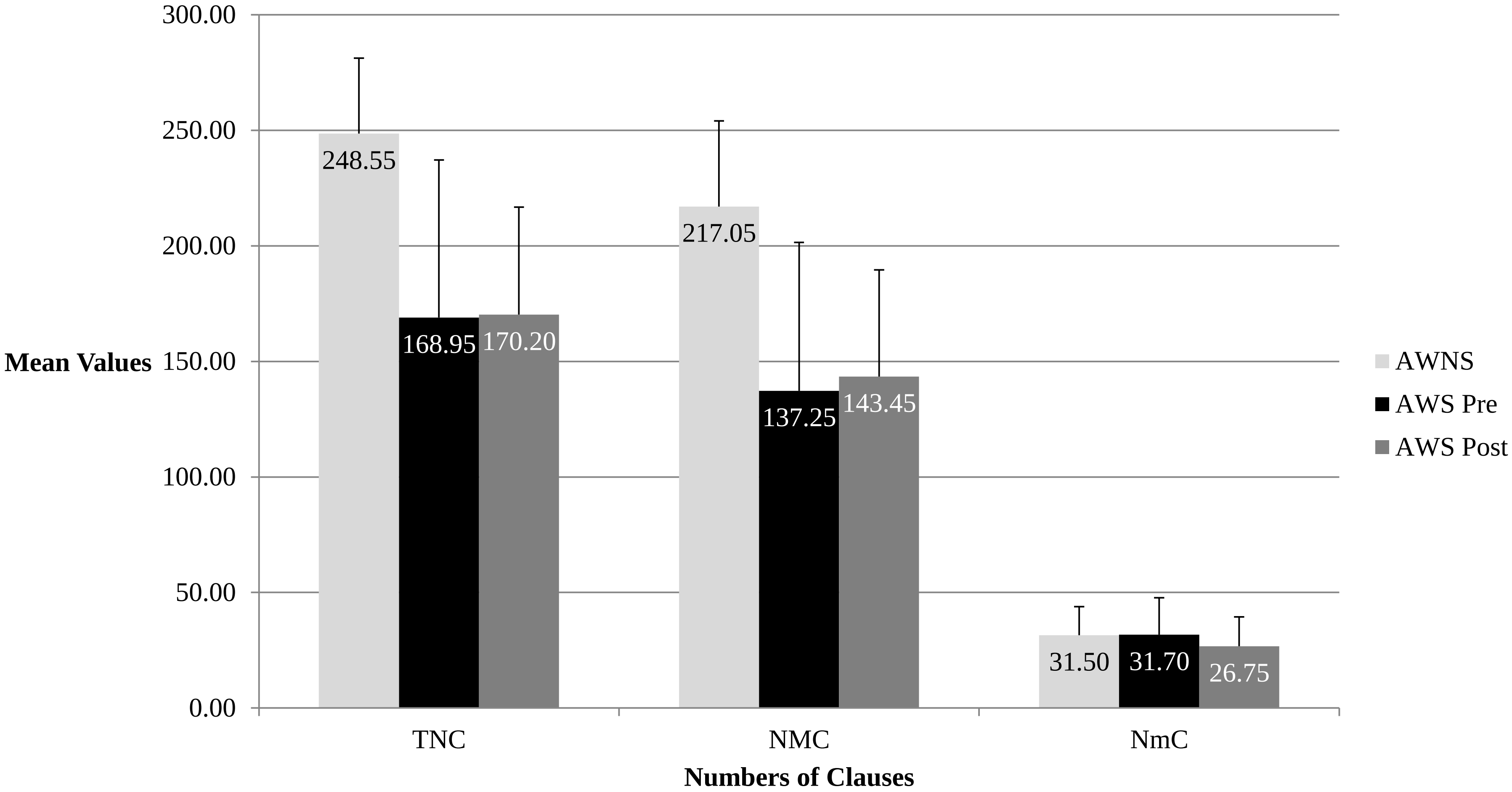
Thomson, 2008). The SFL results for AWNS and AWS are displayed in Appendix 3, Tables 10-14.

Total numbers of clauses (TNC), major and non-finite clauses (NMC), and minor clauses (NmC). The TNC, NMC, and NmC produced by AWNS and AWS are displayed in Figure 6. AWNS participants (*M* = 248.55) produced greater TNC than AWS at both pre- (*M* = 168.95) and post-treatment (*M* = 170.20). Likewise, AWNS (*M* = 217.05) produced significantly greater NMC than AWS at both pre- (*M* = 137.25) and post-treatment (*M* = 143.45). There were no significant differences for AWS between pre- and post-treatment in either TNC or NMC produced. For NmC, there were no significant differences between AWNS (*M* = 31.50) and AWS at pre- (*M* = 31.70) or post-treatment (*M* = 26.75), or for AWS between pre- and post-treatment. The results relating to TNC and NMC correspond to the conventional language results of TNU and TNW, indicating that AWS consistently produced less language than AWNS both before and after treatment.

Grammatical intricacy (GI). The GI scores of the AWNS participants (*M* = 4.33) were significantly higher than those of AWS (*M* = 3.35) at pre-treatment. There was also a trend towards higher GI scores in AWNS than AWS (*M* = 3.63) at post-treatment, but this difference was not significant. There was no difference in GI scores for AWS between pre- and post-treatment. This corresponds to the conventional language measure of SI, and indicates that AWS demonstrated lower utterance complexity than AWNS before treatment, but this may have increased to a level comparable to AWNS after treatment.

Verb process analysis. The verb process types examined were behavioural (%PB), causative (%PC), existential (%PE), material (%PM), mental (%PMe), relational (%PR), and verbal (%PV). For %PB (e.g., *sleep*, *watch*), there were no significant differences between AWNS (*M* = 2.19) and AWS at pre- (*M* = 2.36) or post-treatment (*M* = 2.59), or for AWS between pre- and post-treatment. For %PC (e.g., *make*, *force*, *let*), there were no significant

Figure 6. Mean values for adults with no stuttering (AWNS), and adults with stuttering (AWS) at pre- and post-treatment, for: total numbers of clauses (TNC), major clauses (NMC), and minor clauses (NmC).



differences between AWNS (*M* = 0.50) and AWS at pre- (*M* = 0.29) or post-treatment (*M* = 0.37), or for AWS between pre- and post-treatment. For %PE (e.g., *happen*, *emerge*), there were no significant differences between AWNS (*M* = 2.82) and AWS at pre-treatment (*M* = 3.38) or post-treatment (*M* = 2.78), or for AWS between pre- and post-treatment.

Analysis of %PM (e.g., eat, run) showed no significant differences between AWNS (*M* = 36.95) and AWS at pre-treatment (*M* = 34.74) or post-treatment (*M* = 39.32), or for AWS between pre- and post-treatment. For %PMe (e.g., *think*, *imagine*, *guess*), there were also no significant differences between AWNS (*M* = 14.70) and AWS at pre-treatment (*M* = 15.21) or post-treatment (*M* = 14.90), or for AWS between pre- and post-treatment. For %PR (e.g., *seem*, *become*), there were no significant differences between AWNS (*M* = 39.73) and AWS at pre-treatment (*M* = 41.45) or post-treatment (*M* = 36.05). A pattern of decreased %PR for AWS between pre- and post-treatment was observed but this difference was not significant. Finally, for %PV (e.g., *say*, *suggest*, *ask*), there were no significant differences between AWNS (*M* = 1.53) and AWS at pre-treatment (*M* = 1.58) or post-treatment (*M* = 1.91), or for AWS between pre- and post-treatment. Overall, these results indicate that AWS did not differ from AWNS, and did not change following stuttering treatment, in the types of verb processes expressed in their language.

Modality analysis. The measures examined were the percentages of clauses containing mood adjuncts (%MA), comment adjuncts (%CA), modal operators (%MO), and interpersonal metaphor (%IM), and the total number of modality resources (TNMR). For %MA (e.g., *really*, *always*), there were no significant differences between AWNS (*M* = 28.04) and AWS at pre-treatment (*M* = 30.17) or post-treatment (*M* = 29.51), or for AWS between pre- and post-treatment. For %CA (e.g., *basically*, *to be honest*) at pre-treatment, there was a trend towards lower percentages for AWNS (*M* = 0.82) than for AWS (*M* = 1.25), but this difference did not reach significance. Post-treatment, %CA was significantly lower for AWNS than for AWS (*M* = 1.36). There was no difference for AWS between pre- and post-treatment. As shown in Examples 1 and 2 below, comment adjuncts allow the speaker to express his or her attitude towards (or 'comment' on) his or her own utterance. The findings for %CA suggest that AWS used these resources more frequently than AWNS both before and after treatment. The %CA for AWNS and AWS are shown in Figure 7.

Example 1: Comment adjunct

AWS NZ 6 (pre-treatment): Oh no I have had them once *actually*.

Example 2: Comment adjunct

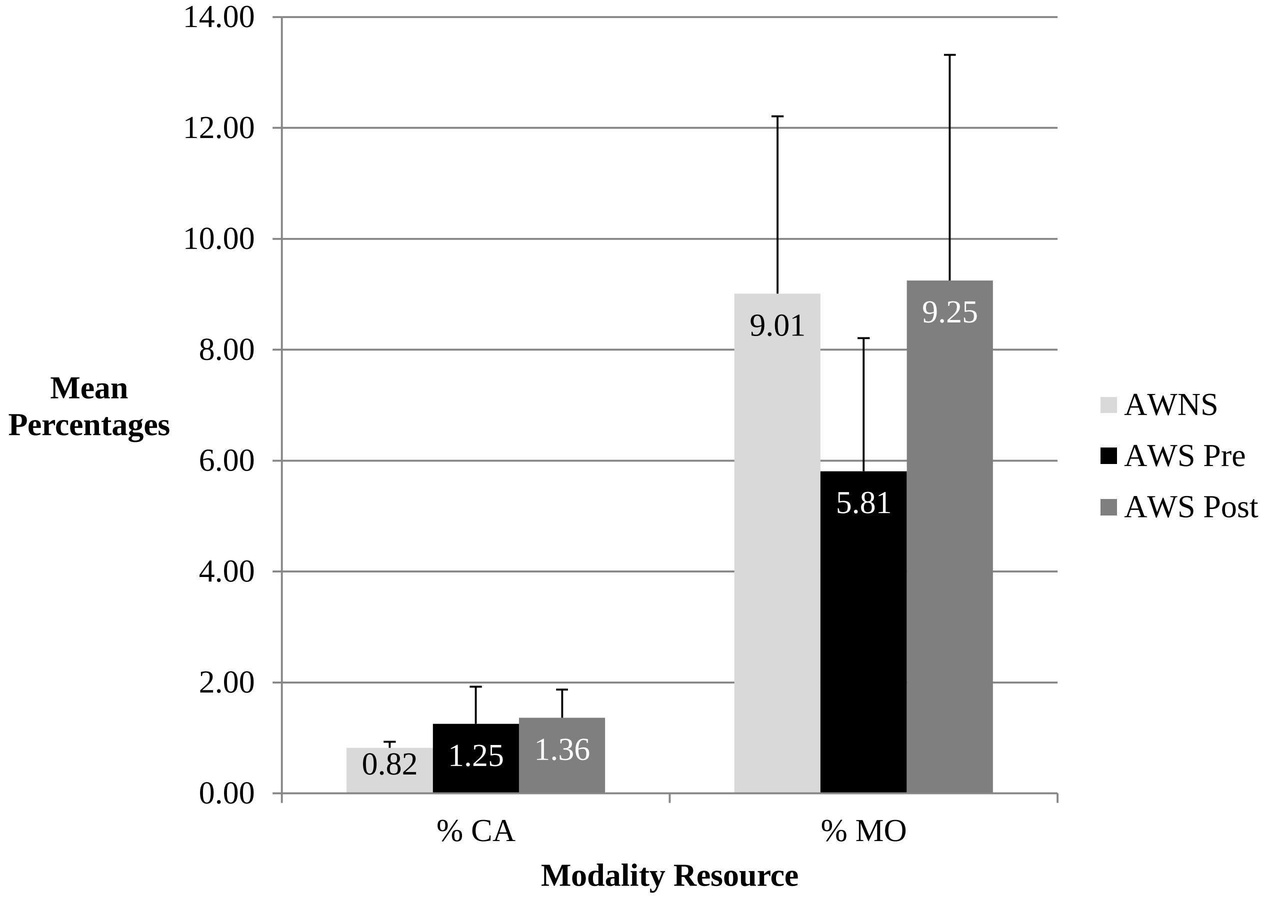
AWS US 10 (post-treatment): I really want to go to Stanford and *hopefully* major in astrophysics.

Analysis of %MO (e.g., *can*/*could*, *have*/*had to*, *will*/*would*) showed that percentages for AWNS (*M* = 9.01) were significantly higher than for AWS (*M* = 5.81) at pre-treatment. Post-treatment, there was no significant difference between AWNS and AWS (*M* = 9.25). Accordingly, a significant increase in %MO for AWS between pre- and post-treatment was also observed. The results indicate that AWS used fewer modal operators than AWNS prior to treatment, but their use of these language resources increased to a degree comparable to AWNS following treatment. The increased use of modal operators by AWS at post-treatment might suggest increased communication flexibility or openness to conversational engagement. Modal operators serve as politeness markers in conversation by varying the degree of directness or certainty expressed by the speaker (Togher & Hand, 1998), as shown in Examples 3 and 4. Results for %MO for AWNS and AWS are displayed in Figure 7.

Example 3: Modal operator

AWNS US 1: My mom *may* have helped a little bit.

Figure 7. Mean values for adults with no stuttering (AWNS), and adults with stuttering (AWS) at pre- and post-treatment, for: percentages of clauses containing comment adjuncts (%CA) and modal operators (%MO).



Example 4: Modal operator

AWS NZ 6 (pre-treatment): It's more our bosses I suppose who *have to* change things around.

The results for %IM (e.g., *I think*, *I reckon*) revealed no significant differences between AWNS (*M* = 5.08) and AWS at either pre-treatment (*M* = 5.23) or post-treatment (*M* = 4.02). A pattern of decreased %IM for AWS between pre- and post-treatment was observed but this difference was not significant. Finally, TNMR values were significantly higher for AWNS (*M* = 126.35) than for AWS at both pre-treatment (*M* = 81.05) and post-treatment (*M* = 86.60) but there was no significant difference for AWS between pre- and post-treatment. The higher TNMR-values observed for AWNS than for AWS suggest that AWS consistently produced less language than AWNS, as also indicated by the measures of language productivity (TNU, TNW, NMC, TNC).

Appraisal analysis. The percentages of words expressing amplification (%AM), judgment (%J), affect (%AF), and appreciation (%AP), and the total percentage of words expressing appraisal (T%A), were examined. Analysis of %AM (e.g., *very*, *kinda*, *extremely*) showed no significant differences between AWNS (*M* = 9.06) and AWS at pre-treatment (*M* = 9.24) or post-treatment (*M* = 8.77), or for AWS between pre- and post-treatment. For %AF (e.g., *happy*, *excited*, *I like*, *I hate*), there were no significant differences between AWNS (*M* = 4.13) and AWS at pre- (*M* = 3.44) or post-treatment (*M* = 5.85), or for AWS between pre- and post-treatment. However, trends towards increased %AF for AWS between pre- and post-treatment, and higher %AF in AWS than AWNS at post-treatment, were seen. This suggests that AWS may demonstrate increased expression of affect after stuttering treatment, to a level greater than that typical of AWNS. Affect involves the articulation of emotional states and responses (Martin & White, 2005), which may be positive (Example 5) or negative (Example 6), and is therefore particularly linked to the expression of personal opinion.

Example 5: Affect

AWS NZ 4 (pre-treatment): But pediatrics was probably the one that *I enjoyed the most from the start*.

Example 6: Affect

AWS US 2 (post-treatment): Just *haven't cared* as much even though *I have never really liked it*.

There was a near-significant difference in %AP (e.g., *good, fun, different*) between AWNS (*M* = 14.60) and AWS at pre-treatment (*M* = 10.59) but not post-treatment (*M* = 12.60). There was no difference for AWS between pre- and post-treatment. Like affect, appreciation is linked to the statement of opinion, expressing a speaker's evaluations of or reactions to 'things' (Martin & White, 2005), as shown in Examples 7 and 8.

Example 7: Appreciation

AWNS NZ 1: But otherwise there's not much happening in the news. *It's either huge things or things that aren't anything.*

Example 8: Appreciation

AWS US 11 (post-treatment): But *they have a really nice water park*.

For %J (e.g., *good (at something), stupid*), there were no significant differences between AWNS (*M* = 4.78) and AWS at pre-treatment (*M* = 3.70) or post-treatment (*M* = 4.89), or for AWS between pre- and post-treatment. The T%A for AWNS (*M* = 32.58) was significantly higher than for AWS at pre-treatment (*M* = 26.97) but not at post-treatment (*M* = 32.11). A pattern of increased T%A for AWS between pre- and post-treatment was observed, but this difference was not significant. Overall, these results indicate that AWS demonstrated increased use of some elements of appraisal following treatment.

Theme analysis. Interpersonal (%INT), textual (%TE), structural (%STR), multiple (%MULT), and marked (%MAR) theme, and instances of 'clause as theme' (%CT) were examined. Analysis of %INT (e.g., *really*, *I think*) revealed no significant differences between AWNS (*M* = 13.08) and AWS at pre-treatment (*M* = 14.85) or post-treatment (*M* = 12.41), or for AWS between pre- and post-treatment. Results for %TE (e.g., *but*, *and*) showed no significant differences between AWNS (*M* = 42.65) and AWS at pre-treatment (*M* = 40.49) or post-treatment (*M* = 42.52), or for AWS between pre- and post-treatment. For %STR (e.g., *because*, *unless*), there were also no significant differences between AWNS (*M* = 14.36) and AWS at pre-treatment (*M* = 10.67) or post-treatment (*M* = 12.47), or for AWS between pre- and post-treatment. However, a trend was seen towards higher %STR in AWNS than AWS at pre-treatment. As evident from Examples 9 and 10, the use of structural theme is closely linked to subordinate clause production. Therefore, the findings relating to %STR suggest less complex language use in AWS at pre-treatment.

Example 9: Structural theme

AWS NZ 3 (pre-treatment): I really only notice it *when* I block on really difficult words in social situations.

Example 10: Structural theme

AWS US 9 (post-treatment): No no no I'm going backpacking *as soon as* we're done here this afternoon.

Analysis of %MULT (e.g., <u>*And then*</u> *I didn't see*) found no significant differences between AWNS (*M* = 44.91) and AWS at pre- (*M* = 41.39) or post-treatment (*M* = 40.39), or for AWS between pre- and post-treatment. For %MAR (e.g., <u>*Spam musubi*</u>*, do you know what that is?*), there were no significant differences between AWNS (*M* = 3.04) and AWS at pre- (*M* = 3.12) or post-treatment (*M* = 3.38), or for AWS between pre- and post-treatment.

Results for %CT (e.g., *By the time she's done*, *I should have a masters in math*) also showed no significant differences between AWNS (M = 1.90) and AWS at pre- (M = 1.48) or post-treatment (M = 1.66), or for AWS between pre- and post-treatment. Overall, the results from theme analysis show that AWS did not differ from AWNS, and did not change after treatment, in terms of types of theme used in conversation.

4.1.6. Group Differences: Key Findings

1) The frequency and severity of stuttering of AWS participants decreased significantly following intensive stuttering treatment, as measured by %SS, the SSI-3 (Riley, 1994), and a stuttering severity self-rating scale.
2) The AWS participants demonstrated significantly higher social anxiety before treatment, as measured using the LSAS (Liebowitz, 1987), and significantly lower self-perceived confidence and flexibility in communication, compared to AWNS participants. However, significant improvements were observed in both areas at post-treatment. The life impact of stuttering as measured by the OASES (Yaruss & Quesal, 2008) also decreased significantly at post-treatment for AWS participants.
3) There were no significant differences between AWS and AWNS participants, or for AWS participants over time, for performance on the UC Picture ID naming task (O'Beirne, 2011).
4) The AWS participants produced significantly less language than AWNS participants both before and after stuttering treatment, as collectively demonstrated by measures from the conventional language (TNU, TNW, NDWR) and SFL (TNC, NMC, TNMR) analyses.
5) The AWS participants used significantly less complex language than AWNS participants before but not after stuttering treatment, as collectively demonstrated by conventional language (MLUw, SI) and SFL (GI, %STR) measures. Accordingly, a

tendency towards increased language complexity in AWS participants with treatment was observed.

6) Three specific differences in language behaviour between AWS and AWNS participants were also evident from the SFL analyses of modality and appraisal:
    a) Both before and after treatment, AWS used more comment adjuncts (e.g., *basically*, *to be honest*) than AWNS, although this difference was significant only at post-treatment.
    b) The AWS produced significantly fewer modal operators (e.g., *can*/*could*, *have/had to*, *will*/*would*) than AWNS before but not after stuttering treatment, and accordingly, there was a significant increase in use of modal operators for AWS with treatment.
    c) The AWS used fewer appraisal resources (in particular, resources of appreciation) than AWNS before but not after stuttering treatment, and accordingly, there was a trend towards increased expression of appraisal for AWS with treatment.

4.2. Correlations between Variables

4.2.1. Stuttering Severity

The relationship between %SS, SSI-3, and a stuttering severity self-rating scale, and a number of self-rating scale and language measures, were examined for (a) AWS at pre-treatment; and (b) AWS at post-treatment. These correlations are displayed in Appendix 4, Tables 15 and 16. The correlation between scores of AWS on %SS and the SSI-3 at pre-treatment did not reach significance. Post-treatment, the positive correlation between %SS and SSI-3 scores was significant. The stuttering severity self-ratings were not significantly correlated with %SS or SSI-3 scores at either pre- or post-treatment. However, the positive correlation between severity self-ratings for the 10-minute conversational sampling period and %SS scores approached significance at pre-treatment. Post-treatment, the positive correlation between the second severity self-rating (concerning the week leading up to the testing session) and SSI-3 scores also approached significance. The findings indicate general agreement among these three measures of stuttering severity.

Stuttering severity and self-rating scales. There were no significant correlations between scores from any of the stuttering severity measures and scores from the LSAS (Liebowitz, 1987), OASES (Yaruss & Quesal, 2008), or self-ratings of confidence and flexibility, for AWS at pre- or post-treatment.

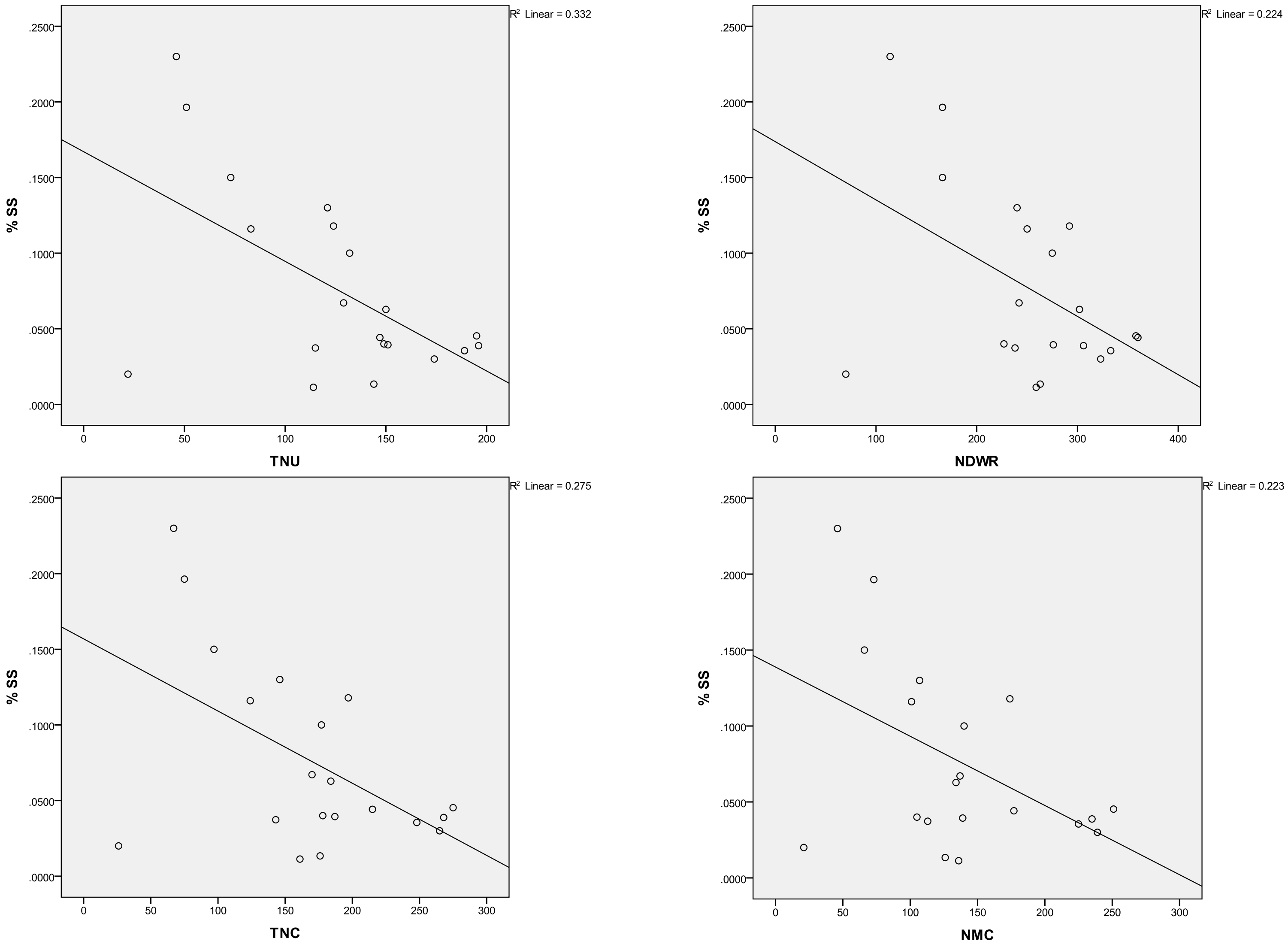
Stuttering severity and language measures. There were no significant correlations between the stuttering severity measures and PPVT scores (Dunn & Dunn, 1997) or any conventional or SFL language measures, for AWS at either pre- or post-treatment. However, at pre-treatment, there was a negative correlation between %SS scores and several measures of language productivity (TNU, NDWR, TNC, NMC), which approached significance. These relationships are shown as scatter plots in Figure 8. This result suggests that before treatment, AWS who stuttered more severely were likely to produce less language in conversation, but this relationship was no longer evident following treatment.

4.2.2. Self-Rating Scales

The relationship between the LSAS, OASES, self-ratings of communication confidence and flexibility, and conventional and SFL language measures, were examined for (a) AWNS; (b) AWS at pre-treatment; and (c) AWS at post-treatment. These correlations are displayed in Appendix 4, Tables 17-19.

There were significant positive correlations between LSAS subscales for both AWNS and AWS at pre-treatment and post-treatment. Significant positive correlations were also found among some OASES subscales for AWS at pre- and post-treatment. For AWS at pre-

Figure 8. Scatter plots depicting the relationship between percentage of syllables stuttered (%SS) and the language productivity measures of total numbers of utterances (TNU), different word roots (NDWR), clauses (TNC), and major clauses (NMC), for adults with stuttering (AWS) at pre-treatment. The corresponding r^2-values are shown.



treatment, the correlation between LSAS and OASES total scores did not reach significance. However, this positive relationship was significant at post-treatment. Interestingly, there was a significant positive correlation between self-ratings of communication confidence and self-ratings of communication flexibility for AWS at post-treatment, which was not evident at pre-treatment. A similar relationship was seen for AWNS, although the correlation did not reach significance. The results suggest that for the AWS group prior to treatment, perceptions of confidence in conversation and flexibility of expression were relatively independent of each other. After treatment, a positive relationship developed between the two, mirroring that observed in AWNS. This shift in perception may have been prompted by discussion around communication behaviour and language use that occurred within the context of treatment.

Self-rating scales and language measures. For AWNS, there were no significant correlations between LSAS scores, OASES scores, or communication self-ratings, and performance on any of the conventional or SFL language variables measured. A similar result was obtained for AWS at both pre- and post-treatment.

4.2.3. Language Productivity

The relationship between measures of language productivity from the conventional (TNU, TNW, NDWR, MLUw) and SFL (TNC, NMC, TNMR) language analyses, and other language measures, were examined for (a) AWNS; (b) AWS at pre-treatment; and (c) AWS at post-treatment. Positive correlations were observed between all language productivity measures, most of which approached or reached significance, for both AWNS and AWS at pre- and post-treatment. These correlations are displayed in Appendix 4, Table 20. Overall, these results indicate correspondence between the various language productivity measures from the conventional and SFL approaches.

Language productivity and other language measures. For AWNS and AWS, there were no significant correlations between any of the language productivity measures and any other specific measures from the SFL analyses of verb process, modality, appraisal, or theme.

4.2.4. Language Complexity

The correlational analyses regarding language complexity examined relationships between measures of language complexity from the conventional (SI) and SFL (GI) language analyses, language productivity measures, and all remaining SFL analyses, for (a) AWNS; (b) AWS at pre-treatment; and (c) AWS at post-treatment. There was a positive correlation between SI and GI for AWNS that approached significance. A similar pattern was observed for AWS at both pre-treatment and post-treatment. These relationships are displayed as scatter plots in Figure 9. This finding suggests correspondence between the two language complexity measures.

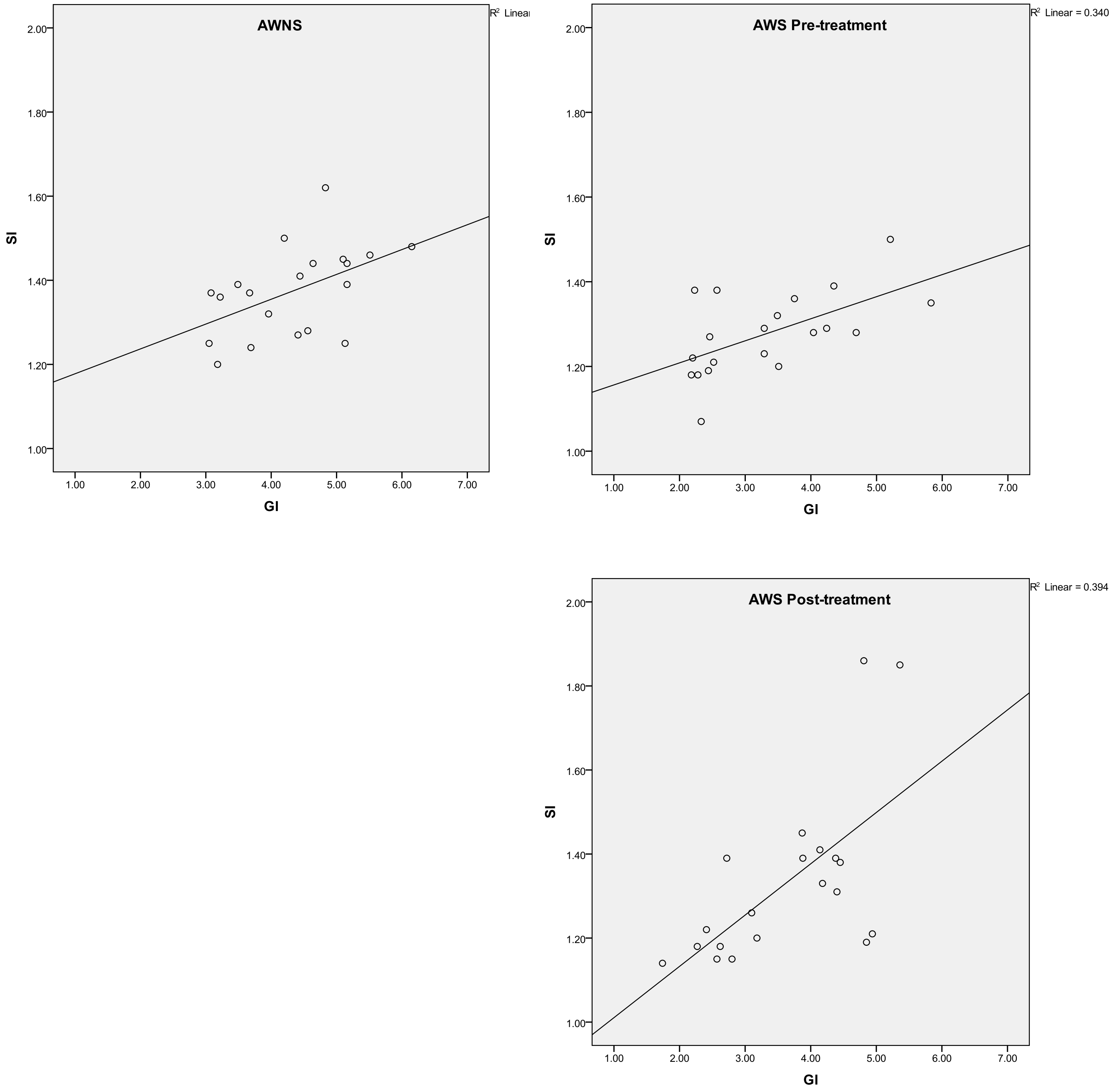
Language complexity and language productivity. There were a number of positive correlations between language complexity (SI, GI) and language productivity (TNW, MLUw, NMC, TNMR) measures, which approached or reached significance for both AWNS and AWS and pre- and post-treatment. These correlations are displayed in Appendix 4, Table 21.

Language complexity and other language measures. There were no significant correlations between any of the language complexity measures and any other specific measures from the SFL analyses of verb process, modality, appraisal, or theme, for AWNS or for AWS at pre- or post-treatment.

4.2.5. Comment Adjuncts

Comment adjuncts typically occur at clause boundaries, and express a speaker's attitude towards the utterance being spoken. The relationship between the percentage of clauses containing comment adjuncts (%CA), stuttering severity, and other language

Figure 9. Scatter plots depicting the relationship between the language complexity measures of subordination index (SI) and grammatical intricacy (GI) for adults with no stuttering (AWNS) and adults with stuttering (AWS) at pre- and post-treatment.

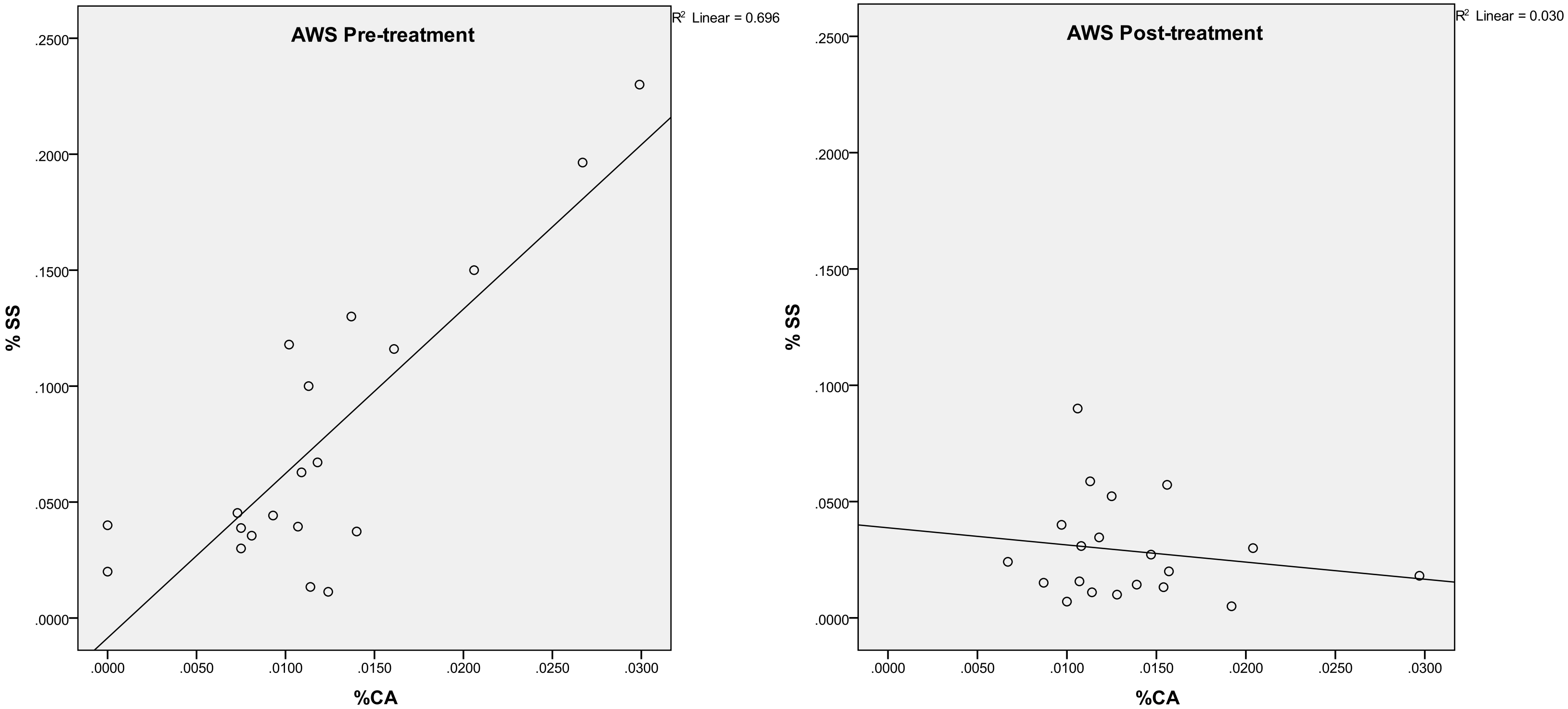


measures, were examined for (a) AWNS; (b) AWS at pre-treatment; and (c) AWS at post-treatment. The measure of %CA was included in the correlational analyses due to the significant differences in group means between AWNS and AWS, as previously reported.

Comment adjuncts and %SS. The correlations between %CA and %SS for AWS at pre- and post-treatment are displayed as scatter plots in Figure 10. There was a significant positive correlation between %CA and %SS for AWS at pre-treatment but not at post-treatment. This finding suggests that AWS who stuttered more severely before treatment also used more comment adjuncts in conversation. This language behaviour may serve a specific function linked to the presentation of stuttering (e.g., as a filler word or to avoid an anticipated disfluency). The finding that this relationship was no longer observed in AWS after treatment may suggest a reduced reliance on such behaviour.

Comment adjuncts and language productivity. These relationships are displayed in Appendix 4, Table 22. Negative correlations that approached or reached significance were observed between %CA and the language productivity measures of TNU, TNW, NDWR, TNC, and NMC, for AWNS. A similar but weaker tendency was observed for AWS at pre-treatment. For AWS at post-treatment, weaker negative correlations approaching significance were also found between %CA and TNU, TNC, and NMC. The negative correlations observed for both AWNS and AWS at pre-treatment indicate that speakers who used more comment adjuncts were likely to produce less language overall in conversation. It is possible that comment adjuncts allow a speaker to briefly and concisely 'comment' or reveal their attitude towards the content of their own utterance, eliminating the need for a separate comment statement. The finding that this relationship did not reach significance in AWS at pre-treatment, and was further weakened at post-treatment, suggests that AWS may not have made use of this resource in the same way as AWNS.

Figure 10. Scatter plots depicting the relationship between percentage of syllables stuttered (%SS) and percentage of clauses containing comment adjuncts (%CA) for adults with stuttering (AWS) at pre- and post-treatment.



Comment adjuncts and other language measures. There were no significant correlations between CA and any other specific measures from the SFL analyses of verb process, modality, appraisal, or theme, for AWNS or for AWS at pre- or post-treatment.

4.2.6. Correlations between Variables: Key Findings

1) The AWS who stuttered more severely at pre-treatment, as measured by %SS, were likely to produce less language in conversation, as measured by TNU, NDWR, TNC, and NMC. This relationship was no longer evident post-treatment.
2) There was a significant positive correlation between self-ratings of communication confidence and flexibility for AWS at post-treatment, which was not observed pre-treatment. A similar relationship to that found for AWS at post-treatment was also seen in AWNS.
3) Positive correlations reaching or approaching significance were found across conventional (TNU, TNW, NDWR, MLUw) and SFL (TNC, NMC, TNMR) measures of language productivity for AWNS and AWS at pre- and post-treatment. This indicates correspondence between measures from the two methods of analysis.
4) Positive correlations approaching significance were found between the conventional (SI) and SFL (GI) measures of language complexity for both AWNS and AWS at pre- and post-treatment. This indicates correspondence between the two measures.
5) The AWS who stuttered more severely at pre-treatment, as measured by %SS, used more comment adjuncts in conversation. This relationship was not evident post-treatment.
6) The AWNS who produced more language in conversation, as measured by TNU, TNW, NDWR, TNC, and NMC, used fewer comment adjuncts in conversation. A similar but weaker pattern was observed for AWS at pre- and post-treatment.

4.3. Subgroup Analyses: NZ and US Participants

The AWS participants in this study were recruited from two intensive clinic programmes: the 1-week Naturalness Intensive Programme (NIP) at the University of Canterbury in Christchurch, New Zealand, and the 2-week Intensive Stuttering Clinic (ISC; Blomgren, 2009) at the University of Utah in Salt Lake City, United States. AWNS controls were matched to AWS for English language variety. Consequently, 9 AWNS and 9 AWS participants were speakers of NZ English, and 11 AWNS and 11 AWS participants were speakers of US English. Although data from the NZ and US groups were combined for 'full group' means comparisons and correlations as previously described, an exploratory analysis was also undertaken to separately examine the two groups. For each group, comparisons were made between AWNS and AWS at pre- and post-treatment, and for AWS between pre- and post-treatment. This analysis was motivated by the possible impact of differences in treatment experiences between the two programmes, as well as differences in English language variety. The original *p*-values and *p**-values from all means comparisons for the NZ and US groups are displayed in Appendix 5, Tables 23 and 24, respectively.

4.3.1. NZ Participants

The false discovery rate threshold was set at 10% (*p**=.1) for all NZ group comparisons. No means comparisons between AWNS, AWS at pre-treatment, or AWS at post-treatment reached significance for the NZ group. However, there were a number of comparisons that approached significance, which were generally consistent with the results obtained from the full group analyses. It is likely that the failure of the comparisons to reach statistical significance was due at least in part to the smaller size of the samples compared.

General measures. The PPVT scores of AWNS (*M* = 123.44) were higher than those of AWS (*M* = 104.89). The AWS scored higher at pre-treatment (*M* = 5.70) than post-treatment (*M* = 2.54) on %SS, and at pre-treatment (*M* = 20.11) than post-treatment (*M* =

8.89) on the SSI-3. This corresponded to the results from the full group analyses. Analysis of articulation rate found no differences between AWNS (*M* = 5.57sps) and AWS at either pre- (*M* = 5.52sps) or post-treatment (*M* = 5.15sps), or for AWS between pre- and post-treatment.

Self-rating scales. The rating scale results for the NZ group were generally in agreement with those observed in the full group analyses. The AWS scored higher (a) at pre-treatment (*M* = 2.67) than post-treatment (*M* = 1.33) on self-ratings of their stuttering severity during the 10-minute conversational sampling period; (b) at pre-treatment (*M* = 3.56) than post-treatment (*M* = 2.50) on ratings of their stuttering severity during the week leading up to the sampling session; and (c) at pre-treatment (*M* = 2.82) than post-treatment (*M* = 2.61) on OASES total scores. No differences were found for (a) PSI total scores for AWS between pre-treatment (*M* = 43.70) and post-treatment (*M* = 30.56); (b) LSAS total scores between AWNS (*M* = 35.00), AWS at pre-treatment (*M* = 55.00), and AWS at post-treatment (*M* = 44.39); (c) BDI scores between AWNS (*M* = 3.78), AWS at pre-treatment (*M* = 5.94), and AWS at post-treatment (*M* = 4.11); and (d) LCB scores between AWNS (*M* = 26.67), AWS at pre-treatment (*M* = 29.56), and AWS at post-treatment (*M* = 32.18). For the communication confidence self-rating scale, AWNS (*M* = 4.59) scored higher than AWS at pre-treatment (*M* = 3.39), but not post-treatment (*M* = 4.28), and there was an increase in scores for AWS between pre- and post-treatment. A similar pattern was observed for the flexibility scale between AWNS (*M* = 4.50), AWS at pre-treatment (*M* = 3.61), and AWS at post-treatment (*M* = 4.22), reflecting the results for the full group.

Naming task. As in the full group analyses, no differences were found for the NZ group for (a) %DM between AWNS (*M* = 71.88), AWS at pre-treatment (*M* = 68.75), and AWS at post-treatment (*M* = 69.62); (b) %NDM between AWNS (*M* = 21.18), AWS at pre-treatment (*M* = 21.35), and AWS at post-treatment (*M* = 22.05); or (c) %NM between AWNS (*M* = 6.94), AWS at pre-treatment (*M* = 9.90), and AWS at post-treatment (*M* = 8.33). For the task difficulty self-rating scale, no differences were found between AWNS (*M* = 1.56), AWS at pre-treatment (*M* = 1.83), and AWS at post-treatment (*M* = 1.56). For the response consideration scale, there were also no differences between AWNS (*M* = 2.11) and AWS at pre-treatment (*M* = 2.83) or post-treatment (*M* = 1.67). However, there was a trend towards higher ratings for AWS at pre-treatment than post-treatment for the response consideration scale, corresponding to the results obtained for the full group.

Conventional language measures. The conventional language results for the NZ group were generally consistent with those for the full group. As with the full group, TNW was greater for AWNS (*M* = 1448.44) than AWS at both pre-treatment (*M* = 1081.22) and post-treatment (*M* = 1012.67), and there was no difference for AWS between pre- and post-treatment. A similar pattern was observed for NDWR between AWNS (*M* = 361.56), AWS at pre-treatment (*M* = 280.11), and AWS at post-treatment (*M* = 282.78). The MLUw scores were greater for AWNS (*M* = 8.15) than AWS at pre-treatment (*M* = 6.93) but not at post-treatment (*M* = 7.48), and there was no difference in scores for AWS between pre- and post-treatment. No differences were observed for (a) TTR scores between AWNS (*M* = 0.28), AWS at pre-treatment (*M* = 0.31), and AWS at post-treatment (*M* = 0.33); (b) VF SubtlexUS scores between AWNS (*M* = 1749.81), AWS at pre-treatment (*M* = 1893.89), and AWS at post-treatment (*M* = 1863.46); and (c) VF WordCount scores between AWNS (*M* = 1260.40), AWS at pre-treatment (*M* = 1212.83), and AWS at post-treatment (*M* = 1429.56), which agreed with the results for the full group.

No difference was found for TNU between AWNS (*M* = 158.33) and AWS at pre-treatment (*M* = 137.11). A higher TNU in AWNS than AWS (*M* = 124.44) was observed at post-treatment only. There was no difference for AWS between pre- and post-treatment. A weak trend towards higher SI scores in AWNS (*M* = 1.41) than AWS at pre-treatment (*M* = 1.33) was observed, which paralleled the full group results. There was no difference in SI between AWNS and AWS at post-treatment (*M* = 1.35), or for AWS between pre- and post-treatment.

SFL analyses. The SFL results for the NZ group also corresponded roughly to those for the full group, with some discrepancies. The mean values obtained by the NZ group on all SFL measures are displayed in Appendix 5, Table 25.

Greater TNC and NMC were found for AWNS than AWS at both pre- and post-treatment, as also observed for the full group. A weak tendency was observed towards higher GI scores in AWNS than AWS at pre-treatment only. As in the full group analyses, no differences were found across comparisons in the areas of verb process and theme analysis. Results of the modality analysis identified weak trends towards (a) higher %MO for AWNS than AWS at pre-treatment only, with an increase in %MO for AWS between pre- and post-treatment; (b) lower %CA for AWNS than AWS at post-treatment; and (c) greater TNMR for AWNS than AWS at pre- and post-treatment. These patterns corresponded to full group results. With regard to appraisal analysis, there were trends towards (a) an increase in %AF for AWS between pre- and post-treatment; and (b) greater %AP and T%A in AWNS than AWS at pre-treatment only. Both patterns were consistent with the results for the full group.

4.3.2. US Participants

The false discovery rate threshold for US group comparisons between AWNS and AWS at pre- and post-treatment was set at 20% (p^*=.2), and at 12% (p^*=.12) for comparisons between pre- and post-treatment for AWS. The comparisons that approached or reached significance generally reflected the results obtained from the full group analyses, although fewer comparisons reached significance for the US group alone than for the full group of participants. As for the NZ group, it is likely that the failure of some comparisons to reach statistical significance was due at least in part to the smaller size of the samples compared. Interestingly, some additional patterns were observed for the US group in the area of SFL theme analysis, which were not evident for the full group.

General measures. For the US group, the PPVT scores of AWNS (*M* = 121.73) were significantly higher than those of AWS (*M* = 103.91). In terms of stuttering severity, AWS scored significantly higher (a) at pre-treatment (*M* = 9.20) than post-treatment (*M* = 3.14) on %SS; and (b) at pre-treatment (*M* = 27.18) than post-treatment (*M* = 11.64) on the SSI-3. The articulation rate of AWNS (*M* = 5.68sps) was observed to be higher than that of AWS at post-treatment (*M* = 4.83sps), but not at pre-treatment (*M* = 5.56sps), although this difference did not reach significance. There was also a pattern of decreased articulation rate for AWS between pre- and post-treatment. All of these results corresponded to those obtained in the full group analyses.

Self-rating scales. The rating scale results for the US group were in agreement with those observed in the full group analyses. The AWS scored higher (a) at pre-treatment (*M* = 3.36) than post-treatment (*M* = 1.40) on self-ratings of their stuttering severity during the 10-minute conversational sampling period; (b) at pre-treatment (*M* = 3.73) than post-treatment (*M* = 2.61) on ratings of their stuttering severity during the week leading up to the sampling session; (c) at pre-treatment (*M* = 52.58) than post-treatment (*M* = 35.91) on PSI total scores; and (d) at pre-treatment (*M* = 3.09) than post-treatment (*M* = 2.35) on OASES total scores. All of these differences approached or reached significance. With regards to BDI scores, there were no differences between AWNS (*M* = 5.73) and AWS at either pre-treatment (*M* = 5.27) or post-treatment (*M* = 2.45), but there was a decrease in scores for AWS between pre- and post-treatment, which approached significance. For the LSAS, the total scores of AWNS (*M* = 33.09) were lower than those of AWS at pre-treatment (*M* = 63.82), but not at post-treatment (*M* = 38.82), and this difference approached significance. Accordingly, there was a significant decrease in LSAS total scores for AWS between pre- and post-treatment. No differences were found for LCB scores between AWNS (*M* = 22.00), AWS at pre-treatment (*M* = 25.26), and AWS at post-treatment (*M* = 21.91). For the communication confidence self-rating scale, AWNS (*M* = 4.09) scored higher than AWS at pre-treatment (*M* = 3.41), but not post-treatment (*M* = 4.18), and there was an increase in scores for AWS between pre- and post-treatment, which approached significance. A similar pattern was observed for the flexibility scale between AWNS (*M* = 4.50), AWS at pre-treatment (*M* = 3.82), and AWS at post-treatment (*M* = 4.32). These results corresponded to those from full group analyses.

Naming task. As in the full group analyses, no differences were found for the US group for (a) %DM between AWNS (*M* = 76.71), AWS at pre-treatment (*M* = 77.13), and AWS at post-treatment (*M* = 76.14); (b) %NDM between AWNS (*M* = 17.47), AWS at pre-treatment (*M* = 17.47), and AWS at post-treatment (*M* = 18.61); or (c) %NM between AWNS (*M* = 5.82), AWS at pre-treatment (*M* = 5.40), and AWS at post-treatment (*M* = 5.26). There were also no differences for (a) the task difficulty self-rating scale between AWNS (*M* = 1.59), AWS at pre-treatment (*M* = 1.86), and AWS at post-treatment (*M* = 1.41); or (b) the response consideration scale between AWNS (*M* = 2.09), AWS at pre-treatment (*M* = 1.86), and AWS at post-treatment (*M* = 1.86).

Conventional language measures. The conventional language results for the US group were generally consistent with those for the full group. TNU was greater for AWNS (*M* = 168.82) than AWS at both pre-treatment (*M* = 115.55) and post-treatment (*M* = 110.27), and there was no difference for AWS between pre- and post-treatment. A similar pattern was observed for TNW between AWNS (*M* = 1409.09), AWS at pre-treatment (*M* = 848.27), and AWS at post-treatment (*M* = 827.82), and for NDWR between AWNS (*M* = 374.00), AWS at pre-treatment (*M* = 230.82), and AWS at post-treatment (*M* = 248.00). All of these differences approached or reached significance.

There were trends towards greater MLUw scores for AWNS (*M* = 7.62) than AWS at pre-treatment (*M* = 6.25), but not at post-treatment (*M* = 7.18), and increased scores for AWS between pre- and post-treatment. There was a trend towards higher SI scores for AWNS (*M* = 1.35) than AWS at pre-treatment (*M* = 1.23), but not at post-treatment (*M* = 1.32), and there was no difference for AWS between pre- and post-treatment. No differences were observed for (a) TTR scores between AWNS (*M* = 0.30), AWS at pre-treatment (*M* = 0.36), and AWS at post-treatment (*M* = 0.34); (b) VF SubtlexUS scores between AWNS (*M* = 1937.81), AWS at pre-treatment (*M* = 1846.34), and AWS at post-treatment (*M* = 1912.65); and (c) VF WordCount scores between AWNS (*M* = 1175.32), AWS at pre-treatment (*M* = 1009.91), and AWS at post-treatment (*M* = 958.42). The data were consistent with full group analyses.

SFL analyses. The SFL results for the US group corresponded roughly to those for the full group, with some discrepancies. The mean values obtained by the US group for all SFL measures are displayed in Appendix 5, Table 26.

With regard to general SFL measures, AWNS were found to produce significantly greater TNC and NMC than AWS at both pre- and post-treatment, as observed for the full group. Also in agreement with full group results, GI scores were higher for AWNS than for AWS at pre-treatment, but not post-treatment, although this difference did not reach significance. There was no difference in scores for AWS between pre- and post-treatment.

As in the full group analyses, no differences were found across comparisons in the areas of verb process analysis. In terms of modality analysis, the results revealed (a) significantly lower %CA for AWNS than AWS at post-treatment; (b) significantly greater %MO for AWNS than AWS at pre-treatment, but not post-treatment, and an increase in %MO for AWS between pre- and post-treatment; and (c) significantly greater TNMR for AWNS than AWS at both pre- and post-treatment, all of which were consistent with the full group results. With regard to appraisal analysis, there were tendencies towards (a) an increase in %AF for AWS between pre- and post-treatment, with lower %AF in AWNS than AWS at post-treatment; and (b) greater %AP in AWNS than AWS at pre-treatment only, which roughly corresponded to the results for the full group. For theme analysis, there was a trend towards greater %STR in AWNS than AWS at pre-treatment only, as observed in the full group analyses. Interestingly, for the US group, trends towards lower %INT in AWNS than AWS at pre-treatment only, and a decrease in %INT for AWS between pre- and post-treatment, were also observed. These patterns were not evident from full group analyses.

4.3.3. Subgroup Analyses: Key Findings

1) The majority of patterns identified across measures were consistent for both the NZ and US groups, although most differences did not reach the same levels of significance observed for the full group of participants.
2) A tendency towards decreased scores on the naming task response consideration self-rating scale for AWS between pre- and post-treatment was seen for the NZ group only.
3) A tendency towards decreased articulation rate for AWS between pre- and post-treatment, with higher articulation rate for AWNS than AWS at post-treatment, was seen for the US group only.
4) For the US group, there was also a pattern of lower %INT in AWNS than AWS at pre-treatment only, with a decrease in %INT for AWS between pre- and post-treatment, which was not identified in the full group analyses.

Chapter 5. Discussion

The purpose of the current study was to explore the conversational language behaviours of AWS, with particular reference to functional language use and communication restriction in social context. To this end, comparisons were made between 20 AWS and 20 matched AWNS, and for AWS between pre- and post-treatment, on the following sets of measures: (a) general measures of receptive vocabulary ability, stuttering severity (AWS only), and articulation rate; (b) self-report questionnaires and rating scales of general and communication-related attitudes, anxiety, and avoidance behaviour; (c) a confrontation naming task designed to objectively examine word choice; (d) conventional measures of language performance; and (e) selected language analyses from the SFL framework (Halliday, 1985). Secondarily, relationships between the different sets of measures were also examined, with a specific focus on correlations between the conventional and SFL language analyses. The aim was to determine the usefulness and relevance of the SFL framework for the evaluation of language behaviour in AWS, for both research and clinical purposes. Discussion pertaining to the hypotheses posed in these areas is presented below, along with a consideration of study limitations, clinical implications, and directions for future research.

5.1. General Results

5.1.1. Language Testing

The *Peabody Picture Vocabulary Test – Third Edition* (PPVT; Dunn & Dunn, 1997), a standardised receptive vocabulary measure, was administered once only to all participants. The PPVT was used as a rough indicator of language ability, to establish participant eligibility for study inclusion by ruling out clinically significant language disorder. All AWS and AWNS participants scored within normal limits on the PPVT, but the AWS participants obtained significantly lower scores. This finding is in agreement with previous research. Prins et al. (1997) reported significantly lower PPVT performance for a group of 12 AWS, compared to 12 AWNS controls, despite their attempts to match participants on PPVT scores. Hennessey et al. (2008) also observed a pattern of lower PPVT scores in AWS than AWNS. The data suggest that AWS may demonstrate poorer vocabulary skills than AWNS, but must be substantiated by further comprehensive evaluation of lexical ability in these individuals. This is particularly important because there is a lack of clarity in the literature around the general receptive and expressive language abilities of AWS. Some studies have reported comparable performance between AWS and AWNS on broad language assessments such as the *Test of Adolescent and Adult Language – Third Edition* (Hammill et al., 1994) (Tsiamtsiouris & Cairns, 2009), while others have observed poorer performance in AWS (Cuadrado & Weber-Fox, 2003; Weber-Fox et al., 2004).

5.1.2. Stuttering Severity

The AWS participants in this study underwent stuttering treatment through an intensive programme. Nine AWS attended the 1-week Naturalness Intensive Programme (NIP) at the University of Canterbury in New Zealand. The remaining 11 AWS participated in the 2-week Intensive Stuttering Clinic (ISC; Blomgren, 2009) at the University of Utah in the United States. Both programmes primarily utilised a prolonged speech or slow speech approach to stuttering intervention, while incorporating a range of stuttering modification, skills transfer, and maintenance planning components. The stuttering severity of the AWS participants as a group was found to decrease between pre- and post-treatment, as measured using percentage of syllables stuttered (%SS), the *Stuttering Severity Instrument – Third Edition* (SSI-3; Riley, 1994), and a severity self-rating scale. It is well documented that prolonged speech interventions can facilitate fluency gains in AWS (Block et al., 2005; O'Brian et al., 2003; Packman et al., 2000), particularly when delivered in an intensive treatment format (Langevin et al., 2010). Such treatments have been identified as being one of the most effective fluency shaping approaches for AWS (Bothe et al., 2006).

5.1.3. Articulation Rate

Between pre- and post-treatment, a decrease in articulation rate to a level below that of AWNS was observed for the US group of AWS participants. A similar but non-significant change was noted for the NZ group. This difference is perhaps unsurprising, as the ISC treatment programme employs a syllable-timed stretched speech approach to fluency shaping, with frequent references to slowed rate throughout treatment. In contrast, the NIP approach is based on Camperdown Program (O'Brian et al., 2009) methods, where AWS are taught to evaluate and modify their speech in terms of a 9-point 'naturalness' scale. No explicit mention is made of specific fluency targets (e.g., gentle onsets, continuous phonation) or speech rate. This may facilitate participants' ability to produce fluent speech, while maintaining certain speech naturalness parameters. In fact, data have shown that the Camperdown Program can result in acceptable post-treatment naturalness and speaking rate, as judged by independent listeners (Onslow et al., 1996; O'Brian et al., 2003). Shenker (2006) emphasised the usefulness of speech rate and naturalness data for AWS in clinical contexts, as a safeguard against unnatural sounding post-treatment speech.

The above findings concerning decreased post-treatment articulation rate are also interesting in light of psycholinguistic theories of stuttering, which propose a link between stuttered disfluency and speaking rate (Howell, 2004; Perkins et al., 1991). Psycholinguistic theories view stuttering as the result of disruption in various speech production processes, which must operate in a timely and synchronous manner for speech output to be fluent. Perkins et al.'s NPL theory asserts that increased time pressure to speak, in the face of linguistic and prosodic system asynchrony, is a necessary condition for stuttering to occur. Likewise, EXPLAN theory (Howell, 2004) states that either disproportionately slow linguistic planning or rapid speech motor execution may be responsible for fluency breakdown. The data for the US group of AWS participants in particular would seem to support these notions. However, there is also substantial counterevidence to this relationship. Several studies have found no correlation between speaking rate and stuttering severity in CWS (Ryan, 2000; Sawyer et al., 2008). Further, there are data to show that fluency improvement resulting from treatments as diverse as altered auditory feedback and prolonged speech need not be accompanied by any significant speech rate reduction (Hudock et al., 2011; Kalinowski et al., 1993; Macleod et al., 1994; Onslow et al., 1996; O'Brian et al., 2003). Based on this evidence, it is possible that the reduced articulation rate observed for the US group represents a by-product of the methods and language employed within the ISC, but not a primary mechanism of participants' fluency gains. Additional research is needed to clarify the relationship between speaking rate and stuttered disfluency, to determine the validity of various psycholinguistic theories of stuttering.

5.2. Hypothesis 1a: AWS will differ significantly from AWNS at pre- and post-treatment, and will change significantly between pre- and post-treatment, on self-rating scale measures examining general and communication-related attitudes and anxiety.

In the current study, a number of self-report rating scales were used to measure participants' general and communication-related attitudes and anxiety. These were the *Beck Depression Inventory* (BDI; Beck et al., 1961), *Locus of Control of Behavior Scale* (LCB; Craig et al., 1984), *Liebowitz Social Anxiety Scale* (LSAS; Liebowitz, 1987), communication confidence and flexibility self-rating scales, *Perceptions of Stuttering Inventory* (PSI; Woolf, 1967), and *Overall Assessment of the Speaker's Experience of Stuttering: Adult* (OASES; Yaruss & Quesal, 2008). The latter two were completed by AWS only. At pre-treatment only, AWS were found to differ from AWNS on the LSAS and self-ratings of confidence and flexibility, but not on the BDI or LCB. Changes between pre- and post-treatment were observed for AWS on the LSAS, self-ratings of confidence and flexibility, PSI, and OASES. Based on these results, Hypothesis 1a was partially accepted.

The lack of observed differences in BDI scores between the AWS and AWNS participants is consistent with previous research (Miller & Watson, 1992). The mean scores reported by Miller and Watson for groups of both AWS and AWNS fall within the range indicative of typical mood (i.e., 10 and below), which was also found in the current study. This suggests that AWS do not systematically differ from AWNS in terms of general mood, as has been noted by other researchers (e.g., Craig et al., 2003).

There were also no differences observed in LCB scores between AWS and AWNS, or for AWS between pre- and post-treatment. Locus of control refers to the degree to which individuals believe they can control their behaviour (Block, Onslow, Packman, & Dacakis, 2006). It has been suggested that successful stuttering therapy should internalise locus of control (Blomgren et al., 2005). That is, it should increase individuals' sense of personal power over their speaking behaviour. Early data from Craig et al. (1984) and Craig and Andrews (1985) supported this idea, showing that AWS whose LCB scores moved in the direction of internality during treatment were more likely to maintain fluency gains in the long term. However, later studies failed to find any significant change in the LCB scores of AWS with treatment (Blomgren et al., 2005; Lee, Manning, & Herder, 2011), or any correlation to %SS immediately post-treatment or at follow-up (Block et al., 2006; De Nil & Kroll, 1995). There seems to be limited evidence of a concrete link between locus of control and fluency gains in treatment. Nonetheless, phenomenological data from Plexico, Manning, and DiLollo (2005) demonstrate that AWS do perceive positive cognitive change and an increased sense of personal responsibility as important factors in the successful management of their own speech. In view of these findings, locus of control should not be disregarded as a valid measure of treatment outcome, and even as a treatment target to effect holistic, quality of life improvement for AWS.

In the present study, the AWS obtained higher LSAS subscale and total scores than the AWNS, at pre-treatment only. The LSAS consists of subscales measuring fear or anxiety and avoidance across a range of social situations. Although it is not commonly cited as a treatment outcome measure in the stuttering literature, it possesses strong psychometric properties and is a sensitive measure of social anxiety (Baker, Heinrichs, Kim, & Hofmann, 2002; Freso et al., 2001). Numerous studies have reported greater anxiety in AWS than typically fluent speakers (e.g., Blumgart et al., 2010; Craig et al., 2003; Davis et al., 2007; Messenger et al., 2004; Mulcahy et al., 2008), particularly in the domain of social anxiety (Blumgart et al., 2010; Messenger et al., 2004). Similarly, the use of situational or word avoidance behaviours by AWS to escape negative experiences associated with stuttering is well documented (e.g., Cream et al., 2003; Plexico et al., 2009; Vanryckeghem et al., 2004). The present findings are consistent with these data.

Following conversational language sampling, participants in the current study were also asked to rate their communication confidence and flexibility on 5-point Likert-type scales, in response to the questions, "How confident did you feel in the previous 10 minutes of conversation?" and, "How much did you feel you could use your words to say exactly what you meant to say?", respectively. These questions were designed to elicit simple expressions of participant attitudes towards their own conversational interactions, in order to supplement the quantitative analyses of functional language behaviour that formed a primary focus of this study. The AWS rated themselves more poorly than the AWNS on both these scales. Although the two rating scales were in a sense arbitrarily defined, the findings correspond to existing evidence of poorer self-perceived communication competence in stuttering individuals (*confidence*) (Blood & Blood, 2004; Blood, Blood, Tellis, & Gabel, 2001), and their use of verbal avoidance strategies despite the potential cost of impaired or restricted communication (*flexibility*) (Cream et al., 2003; Plexico et al., 2009).

The observed improvements in LSAS, PSI, OASES, and confidence and flexibility rating scale scores of the AWS participants following intensive stuttering treatment also correspond to existing evidence. At post-treatment, AWS no longer differed from AWNS on any of these measures. Although both the NIP and ISC were primarily fluency shaping treatments, both also included stuttering modification, cognitive change, and counselling components as key elements of therapy. Such treatments, termed 'comprehensive', have been shown to reduce anxiety, expectancy, and avoidance in AWS (e.g., Blomgren et al., 2005; Langevin et al., 2010; Menzies et al., 2008), whereas pure fluency shaping interventions may not (Bothe et al., 2006). Langevin et al. also reported increased speech-related confidence in AWS following comprehensive stuttering treatment.

Present findings relating to the OASES are noteworthy due to the relatively recent development of this instrument, as a comprehensive stuttering impact measure based on the World Health Organization's *International Classification of Functioning, Disability, and Health* (2001) (Yaruss & Quesal, 2004). The OASES has been shown to be psychometrically sound (Yaruss & Quesal, 2006), and normative data are now available for Dutch (Koedoot, Versteegh, & Yaruss, 2011), Australian (Blumgart, Tran, Yaruss, & Craig, 2012), and New Zealand (Wivell, Purdy, & Hearne, 2009) populations. Wivell et al. reported lower (i.e., more positive) mean scores on the 'Reactions to Stuttering' and 'Quality of Life' sections of the OASES for a NZ group of AWS, compared to the original normative sample. Similar patterns were observed in the current study, but when NZ and US group means were statistically compared, no significant differences were found on any sections of the OASES. Thus, it is unlikely that the results of the study were influenced by geographic differences. Overall, the findings add to existing evidence of positive social-emotional and quality of life outcomes from comprehensive, intensive stuttering treatment for AWS.

5.3. <u>Hypothesis 1b</u>: AWS will differ significantly from AWNS at pre- and post-treatment, and will change significantly between pre- and post-treatment treatment, on the UC Picture ID task.

The UC Picture ID naming task (O'Beirne, 2011) was administered to all AWS and AWNS participants in this study. The task utilised picture stimuli from Snodgrass and Vanderwart's (1980) picture set, and existing norms for the dominant and non-dominant names used by American speakers to label those picture stimuli (Yoon et al., 2004). The aim of the task was to examine name choices made by AWS and AWNS for everyday objects in comparison to this normative data, and thus indirectly to examine verbal avoidance behaviours in AWS. Task performance was represented as percentages of responses scored 'dominant match', 'non-dominant match', or 'no match'. No differences in task performance were observed across comparisons. On the basis of these results, Hypothesis 1b was rejected.

The UC Picture ID naming task was developed as an exploratory verbal avoidance measure based on the concept of avoidance as a cognitive-behavioural aspect of stuttering, and on specific behavioural data from Newman and Bernstein Ratner (2007). Newman and Bernstein Ratner administered a confrontation naming task to groups of AWS and AWNS, and observed that AWS produced a higher rate of incorrect responses when naming simple picture stimuli. The authors suggested that the use of avoidance strategies by the AWS group might be responsible for this difference, citing several examples of unusual, low frequency word responses to relatively common stimuli (e.g., *androgyne* for *boy*, and *patella* for *knee*). In contrast, the errors produced by AWNS were less unexpected (e.g., *child* for *boy*, and *elbow* for *knee*). The UC Picture ID task was therefore designed as a preliminary means of testing this phenomenon, with a view towards developing a simple behavioural tool for the clinical assessment of verbal avoidance behaviours in AWS.

The lack of observed differences in percentages of naming responses scored correct (i.e., both ‘dominant match’ and ‘non-dominant match’) between AWS and AWNS in this study is inconsistent with the findings of Newman and Bernstein Ratner (2007). Other studies examining confrontation naming in AWS have also produced equivocal results. Hennessey et al. (2008) reported a non-significant tendency towards higher picture naming error rates in AWS than AWNS, but neither Maxfield, Huffman, Frisch, and Hinckley (2010) nor Bernstein Ratner, Newman, and Strekas (2009) noted any differences in error rates for AWS and CWS, respectively, as compared to normally fluent peers. Numerous task administration and scoring variations may account for this discrepancy. It is also important to note that most of these studies examined confrontation naming performance within the framework of reaction time, whereas UC Picture ID was not a timed task. The combination of simple stimuli, straightforward response requirements, and lack of time pressure may have created a low demand speaking condition, so that the task was not sensitive to differences in confrontation naming behaviour. Data have shown that differences in the linguistic performance of AWS may be apparent only under increased processing demands, such as complex or dual task conditions (e.g., Bosshardt et al., 2002; Hennessey et al., 2008).

Also interesting is the observation that AWS and AWNS did not differ in the proportions of dominant versus non-dominant word labels produced. One interpretation is that the AWS participants simply did not employ word avoidance strategies within the context of the UC Picture ID task. Self-report data from AWS show that the occurrence of these behaviours varies according to the speaking situation (Crichton-Smith, 2002; Plexico et al., 2009). In utilising such strategies, AWS are driven by a need to protect themselves from the negative emotional consequences of stuttering, such as embarrassment and rejection

(Cream et al., 2003). The UC Picture ID task involved decontextualised single word production, in a clinical setting with therapists sensitive to the needs of AWS, and where stuttering was openly considered. A speaking context such as this may have voided the primary purpose of verbal avoidance behaviour, and thus discouraged its use.

Alternatively, it is possible that the avoidance patterns of individual AWS, being highly idiosyncratic, were not reflected in systematic confrontation naming differences detectable from group analyses. Similar to the observations of Newman and Bernstein Ratner (2007), several instances of unusual word use by AWS were observed in this study (e.g., *mammal* or *four-legged animal* for *sheep*), but these comprised a very small proportion of total responses. Detailed, descriptive analyses of participant responses, which were beyond the scope of this study, may have revealed subtle patterns of word avoidance in some AWS participants. One minor finding relating to the response consideration self-rating scale is also noteworthy on this point. Immediately following completion of the UC Picture ID task, participants were asked to provide a rating on a 5-point Likert-type scale, in response to the question, “How much did you have to think about your response before you said it?” A non-significant decrease in response consideration scores between pre- and post-treatment was observed for the NZ group of AWS participants. Although numerous explanations are possible, this finding may suggest reduced verbal avoidance, and thus more spontaneous speech output, in certain AWS participants at post-treatment.

Overall, further exploration of the UC Picture ID task paradigm may yet lead to the development of a clinically relevant verbal avoidance assessment instrument for AWS. The cognitive-linguistic processing demands of the test should be increased through the introduction of time pressure, or the manipulation of other task complexity factors. In addition, test stimuli should be modified to elicit target responses within the more natural context of connected speech. The resulting task would better simulate the communicative pressure of spontaneous conversation, and therefore be more likely to reveal differences in the linguistic behaviour of AWS arising from word avoidance behaviour.

5.4. <u>Hypothesis 1c</u>: AWS will differ significantly from AWNS at pre- and post-treatment, and will change significantly between pre- and post-treatment, on conventional language measures.

In the present study, conventional language measures were used to obtain general information on the language ability and performance of the AWS and AWNS participants. The measures used were total number of utterances (TNU), total number of words (TNW), number of different word roots (NDWR), type-token ratio (TTR), mean length of utterance in words (MLUw), subordination index (SI), and verb word frequency (VF) values according to SubtlexUS (Brysbaert & New, n.d., 2009) and WordCount (Harris, 2003). The AWS differed from the AWNS at both pre- and post-treatment on the measures of language productivity and diversity (TNU, TNW, NDWR, TTR). For the measures of language complexity (MLUw and SI), differences were observed between AWS and AWNS at pre-treatment, and for AWS between pre- and post-treatment. No differences in VF values were observed across comparisons. Based on these results, Hypothesis 1c was partially accepted.

The AWS participants were found to produce consistently less language than the AWNS controls, as measured by TNU, TNW, and TNWR. This corresponds to Spencer et al. (2009), who reported reduced TNU and TNW in AWS during 5-minute monologues, as compared to fluent controls. In explaining their findings, Spencer et al. stated that, "Stuttering is likely to result in an overall decrease in verbal output as measured by word counts due to the time taken up by the presence of stuttering" (p.483). This explanation is logical, but does not account for the present finding of reduced verbal output in the AWS group even following treatment, when stuttering frequency was considerably diminished. However, this apparent discrepancy is readily resolved: the AWS participants demonstrated a concurrent reduction in articulation rate after treatment, which may have contributed to their continued lower language productivity. Spencer et al. also recognised the influence of speech-related attitudes and stuttering expectancy on verbal output in AWS. Many avoidance strategies used by AWS, such as ‘letting the other person talk’, refraining from asking questions, and deflecting questions using a planned response (Cream et al., 2003), could manifest as reduced verbal output. The results may further be explained from a cognitive-linguistic processing perspective. Bosshardt et al. (2002) and Bosshardt (2006) observed that AWS produced fewer propositions than AWNS on a sentence generation task, under dual task but not single task conditions. The authors suggested that the speech production systems of AWS may be particularly vulnerable to increased processing load. This results in altered speech output as a coping strategy, perhaps to maintain some degree of fluency, in a balancing act reminiscent of the DCM account of stuttering (Starkweather, 1987). The cognitive-linguistic, motor speech, and social-emotional demands of spontaneous speech might be sufficient to produce this effect in AWS. It is likely that the present finding emerged from a combination of these factors.

The AWS in this study had higher TTR scores than the AWNS, at both pre- and post-treatment. TTR is a measure of vocabulary diversity, defined as the ratio of different words (‘types’) to total words (‘tokens’) in a language sample (Templin, 1957). Although the data seem to indicate more varied vocabulary use by AWS, they should be interpreted with caution, especially in view of the poorer PPVT (Dunn & Dunn, 1997) scores of this group. It is known that TTR reflects an influence of language sample size. In adult language users, due to the effect of frequently occurring, closed-class words, lower TTR values are typically observed for larger language samples (Owen & Leonard, 2002).

Given that AWNS produced consistently greater TNU and TNW than AWS, this effect may have been at least partially responsible for the observed TTR differences. However, the use of more diverse vocabulary by AWS in general is still a possibility. As previously mentioned, Newman and Bernstein Ratner (2007) observed several instances of unusual word use by AWS on a picture naming task. Additionally, Davies (2010) observed that CWS and CWNS used comparable numbers of verb types in spontaneous speech, despite a smaller number of total verbs being produced by the CWS group (i.e., the CWS group used a proportionally greater variety of verbs). Although Davies' data are preliminary and cannot be directly generalised to the AWS population, it is possible that one by-product of verbal avoidance in these individuals might be increased lexical diversity.

In the current study, the AWS were also found to produce shorter and less complex utterances than the AWNS at pre-treatment, as measured by MLUw and SI. Trends towards increased utterance length and complexity after treatment were also seen. The first finding agrees with Packman, Hand, Cream, and Onslow (2001) and Spencer et al. (2009). Both studies examined the same monologues obtained from 10 AWS and 10 AWNS, but applied different linguistic analyses to the samples. Studies have shown that AWS may score more poorly than AWNS on standardised language measures (e.g., Cuadrado & Weber-Fox, 2003; Prins et al., 1997; Weber-Fox et al., 2004), indicating that reduced linguistic capacity could be one cause of the observed complexity differences. As discussed with regards to language productivity, influences of speech avoidance and cognitive-linguistic processing factors are also probable. The implication of the second finding is that intensive comprehensive stuttering treatment, as well as improving fluency, may facilitate more complex language use by AWS. Prior research directly examining changes in language complexity after stuttering intervention is lacking, but there is evidence that treatments incorporating cognitive-behavioural components can effectively decrease verbal avoidance (Blomgren et al., 2005; Menzies et al., 2008). By extension, these data imply qualitative changes in the language behaviour of AWS, which may be reflected in increased complexity scores. However, the specific structures or areas of change, and their functional implications, are not identifiable using general measures such as MLUw and SI. For this reason, Spencer et al. (2005, 2009) pioneered the use of the SFL language analyses with AWS, as will be discussed in the following section.

Finally, no differences were seen across comparisons on VF SubtlexUS or VF WordCount scores for the lexical verbs used by the participants in conversation. SubtlexUS, based on a corpus of 50 million words, lists the frequency of occurrence of each lexical item. WordCount assigns number rankings to the 86,800 most commonly occurring words. The values obtained for individual verbs in each language sample were averaged to give overall SubtlexUS and WordCount scores for that sample. The rationale for measuring word frequency in this study came from evidence of differences in lexical ability between AWS and AWNS (e.g., Hennessey et al., 2008; Prins et al., 1997), as well as data illustrating the link between stuttering and word frequency (Dayalu et al., 2002; Hubbard & Prins, 1994; Newman & Bernstein Ratner, 2007). Poorer lexical ability might create an over-reliance on commonly occurring, high frequency words, while stuttering avoidance might result in either a similar or the opposite effect (i.e., the use of unusual, low frequency synonyms, as observed by Newman & Bernstein Ratner, 2007). Indeed, Wagovich and Bernstein Ratner (2007) reported significantly fewer different verbs in the spontaneous play-based conversation of CWS than CWNS, while Davies (2010) found that the verbs produced by CWS had lower word frequency values, compared to those produced by CWNS. The substantial differences between child and adult language notwithstanding, it is possible that VF differences also existed in the current data, but were obscured by the quantity of items averaged, many of which were high frequency ‘all-purpose’ verbs (e.g., *do*). In this regard, detailed word frequency analysis comparing AWS and AWNS within a structured task such as UC Picture ID might be helpful in the future.

5.5. Hypothesis 1d: AWS will differ significantly from AWNS at pre- and post-treatment, and will change significantly between pre- and post-treatment, on SFL analyses.

Further to the conventional language measures, SFL analyses drawn from Halliday’s (1985) systemic description of functional grammar and related works (Eggins, 1994; Ferguson & Thomson, 2008; Martin & White, 2005) were also applied to all AWS and AWNS language samples. The SFL approach allows for the quantification of specific linguistic structures, towards an analysis of how individuals use language to construct and convey meaning within social contexts. Spencer et al. (2005, 2009) first applied SFL analyses to the spontaneous language of AWS. Since these initial reports, no further data have been published in this area. The SFL measures used in the current study were total number of clauses (TNC), numbers of major (NMC) and minor (NmC) clauses, grammatical intricacy (GI), and analyses pertaining to each of the three metafunctions described by Halliday: the experiential (verb process analysis), interpersonal (modality and appraisal analyses), and textual (theme analysis) metafunctions. Specific differences between AWS and AWNS, and for AWS between pre- and post-treatment, were observed in all areas except verb process analysis, and were most widespread in modality and appraisal analyses. The findings are discussed in detail below. On the basis of the results, Hypothesis 1d was partially accepted.

5.5.1. General SFL Analyses

The results of the general SFL measures paralleled the key findings from the conventional analyses. That is, the AWS participants produced less language than the AWNS controls at pre- and post-treatment, as measured using TNC and NMC, and produced less complex language at pre-treatment only, as measured using GI. The data are in line with those of Spencer et al. (2009), who first compared groups of AWS and AWNS on TNC, NMC, and GI. A range of social-emotional and cognitive-linguistic factors may be accountable for the findings. Like the conventional analyses, these general SFL measures do not allow for the description of specific differences in the language behaviour of AWS, or their functional role. The detailed analyses specific to Halliday's (1985) three metafunctions of language, discussed in turn below, hold significant potential towards this end.

5.5.2. Verb Process Analysis

The first of these analyses, relating to the use of language to symbolise experience, examined the types and proportions of verb processes produced by participants. No differences were observed across comparisons. Consistent with Spencer et al. (2005), both AWS and AWNS were found to use the full range of process types, and in similar proportions. Material and relational verbs were by far the most commonly occurring, together accounting for 70 to 80% of total processes. Although it is true that certain process types are associated with specific linguistic functions (e.g., mental processes convey opinions), more generally, verb process type simply reflects the nature of the experiential content expressed. Material verbs communicate action, existential verbs imply states of being or happening, and behavioural verbs describe aspects of physiological functioning. In this study, a wide range of conversation topics was sampled during data collection, and these were free to shift and change according to the speakers' ideas. Therefore, it seems reasonable that no systematic restriction or difference was seen in the process types used by the AWS and AWNS participants. However, there is evidence that subtle aspects of verb process use distinguish some communication disordered populations. Armstrong (2005b) observed that aphasic speakers produced mental verbs that were less diverse, more common (in terms of word frequency), and less likely to refer to their own feelings or attitudes, than normal controls. There was no disparity in the overall percentage of mental verbs used by the two groups. While the findings in this instance point to the language impairment underlying aphasic speech, it is possible that functional language differences in AWS might also subtly alter verb process usage in these speakers, regardless of conversation topic. In the present study, broad analyses of VF values and SFL process types were separately conducted, with neither revealing significant differences between AWS and AWNS, or for AWS with treatment. A more thorough combined analysis, similar to that used by Armstrong, might facilitate the identification of patterns of verb use and linguistic expression unique to AWS.

5.5.3. Modality Analysis

The second set of SFL analyses, concerned with participants' use of language to symbolise interpersonal relationships and attitudes, involved frequency measures of modality resource subtypes. The AWS differed from the AWNS on numbers of clauses (expressed as a percentage of total clauses) containing modal operators and comment adjuncts, but not mood adjuncts or interpersonal metaphors. There were no differences in overall percentage of total modality resources, contrary to Spencer et al. (2005, 2009). Spencer et al. (2005) described two cases of AWS who, in telephone conversations, increased their overall expression of modality after treatment. In a later study, the same authors reported a large effect size for a lower overall percentage of clauses expressing modality in the monologues of 10 AWS, compared to 10 AWNS (2009).

Although the overall patterns seen by Spencer et al. (2005, 2009) were not seen in the current study, a similar pattern was observed specifically for the category of modal operators. That is, the AWS in the current study used fewer modal operators than the AWNS at pre-treatment and subsequently increased their use of this resource following treatment. The same post-treatment effect specific to modal operators was seen for only one of the two cases described by Spencer et al. (2005). It is possible that Spencer et al.'s smaller participant numbers may have masked some of the patterns in modality resource use identified in the present study. Otherwise, the discrepancies could also be due to procedural variation, such as the criteria used to identify structures under each modality resource subcategory. Spencer et al. (2009) examined the proportions of clauses (expressed as a percentage of total clauses containing modality resources) containing each subtype of modality resource. This was not explored in the current study. Further evidence is needed to clarify the nature of modality system differences between AWS and AWNS, and to identify the role of specific modality resource subtypes.

Despite the above discrepancies, the present findings relating to modal operators remain of interest. In the language of SFL, the term 'modal operators' refers to the closed class of modal auxiliary verbs, which function as politeness markers by enabling speakers to express varying degrees of certainty and directness (Eggins, 1994; Togher & Hand, 1998). These verbs are not necessary to the expression of topical content; rather, their use constitutes a linguistic choice that realises some element of the interpersonal speaker-listener dynamic. Use of politeness markers has been shown to distinguish speakers from other communication disordered populations, including those with TBI (Togher & Hand, 1998). As also suggested by Spencer et al. (2005, 2009), the current results may exemplify the reduced openness of some AWS to interpersonal engagement within conversational exchanges. This implies that speech-related anxiety and avoidance can effect concrete, systematic changes in the language behaviour of AWS, which restrict their use of language towards its various ends. However, the observation that the AWS in this study increased their use of modal operators following treatment, to a level comparable to AWNS, is cause for optimism. It suggests that treatment can facilitate increased linguistic flexibility and openness to communication engagement in AWS. It must also be recognised that the patterns seen for modal operators and for the two complexity indices (SI and GI, previously discussed), despite being parallel and possibly interrelated, do appear to reflect distinct phenomena. Neither SI nor GI considers modal auxiliary verbs in indexing linguistic complexity, and thus, neither is capable of reflecting the sociolinguistic elements of complexity represented by this linguistic resource.

The finding that AWS produced more comment adjuncts than their fluent peers at both pre- and post-treatment is also noteworthy. Comment adjuncts express a speaker's assessment of or attitude towards his or her own utterance (Eggins, 1994). Increased use of this resource may be a particular manifestation of verbal avoidance in AWS, either as a simple filler behaviour, or as a means of conveying an attitude succinctly and minimally – literally, in a word. The tendency of comment adjuncts to occur in clause-initial position lends plausibility to this explanation. Comment adjuncts were not a frequently occurring structure but did appear in the conversational samples of all but one participant.

Alternatively, the results may reveal something of a perceived 'status differential' between the AWS and their conversation partner, in this case, the SLP. Togher and Hand (1998) observed a tendency towards increased use of politeness markers, including modal operators and comment adjuncts, in brain-injured individuals when speaking to a person of higher status. However, it seems likely that any such effect would be distributed across the different modality resource subtypes, instead of being apparent solely in one subcategory. Overall, the present findings concerning modality resource usage in AWS are interesting, but their clinical and functional significance remains to be explored. Modal operators in particular may have the potential to serve as a simple yet sensitive index of interpersonal language use in AWS, and perhaps even as a functional measure of treatment change. Future research to investigate this possibility through a more extensive analysis of modality in the language of AWS would be useful.

5.5.4. Appraisal Analysis

The third area of analysis was that of appraisal. Appraisal analysis also relates to the interpersonal metafunction of language, being concerned with the expression of opinion and evaluation (Eggins, 1994; Martin & White, 2005). The AWS were found to use fewer words expressing appraisal (as a percentage of total words) than the AWNS at pre-treatment, particularly in the area of appreciation (i.e., evaluations and reactions concerning the aesthetics and value of 'things'). Similar patterns have been reported for speakers with brain injury (Sherratt, 2007). A pattern of increased expression of appraisal, and in particular, affect (i.e., expressions of feeling and emotion), was also seen in the AWS after treatment. These findings may be interpreted in conjunction with those regarding modal operators. They suggest a reduced openness of AWS to developing interpersonal relationships through the communication of opinions and attitudes, a tendency which nonetheless appears to diminish with treatment.

Appraisal deals with explicitly evaluative or affective language, and the form of its expression is governed largely by the speaker's linguistic creativity. Thus, appraisal analysis may demonstrate increased vulnerability to the influence of conversational topic, and increased subjectivity of judgment as to which words or phrases constitute expressions of particular attitudes. It is possible that the differences seen in expression of appraisal were the result of variation in the experiential content of the conversational samples analysed. However, it would be difficult to control for such variation without also taking away from the naturalness and spontaneity of the communication exchange, and thus from the ecological validity of the findings.

5.5.5. Theme Analysis

The final SFL analysis was concerned with the use of language to create cohesion and context, involving frequency measures of different types of theme. Halliday (1985) defined ‘theme’ as the starting-point of the clause, or the element occurring in clause-initial position. No differences were found across comparisons for numbers of clauses (expressed as a percentage of total clauses) containing interpersonal, textual, multiple, or marked theme, or instances of ‘clause as theme’. The exceptions were a tendency towards lower use of structural theme by AWS than AWNS at pre-treatment, and non-significant differences in frequency of use of interpersonal theme for the US group of AWS. The results somewhat agree with those of Spencer et al. (2009), who similarly observed a lack of difference between AWS and AWNS on some aspects of theme use (i.e., multiple theme). A level of consistency in thematic use across speakers is to be expected. Within the clause, the theme element typically contains information that is ‘given’, or familiar to all conversational parties, rather than that which is ‘new’ (Eggins, 1994). Therefore, it is at least partially determined by the given/new distinction. This distinction is fixed by context, and thus closed to speaker manipulation. However, certain types of theme may also relate to specific linguistic features. For example, structural theme, realised primarily through subordinating conjunctions, is linked to language complexity. The observed pattern of reduced structural theme use by AWS at pre-treatment may therefore correspond to the less complex pre-treatment language also seen in these participants.

It is interesting that differences were not found with regard to either marked theme or ‘clause as theme’, which also reflect linguistic complexity. Both types of theme occurred relatively infrequently in the current data set (in about 3% and 2% of clauses, respectively). The mean rates of marked theme use observed by Spencer et al. (2009) in the monologues of their AWS and AWNS participants were substantially higher (roughly 11% and 6%, respectively), and significantly different from each other. In discussing this result, the authors suggested a text type influence, noting that marked theme might be expected to occur more often in narrative-type discourses. Variation in sampling context might likewise be responsible for the discrepancy in marked theme rates seen by Spencer et al. and in the present study. However, given that theme markedness constitutes an explicit choice to differentially highlight selected linguistic content, it is possible that AWS do in fact manipulate this resource in their efforts to avoid stuttering, thus producing marked themes with greater frequency within certain discourse types. The tendency for stuttering to occur at the beginning of utterances (Brown, 1945), and, accordingly, on elements of theme, adds weight to this notion.

Verbal avoidance is also a plausible explanation for the differences in interpersonal theme usage observed for the US group of AWS in the current study. Compared to the NZ group, this group produced interpersonal theme with greater frequency than their AWNS counterparts at pre-treatment only, reducing their use of this type of theme after treatment. Interpersonal theme comprises optional ‘sentence starter’ elements conveying attitude or opinion (e.g., *really*, *I think*). Thus, the findings may represent the use of this resource by AWS as an arbitrary linguistic filler to postpone or avoid stuttering, a behaviour which diminished following intensive treatment. The idiosyncratic nature of verbal avoidance patterns for individual speakers may explain the appearance of this pattern only for a subgroup of AWS, rather than for the full group of AWS participants in this study.

Finally, no group differences were found for comparisons related to textual theme in the current study. In contrast, Spencer et al. (2005) reported various changes between pre- and post-treatment for two AWS in proportions of textual theme subtypes (expressed as percentages of total textual themes). For example, a considerable increase in use of continuative theme was found for one of the AWS participants. Continuative theme is a subcategory of textual theme consisting of words such as *oh* and *well*, which function to begin a new utterance while indicating continuity with the previous one (Eggins, 1994).

This type of theme encompasses typical filler words and interjections, which, though commonly used by all speakers, may serve the purpose of postponing or preventing stuttering in AWS. Subtypes of textual theme were not explored in the current study. Alternative explanations for Spencer et al.'s observations are also possible, especially since continuative theme use was seen to increase rather than decrease following treatment, as might be anticipated in the case of verbal avoidance. The findings of Spencer et al. suggest that specific idiosyncrasies may exist in the ways some AWS use these linguistic resources in spontaneous speech. Further detailed analyses of theme types and subtypes may facilitate the identification of such subtle patterns of language use, which may not be apparent from purely group-based analyses.

5.6. Hypothesis 2a: Stuttering severity will be significantly correlated to self-rating scales, conventional language measures, and SFL analyses.

In the current study, %SS, the SSI-3 (Riley, 1994), and a severity self-rating scale were employed as complementary measures of stuttering severity. Positive Pearson correlations that approached or reached significance were seen among these measures. There were no correlations between severity and any of the attitudinal self-rating scales administered to the AWS participants. With regard to language performance, the only pattern observed was an inverse relationship between %SS and several measures of language productivity, which was evident only at pre-treatment (see **Section 5.4. Hypothesis 1c**). Based on these results, Hypothesis 2a was partially accepted.

Multiple severity measures were utilised in this study to obtain a fuller, more accurate representation of the core and secondary stuttering features manifested by each AWS participant. Both %SS and the SSI-3 were scored in real-time, using audiovisual recordings. Data have shown that assessment of stuttering frequency and type does not suffer from the use of real-time (as opposed to transcript-based) methods (Yaruss, Max, Newman, & Campbell, 1998), but %SS may be underestimated by up to one fifth when audio-only measures are made (Rousseau, Onslow, Packman, & Jones, 2008). The SSI-3 is a commonly used instrument of stuttering assessment, thought to provide a more complete analysis than %SS alone, because it also considers stutter duration and severity of physical concomitants (Howell, Soukup-Ascencao, Davis, & Rusbridge, 2011). However, doubts have been raised as to whether SSI-3 scaled scores accurately reflect the raw data on which they are based (Lewis, 1995). For this reason, both raw %SS scores and the SSI-3 were used to evaluate participants' stuttering behaviour in this study, and a high degree of association was observed between the two. High intra- and inter-rater reliability has been reported for both measures (Lewis, 1995; O'Brian, Packman, Onslow, & O'Brian, 2004), as was found in the current study. A self-rating scale was also administered to the AWS in this study, in order to obtain a participant perspective on stuttering severity. Such scales can be a valid and reliable method for evaluating stuttering severity, and have been found to correspond to clinician %SS ratings (O'Brian, Packman, & Onslow, 2004).

No significant correlations were observed between stuttering severity and any general or speech-related attitudes or anxiety in the AWS participants, as measured using the BDI (Beck et al., 1961), LCB (Craig et al., 1984), LSAS (Liebowitz, 1987), communication confidence and flexibility self-rating scales, PSI (Woolf, 1967), and OASES (Yaruss & Quesal, 2008). The results are consistent with previous data, which show that state anxiety in AWS and the impact of stuttering on quality of life are not proportional to the severity of stuttering behaviours (Blood et al., 1994; Mulcahy et al., 2008), although physiological and subjective evidence to the contrary do exist (Ezrati-Vinacour & Levin, 2004; Weber & Smith, 1990). Further research on the relationship between behavioural and social-emotional aspects of stuttering is required for clarification.

5.7. <u>Hypothesis 2b</u>: Self-rating scales will be significantly correlated to conventional language measures and SFL analyses, for both AWS and AWNS.

The BDI (Beck et al., 1961), LCB (Craig et al., 1984), LSAS (Liebowitz, 1987), communication confidence and flexibility self-rating scales, PSI (Woolf, 1967), and OASES (Yaruss & Quesal, 2008) were administered to participants in this study. The latter two were completed by the AWS only. Scores were not significantly correlated to any conventional or SFL language analyses, for either AWS or AWNS. On this basis, Hypothesis 2b was rejected.

Generally, there were no significant correlations among scores across the different scales. Positive relationships were observed among the subscales of the LSAS and OASES, indicating the internal consistency of these instruments. Interestingly, a significant correlation was also found between the self-rating scales of communication confidence and flexibility for the AWS participants, but only at post-treatment. The AWS scored more poorly than the AWNS on these scales at pre-treatment, but their self-ratings increased to a level comparable to the AWNS following treatment. The findings suggest that, prior to treatment, the speakers' perceptions of their confidence in conversation and flexibility of expression were relatively independent of each other. After treatment, a positive relationship developed between the two and self-ratings in both areas improved, mirroring the pattern observed for AWNS. This shift in perception may have been prompted by discussion around communication behaviour, language use, and avoidance, occurring within the context of treatment. The results show that comprehensive stuttering intervention can effect attitudinal change in AWS, as previous studies have shown (e.g., Langevin et al., 2010; Menzies et al., 2008). This might be expected also to bring about behavioural change in terms of language use for social communication.

Based on the current data, there does not appear to be a clear relationship between self-perceived social-emotional attitudes and their possible linguistic counterparts (i.e., verbal avoidance behaviour) in AWS. Previous reports have also recognised that these different manifestations of anxiety can occur independently of each other (Menzies et al., 1999; Peters & Hulstijn, 1984). For example, subjective reports of high anxiety levels are often observed in the absence of significant physiological indicators of anxiety (Blood et al., 1994; Dietrich & Roaman, 2001). The lack of straightforward correlations between commonly used anxiety and avoidance questionnaires, and the linguistic-behavioural indicators applied in the current study, also cautions against a singular reliance on self-report data in evaluating the functional communicative impact of stuttering for AWS. Objective assessment tools for indexing quantifiable linguistic behaviours would be of great value in this regard.

5.8. Hypothesis 2c: UC Picture ID scores will be significantly correlated to self-rating scales, conventional language measures, and SFL analyses, for both AWS and AWNS.

No differences were observed on group comparisons for the UC Picture ID naming task (O'Beirne, 2011) in this study. This was interpreted as a lack of task sensitivity to possible differences in the confrontation naming performance of AWS, arising from verbal avoidance behaviour. Consequently, naming task variables were excluded from the correlational analyses.

5.9. Hypothesis 2d: Conventional language measures and SFL analyses will be significantly positively correlated, for both AWS and AWNS.

All conventional and SFL language variables for which significant group differences were observed were included in the correlational analyses. Positive correlations were observed between conventional and SFL measures of language productivity, and between conventional and SFL measures of language complexity, for AWS and AWNS. The majority of the remaining variables across the SFL analyses of verb process, modality, appraisal, and theme were not significantly correlated to any other variables. As an exception, use of comment adjuncts was correlated to both stuttering severity and language productivity. Based on these results, Hypothesis 2d was partially accepted.

The parallels observed between the conventional and SFL measures of speech productivity (TNU, TNW, NDWR, MLUw, and TNC, NMC, TNMR, respectively) and complexity (SI and GI, respectively) are unsurprising, since both methods measure closely related constructs. The SFL analyses simply reflect the framework's greater functional emphasis, and its view of the clause and clause complex as primary units of meaning. It is conceivable that TNU and TNW represent 'purer' measures of speech volubility, whereas TNC and NMC may demonstrate a relatively greater effect of syntactic (i.e., clausal) complexity. However, any such effect did not appear to influence overall patterns in the present data. There are also conceptual and practical differences in the calculation of GI, as opposed to SI. Whereas SI represents a simple index of syntactic subordination (Gillon et al., 2008), GI considers relationships of both coordination and subordination and recognises the semantic-pragmatic, as well as syntactic, expression of these relationships (Halliday & Matthiessen, 2004). GI therefore provides a broader and more functional complexity measure that is, at least in theory, well suited to the study of social communication in AWS. In this study, GI did not yield additional complexity information over and above SI, but a closer comparative analysis of the two measures might show otherwise. The findings suggest that for future clinical or research purposes, the use of a single productivity measure and a single complexity measure, from either approach, would suffice to provide information on a speaker's linguistic performance in these two areas.

Further, the finding that few significant correlations were seen between the basic measures of linguistic productivity and complexity and the remaining SFL variables is encouraging. This indicates that detailed analysis across Halliday's (1985) metafunctions provides specific information on subtle features of language behaviour, distinct to that obtained from conventional analyses or basic SFL measures of language productivity and complexity. The SFL framework for linguistic analysis is therefore a promising alternative to conventional methods, which bears a special utility for examining language behaviour in speaker groups for whom communication in social contexts is of particular interest.

Finally, the observed correlations involving speaker use of comment adjuncts are noteworthy. Use of this linguistic resource was observed to be positively correlated to stuttering severity (%SS) for the AWS participants at pre-treatment only. Use of comment adjuncts was also negatively correlated to language productivity (TNU, TNW, NDWR, TNC, NMC) for both AWS and AWNS participants. The AWS in this study produced more comment adjuncts than the AWNS controls at both pre- and post-treatment, which was interpreted either as a particular manifestation of verbal avoidance, or as the result of a perceived status differential between the conversational partners. Both explanations remain plausible in light of the current correlational data. Individuals who stutter more produce less language, and may exhibit a greater tendency towards certain verbal avoidance behaviours. These AWS may also perceive themselves or their communication abilities to be more inferior, in comparison to the SLP. Although the stuttering severity of the AWS participants decreased significantly following treatment, their production of comment adjuncts did not. This suggests the persistence of associated habits of behaviour or perception even in the face of stuttering reduction, such that the correlation between %SS and use of comment adjuncts was no longer evident. The finding of an inverse correlation between comment adjunct use and language productivity for both AWS and AWNS is curious. It is possible that use of this linguistic resource represents a certain communicative efficiency even in typically fluent speakers, because it enables the expression of attitude in as little as a single word. Further investigation into the production of comment adjuncts, and their communicative function, is required to better understand the dynamics underlying these data.

5.10. Study Limitations

In considering the present findings, it is necessary to recognise certain procedural limitations potentially affecting the data and their interpretation, with regard to social communication and verbal avoidance behaviour in AWS. Firstly, the AWS participants in this study were recruited from two separate treatment programmes, with the result that two different varieties of English were represented within the participant pool. A preliminary analysis revealed few differences between the two groups (see **Section 4.3. Subgroup Analyses**). On the one hand, this fact may be viewed as a methodological strength. Treatment change and linguistic behaviour were highly similar for both the NZ and US groups, suggesting a certain generalisability of the findings across treatment and linguistic backgrounds. However, it is also known that different varieties of English are characterised by unique features of phonology, semantics, syntax, and discourse style (Schneider, 2003). It is therefore possible that aspects of language use particular to AWS speakers of one English variety, which nevertheless distinguish them from AWNS from the same linguistic background, were not observable from the current data set. Future research should involve a larger participant group with a common English language background.

A second methodological weakness concerned the language sampling processes undertaken in the current study. A semi-structured conversational sampling format was chosen, in order to elicit the required linguistic material while maintaining the naturalness and spontaneity essential to an analysis of social communication. However, in all conversational exchanges, an SLP served as communication partner to the AWS or AWNS participant. This ‘therapist-client’ or ‘researcher-subject’ dynamic may have influenced participants’ language use in idiosyncratic or systematic ways. In the future, sampling could occur within the context of ‘participant-significant other’ exchanges around pre-determined conversation topics, as this might more closely reflect real world communicative behaviour. This sampling method would be similar to that employed by Spencer et al. (2005).

Lastly, it must be noted that the SFL analyses applied in this study were by no means an exhaustive representation of the SFL framework. Exploration of AWS communication behaviour using this functional linguistics approach is in its very initial stages. Thus, a primary aim of the study was to obtain preliminary data to objectively describe conversational language use for a reasonably-sized group of AWS and AWNS, with reference to Halliday's (1985) three metafunctions. Towards this end, breadth of analysis was prioritised over depth, and quantifiable measures of language behaviour were favoured to the exclusion of their qualitative counterparts. This approach was suited to the present purpose, but many gaps of enquiry remain to be filled. More thorough investigation is required, which takes into account not only the frequency of use of various linguistic resources, but also the range, subtypes, and other related characteristics of each. Possible directions are indicated by related reports in the literature (e.g., Armstrong, 2005b; Spencer et al., 2005, 2009). Consideration should also be given to the tier of SFL analyses examining discourse-level communication behaviour, which may involve descriptive analyses in areas such as thematic progression (Eggins, 1994). These analyses may lend themselves less readily to quantifiable evidence, but are nonetheless relevant to understanding the interactions between speech-related anxiety, language use, and verbal avoidance behaviour in AWS.

5.11. Clinical Implications

The present findings may be translated into a number of clinical implications, primarily concerning aspects of stuttering assessment additional to basic speech evaluation. Straightforward correlations were not found between stuttering severity and scores on self-report measures of speech-related attitudes and anxiety, as past reports have also shown

(Blood et al., 1994; Mulcahy et al., 2008). These data highlight the need to explicitly address AWS clients' emotional needs and experienced impact of stuttering, as mild stuttering does not necessarily equate to minimal impact, and vice versa. Likewise, self-perceived anxiety levels may not correspond to the extent of their actual behavioural expression, that is, in the form of verbal avoidance within real world communicative contexts.

The current data provide preliminary evidence that concrete characteristics of language use distinguish the conversational exchanges of AWS from those of AWNS, which may reflect systematic patterns of avoidance behaviour. In light of these findings, there is a need to initiate methods, perhaps based on the SFL framework or a confrontation naming paradigm, for the thorough and objective evaluation of these speaking behaviours within clinical practice. As already widely recognised, speech and language evaluation with AWS should take place within a range of natural contexts. It is known that AWS experience communication restriction (Cream et al., 2003; Crichton-Smith, 2002; Plexico et al., 2009). The development of practical and sensitive verbal avoidance indices could 'objectify' experience, enabling SLPs to identify specific areas of functional language limitation relevant to individual clients. These areas could be monitored over the course of treatment, and brought to the client's attention to facilitate improvement if necessary. Overall, the results of the present study underscore the need for SLPs to take a functional communication perspective to stuttering assessment, and to ensure that treatment gains in speech fluency are mirrored by positive changes in speech-related attitudes and behavioural avoidance.

5.12. Future Directions

There are many questions left to be asked and answered with respect to social communication and verbal avoidance behaviour in AWS. The current study and those of Spencer et al. (2005, 2009) provide initial evidence for the value of the SFL framework to this area of exploration, over and above conventional language analyses. This approach allows for the dissection of functional language in context, so that the richness and diversity of linguistic choices realising each language metafunction may be perceived and understood in relation to the 'whole speaker'. A more complete and rigorous application of SFL analyses, both quantitative and descriptive, would assist researchers and clinicians to more fully comprehend how AWS experience communication in daily life. Further attention to the use of modal operators, comment adjuncts, and appraisal resources by AWS would be beneficial, in order to confirm or refute their role in mediating degrees of interpersonal engagement within the conversational exchanges of these speakers. Furthermore, the closed class of modal operators could be tested for viability as an index of communicative openness. This could be by means of an online scoring instrument for use during spontaneous language evaluation, or a sentence generation task using picture stimuli, for which the interpersonal mood or 'tone' of the response may freely be determined by the respondent.

In a similar vein, further exploration of the UC Picture ID confrontation naming task (O'Beirne, 2011) paradigm would also be worthwhile, towards the development of an objective and clinically relevant verbal avoidance assessment tool for use with AWS. Adaptation of the existing test to increase its cognitive-linguistic processing demands might enable the closer replication of communicative pressures characteristic of spontaneous conversation, thus provoking AWS to their habitual verbal avoidance strategies. This might involve the introduction of time pressure to the task, or the embedding of target responses within a sentence production context, while still relying on the picture stimuli and normative naming data of Snodgrass and Vanderwart (1980) and Yoon et al. (2004), respectively. Such a task, along with any suitable linguistic indices, could become a valuable source of behavioural evidence to supplement currently available subjective reports describing the nature, extent, and variability of verbal avoidance in AWS (e.g., Cream et al., 2003; Crichton-Smith, 2002; Plexico et al., 2009).

Manifestations of speech-related anxiety have been described as three-fold, comprising verbal-cognitive (i.e., self-reports of emotion), behavioural (i.e., avoidance), and physiological components (Menzies et al., 1999; Peters & Hulstijn, 1984). As such, another logical direction for extending the current research would be to pair the quest for behavioural data on functional communication in AWS, with continued exploration of speech-related autonomic arousal in these individuals. Research examining physiological indicators of arousal in AWS, such as heart rate, skin conductance, and salivary cortisol response, has generally found little correlation to self-reported anxiety levels (e.g., Dietrich & Roaman, 2001; Peters & Hulstijn, 1984). It would be interesting also to examine physiological arousal in conjunction with behavioural avoidance, in order to determine the degree of corroboration between these two less subjective expressions of anxiety.

From a more immediate clinical standpoint, future study concerning treatment-related change in the communication behaviours of AWS should also take into account participants' communicative status at long-term follow-up. In the current study, improvements in the AWS participants' linguistic complexity, use of politeness markers, and expression of appraisal were seen immediately post-treatment. Long-term data are required to determine whether intensive treatment can produce lasting, functional changes to participants' use of language, and to identify any further changes that may occur during a given follow-up period. This is important both because stuttering is prone to relapse, and because there is a general lack of long-term treatment data in the literature (Craig et al., 1996; Bothe et al., 2006). Finally, given the wide range of available stuttering interventions, future research may also attempt to differentiate the functional communicative outcomes associated with different treatment perspectives and formats, and to isolate essential principles resulting in positive change.

5.13. Summary and Conclusion

In summary, the current study presents objective evidence for systematic patterns of functional language behaviour in AWS, which are indicative of communication restriction. Analyses from the SFL framework revealed fewer politeness-marking modal operators, more frequent comment adjuncts, and reduced expression of appraisal in the spontaneous conversation of AWS, as compared to AWNS. The AWS speakers also demonstrated reduced overall verbal output and linguistic complexity, as evident from both conventional and SFL-based indices. The findings suggest a communication profile characterised by verbal avoidance and a certain reluctance for interpersonal engagement. Promisingly, measurable change in a positive direction was observed for some of these linguistic behaviours following intensive stuttering intervention. The findings demonstrate that the SFL framework for linguistic analysis is a favourable alternative to conventional methods, yielding unique insights into the communication behaviours of AWS. Indeed, the framework bears a special utility for the exploration of language behaviour in speaker groups like AWS, for whom functional communication in social contexts is particularly pertinent.

With regard to the UC Picture ID task (O'Beirne, 2011), no differences were found between AWS and AWNS for confrontation naming performance in the current study. This result does not negate the potential utility of the picture naming paradigm as a tool for the behavioural evaluation of verbal avoidance. Rather, it provides objective insight into the conditions under which these behaviours are prone to occurring, which may yet lead to the development of a sensitive behavioural assessment instrument. As a concluding point, the lack of straightforward correlations between the verbal-cognitive and behavioural-linguistic measures employed in this study merits a final mention. These data highlight the need for researchers and clinicians to take a holistic perspective in evaluating stuttering and its impact on communication behaviour – one which is informed by multiple sources, which seeks objectivity without diminishing the value of personal experience, and which continually recalls the overarching functions of communication.

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APPENDICES

Appendix 1

Participant information sheets and consent form

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UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Communication Behaviour in Adults who Stutter
Information Sheet for Participants who Stutter

I am a doctoral student at the Department of Communication Disorders, University of Canterbury. I am interested in the communication behaviour of adults who stutter and how these change with stuttering treatment.

I would like to invite you to participate in my present study. If you agree to take part, you will be involved in two data collection sessions, as follows: 1) immediately prior to your attendance at an intensive stuttering treatment programme and 2) immediately following treatment. At each session, you will be asked to:

- Complete questionnaires about your general attitudes, perceptions, and anxiety, as well as your attitudes and perceptions relating to your stuttering. This will take 15 to 30 minutes.
- Take part in three speaking tasks: 1) a 10-minute conversation with an unfamiliar individual, 2) oral reading of a short passage, and 3) a computer-based picture naming task. You will also be asked to rate aspects of your performance on each of these tasks. These procedures will be video-recorded, and will take approximately 30 minutes.

Please note that participation in this study is voluntary. If you do participate, you have the right to withdraw from the study at any time without penalty. If you withdraw, I will destroy any collected information relating to you. I will take particular care to ensure the confidentiality of all data gathered for this study. All the data will be securely stored in password protected facilities and locked storage at the University of Canterbury. The data will be destroyed within five years of study completion. The results of this research may be reported internationally, at conferences and in communication disorders journals. I will take care to ensure your anonymity in publications of the findings.

If you have any questions about the study, please contact me (details above). If you have a complaint about the study, you may contact the Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in this study, please complete the attached consent form and return it to me in the envelope provided by day/month. I look forward to working with you and thank you in advance for your contributions.

Amanda Lee

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UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Communication Behaviour in Adults who Stutter
Information Sheet for Control Participants

I am a doctoral student at the Department of Communication Disorders, University of Canterbury. I am interested in the communication behaviour of adults who stutter and how these compare to the communication behaviour of adults who do not stutter.

I would like to invite you to participate in my present study. If you agree to take part, you will be involved in a data collection session where you will be asked to:

- Complete questionnaires about your general attitudes, perceptions, and anxiety. This will take 15 to 30 minutes.
- Take part in three speaking tasks: 1) a 10-minute conversation with an unfamiliar individual, 2) oral reading of a short passage, and 3) a computer-based picture-naming task. You will also be asked to rate aspects of your performance on each of these tasks. These procedures will be video-recorded, and will take approximately 30 minutes.

Please note that participation in this study is voluntary. If you do participate, you have the right to withdraw from the study at any time without penalty. If you withdraw, I will destroy any collected information relating to you. I will take particular care to ensure the confidentiality of all data gathered for this study. All the data will be securely stored in password protected facilities and locked storage at the University of Canterbury. The data will be destroyed within five years of study completion. The results of this research may be reported internationally, at conferences and in communication disorders journals. I will take care to ensure your anonymity in publications of the findings.

If you have any questions about the study, please contact me (details above). If you have a complaint about the study, you may contact the Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in this study, please complete the attached consent form and return it to me in the envelope provided by day/month. I look forward to working with you and thank you in advance for your contributions.

Amanda Lee

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CHRISTCHURCH NEW ZEALAND

Communication Behaviour in Adult who Stutter
Consent Form for Participants

I have been given a full explanation of this project and have been given an opportunity to ask questions.

I understand what will be required of me if I agree to take part in this project.

I understand that I will be video-recorded as part of the procedures of this project.

I understand that my participation is voluntary and that I may withdraw at any stage without penalty.

I understand that any information I provide will be kept confidential to the researcher and that any published or reported results will not identify me.

I understand that all data and video recordings collected for this study will be kept in locked and secure facilities at the University of Canterbury and will be destroyed within five years of study completion.

I understand that if I require further information I can contact the researcher, Amanda Lee. If I have any complaints, I can contact the Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

By signing below, I agree to participate in this research project.

Name: ____________________________
Date: ______________________________
Signature: __________________________
Email address: _____________________

Please return this completed consent form to Amanda Lee in the envelope provided by day/month.

Appendix 2

Example transcripts coded for conventional language measures and SFL analyses

Transcript 1. Partial conventional language measures transcript for conversation between participant AWS US 11 (S) at pre-treatment and the examiner (E), transcribed according to Systematic Analysis of Language Transcripts – New Zealand (SALT-NZ) conventions, with subordination index (SI) codes.

E Mhm ok so do you like Salt_Lake_City?
S Yeah I like it [SI-1].
S It/'s alright [SI-1].
S (Um) but I miss Hawaii because that/'s my home and that/'s <where I> grew up [SI-4].
E <Mhm> mhm.
S I miss all my family and friend/s [SI-1].
E Mhm.
S And it/'s very different from here [SI-1].
E Ok yeah I/'ve heard that Hawaii/'s the Spam capital of the world.
S Yeah.
= subject and examiner laugh.
S We eat a lot of Spam [SI-1].
S I still eat Spam down over here though < > (so[FP] yeah[FP]) [SI-1].
E <Uhhuh> yeah.
S Spam musubi do you know what that is [SI-2]?
S It/'s (like[FP]) rice wrap/ed in (like[FP]) seaweed with (like[FP]) Spam [SI-1].
= subject gestures.
E Kinda like Spam sushi?
S <Yeah> but we call it Spam musubi <(so[FP] yeah [FP])> [SI-1].
E <Yeah> uhhuh <so> do you make it on your own here?
S Yeah < > my mom make/3s it [SI-1].
E <Yeah> uhhuh so are you in school?
S Yes.
E (What uh) what grade are you in?
S I/'m a senior < > (so[FP] yeah[FP]) [SI-1].
E <Ok> so you/'ll have one last year <of high school>.
S <Yeah>.
E And then you/'ll be all done.
S Mhm.
E Ok so what are your plan/s for college?
E Do you know yet?
S (Um) not really.
S But I want to go to college but not anytime soon < > because I want to just (like[FP]) take a break [SI-2].
E <Mhm> uhhuh.

Transcript 2. Partial systemic functional linguistics (SFL) transcript for conversation between participant AWS US 11 (S) at pre-treatment and the examiner (E), segmented and coded for grammatical intricacy (GI) (*[M]* indicates minor clauses).

E Mhm ok so do you like Salt_Lake_City?
S Yeah I like it [GI-8].
    S It/'s alright.
    S (Um) but I miss Hawaii.
    S Because that/'s my home.
    S And that/'s.
    S <Where I> grew up < >.
    S I miss all my family and friend/s < >.
    S And it/'s very different from here.
E <Mhm> <mhm> <mhm>.
E Ok yeah I/'ve heard that Hawaii/'s the Spam capital of the world.
S Yeah [M].
= subject and examiner laugh.
S We eat a lot of Spam [GI-2].
    S I still eat Spam down over here though < > (so[FP] yeah[FP]).
E <Uhhuh> yeah.
S Spam musubi do you know [GI-4].
    S What that is?
    S It/'s (like[FP]).
    S Rice wrap/ed in (like[FP]) seaweed with (like[FP]) Spam.
= subject gestures.
E Kinda like Spam sushi?
S <Yeah> but we call it Spam musubi <(so[FP] yeah [FP])> [GI-1].
E <Yeah> uhhuh <so> do you make it on your own here?
S Yeah < > my mom make/3s it [GI-1].
E <Yeah> uhhuh so are you in school?
S Yes [M].
E (What uh) what grade are you in?
S I/'m a senior < > (so[FP] yeah[FP]) [GI-1].
E <Ok> so you/'ll have one last year <of high school>.
S <Yeah> [M].
E And then you/'ll be all done.
S Mhm [M].
E Ok so what are your plan/s for college?
E Do you know yet?
S (Um) not really [M] [GI-4].
    S But I want.
    S To go to college.
    S But not anytime soon < > [M].
    S Because I want.
    S To just (like[FP]) take a break < >.
E <Mhm> <uhhuh>.

Transcript 3. Partial systemic functional linguistics (SFL) transcript for conversation between participant AWS US 11 (S) at pre-treatment and the examiner (E), coded for types of verb processes (*[M]* indicates material processes; *[Me]* indicates mental processes; *[R]* indicates relational processes; *[V]* indicates verbal processes).

```
E Mhm ok so do you like Salt_Lake_City?
S Yeah I like[ME] it.
      S It/'s[R] alright.
      S (Um) but I miss[ME] Hawaii.
      S Because that/'s[R] my home.
      S And that/'s[R].
      S <Where I> grew[M] up < >.
      S I miss[ME] all my family and friend/s < >.
      S And it/'s[R] very different from here.
E <Mhm> <mhm> <mhm>.
E Ok yeah I/'ve heard that Hawaii/'s the Spam capital of the world.
S Yeah.
= subject and examiner laugh.
S We eat[M] a lot of Spam.
      S I still eat[M] Spam down over here though < > (so[FP] yeah[FP]).
E <Uhhuh> yeah.
S Spam musubi do you know[ME].
      S What that is[R]?
      S It/'s[R] (like[FP]).
      S Rice wrap/ed[M] in (like[FP]) seaweed with (like[FP]) Spam.
= subject gestures.
E Kinda like Spam sushi?
S <Yeah> but we call[V] it Spam musubi <(so[FP] yeah [FP])>.
E <Yeah> uhhuh <so> do you make it on your own here?
S Yeah < > my mom make/3s[M] it.
E <Yeah> uhhuh so are you in school?
S Yes.
E (What uh) what grade are you in?
S I/'m[R] a senior < > (so[FP] yeah[FP]).
E <Ok> so you/'ll have one last year <of high school>.
S <Yeah>.
E And then you/'ll be all done.
S Mhm.
E Ok so what are your plan/s for college?
E Do you know yet?
S (Um) not really.
      S But I want[ME].
      S To go[M] to college.
      S But not anytime soon < >.
      S Because I want[ME].
      S To just (like[FP]) take[M] a break < >.
E <Mhm> <uhhuh>.
```

Transcript 4. Partial systemic functional linguistics (SFL) transcript for conversation between participant AWS US 11 (S) at pre-treatment and the examiner (E), coded for types of modality resources (*[MA]* indicates mood adjuncts).

E Mhm ok so do you like Salt_Lake_City?
S Yeah[MA] I like it [MA].
S It/'s alright.
S (Um) but I miss Hawaii.
S Because that/'s my home.
S And that/'s.
S <Where I> grew up < >.
S I miss all my family and friend/s < >.
S And it/'s very[MA] different from here [MA].
E <Mhm> <mhm> <mhm>.
E Ok yeah I/'ve heard that Hawaii/'s the Spam capital of the world.
S Yeah.
= subject and examiner laugh.
S We eat a lot of Spam.
S I still[MA] eat Spam down over here though < > (so[FP] yeah[FP]) [MA].
E <Uhhuh> yeah.
S Spam musubi do you know.
S What that is?
S It/'s (like[FP]).
S Rice wrap/ed in (like[FP]) seaweed with (like[FP]) Spam.
= subject gestures.
E Kinda like Spam sushi?
S <Yeah[MA]> but we call it Spam musubi <(so[FP] yeah [FP])> [MA].
E <Yeah> uhhuh <so> do you make it on your own here?
S Yeah[MA] < > my mom make/3s it [MA].
E <Yeah> uhhuh so are you in school?
S Yes[MA] [MA].
E (What uh) what grade are you in?
S I/'m a senior < > (so[FP] yeah[FP]).
E <Ok> so you/'ll have one last year <of high school>.
S <Yeah[MA]> [MA].
E And then you/'ll be all done.
S Mhm[MA] [MA].
E Ok so what are your plan/s for college?
E Do you know yet?
S (Um) not[MA] really[MA] [MA].
S But I want.
S To go to college.
S But not[MA] anytime soon[MA] < > [MA].
S Because I want.
S To just[MA] (like[FP]) take a break < > [MA].
E <Mhm> <uhhuh>.

Transcript 5. Partial systemic functional linguistics (SFL) transcript for conversation between participant AWS US 11 (S) at pre-treatment and the examiner (E), coded for types of appraisal resources (*[AM]* indicates words expressing amplification; *[AF]* indicates words expressing affect; *[AP]* indicates words expressing appreciation).

```
E Mhm ok so do you like Salt_Lake_City?
S Yeah I[AF] like[AF] it[AF].
      S It/'s[AP] alright[AP].
      S (Um) but I[AF] miss[AF] Hawaii[AF].
      S Because that/'s[AF] my[AF] home[AF].
      S And that/'s.
      S <Where I> grew up < >.
      S I[AF] miss[AF] all[AM] my[AF] family[AF] and[AF] friend/s[AF] < >.
      S And it/'s[AP] very[AM] different[AP] from[AP] here[AP].
E <Mhm> <mhm> <mhm>.
E Ok yeah I/'ve heard that Hawaii/'s the Spam capital of the world.
S Yeah.
= subject and examiner laugh.
S We eat a[AM] lot[AM] of[AM] Spam.
      S I still[AM] eat Spam down over here though < > (so[FP] yeah[FP]).
E <Uhhuh> yeah.
S Spam musubi do you know.
      S What that is?
      S It/'s (like[FP]).
      S Rice wrap/ed in (like[FP]) seaweed with (like[FP]) Spam.
= subject gestures.
E Kinda like Spam sushi?
S <Yeah> but we call it Spam musubi <(so[FP] yeah [FP])>.
E <Yeah> uhhuh <so> do you make it on your own here?
S Yeah < > my mom make/3s it.
E <Yeah> uhhuh so are you in school?
S Yes.
E (What uh) what grade are you in?
S I/'m a senior < > (so[FP] yeah[FP]).
E <Ok> so you/'ll have one last year <of high school>.
S <Yeah>.
E And then you/'ll be all done.
S Mhm.
E Ok so what are your plan/s for college?
E Do you know yet?
S (Um) not really[AM].
      S But I[AF] want[AF].
      S To[AF] go[AF] to[AF] college[AF].
      S But not anytime[AM] soon < >.
      S Because I[AF] want[AF].
      S To[AF] just[AM] (like[FP]) take[AF] a[AF] break[AF] < >.
E <Mhm> <uhhuh>.
```

Transcript 6. Partial systemic functional linguistics (SFL) transcript for conversation between participant AWS US 11 (S) at pre-treatment and the examiner (E), coded for types of theme* (*[INT]* indicates interpersonal theme; *[TE]* indicates textual theme; *[STR]* indicates structural theme; *[MULT]* indicates multiple theme; *[MAR]* indicates marked theme).

```
E Mhm ok so do you like Salt_Lake_City?
S Yeah I like it [INT] [MULT].
      S It/'s alright.
      S (Um) but I miss Hawaii [TE] [MULT].
      S Because that/'s my home [STR] [MULT].
      S And that/'s [TE] [MULT].
      S <Where I> grew up < > [STR] [MULT].
      S I miss all my family and friend/s < >.
      S And it/'s very different from here [TE] [MULT].
E <Mhm> <mhm> <mhm>.
E Ok yeah I/'ve heard that Hawaii/'s the Spam capital of the world.
S Yeah[TE].
= subject and examiner laugh.
S We eat a lot of Spam.
      S I still eat Spam down over here though < > (so[FP] yeah[FP]).
E <Uhhuh> yeah.
S Spam musubi do you know [MAR] [MULT].
      S What that is [STR] [MULT]?
      S It/'s (like[FP]).
      S Rice wrap/ed in (like[FP]) seaweed with (like[FP]) Spam.
= subject gestures.
E Kinda like Spam sushi?
S <Yeah> but we call it Spam musubi <(so[FP] yeah [FP])> [INT] [TE] [MULT].
E <Yeah> uhhuh <so> do you make it on your own here?
S Yeah < > my mom make/3s it [INT] [MULT].
E <Yeah> uhhuh so are you in school?
S Yes [INT].
E (What uh) what grade are you in?
S I/'m a senior < > (so[FP] yeah[FP]).
E <Ok> so you/'ll have one last year <of high school>.
S <Yeah> [INT].
E And then you/'ll be all done.
S Mhm [INT].
E Ok so what are your plan/s for college?
E Do you know yet?
S (Um) not really [INT].
      S But I want [TE] [MULT].
      S To go to college.
      S But not anytime soon < > [TE].
      S Because I want [STR] [MULT].
      S To just (like[FP]) take a break < >.
E <Mhm> <uhhuh>.
```

* Topical theme, the essential thematic element (Halliday, 1994), was not explicitly coded because it represents an obligatory clausal component; every major clause must contain one (and only one) topical theme. Instances of topical theme are underlined in the above transcript for illustrative purposes.

Appendix 3

Statistical tables for analysis of group differences

Table 1. Original *p*-values and *p**-values from all means comparisons between adults with no stuttering (AWNS) and adults with stuttering (AWS) at pre- and post-treatment, and for AWS between pre- and post-treatment.

Measure	AWS Pre vs. Post		AWNS vs. AWS Pre		AWNS vs. AWS Post	
	p	*p**	*p*	*p**	*p*	*p**
General Results						
PPVT	-	-	.000	.000~	-	-
% SS	.000	.000~	-	-	-	-
SSI-3	.000	.000~	-	-	-	-
Articulation Rate	.014	.215	.656	1.000	.006	.143
Rating Scales						
Severity: 10 mins	.000	.000~	-	-	-	-
Severity: Week	.002	.049~	-	-	-	-
PSI	.008	.156	-	-	-	-
OASES 1	.000	.000~	-	-	-	-
OASES 2	.014	.215	-	-	-	-
OASES 3	.000	.000~	-	-	-	-
OASES 4	.000	.000~	-	-	-	-
OASES Total	.000	.000~	-	-	-	-
BDI	.025	.332	.512	1.000	.341	1.000
LSAS: Fear/Anxiety	.010	.183	.001	.022~	.091	1.000
LSAS: Avoidance	.001	.032~	.007	.090~	.678	1.000
LSAS: Total	.002	.049~	.001	.022~	.355	1.000
LCB	.798	1.000	.289	1.000	.529	1.000
Confidence	.001	.032~	.002	.037~	.904	1.000
Flexibility	.003	.067~	.001	.022~	.327	1.000
Naming Task						
%DM	.903	1.000	.641	1.000	.535	1.000
%NDM	.381	1.000	.964	1.000	.469	1.000
%NM	.274	1.000	.485	1.000	.817	1.000
Difficulty	.339	1.000	.820	1.000	.529	1.000
Response consideration	.078	.844	.820	1.000	.114	1.000
Conventional Language Measures						
TNU	.423	1.000	.006	.082~	.000	.000~
TNW	.618	1.000	.000	.000~	.000	.000~
NDWR	.502	1.000	.000	.000~	.000	.000~
TTR	.707	1.000	.036	.376	.002	.054~
MLUw	.019	.278	.004	.063~	.340	1.000
SI	.192	1.000	.005	.073~	.417	1.000
VF SubtlexUS	.868	1.000	.883	1.000	.820	1.000
VF WordCount	.693	1.000	.165	1.000	.659	1.000
SFL: General Analyses						
TNC	.939	1.000	.000	.000~	.000	.000~
NMC	.671	1.000	.000	.000~	.000	.000~
NmC	.242	1.000	.965	1.000	.239	1.000
GI	.155	1.000	.004	.063~	.030	.642
SFL: Verb Process Analysis						
%PB	.710	1.000	.787	1.000	.422	1.000
%PC	.664	1.000	.246	1.000	.533	1.000
%PE	.247	1.000	.474	1.000	.950	1.000
%PM	.095	.957	.331	1.000	.425	1.000
%PMe	.854	1.000	.803	1.000	.907	1.000
%PR	.028	.356	.445	1.000	.109	1.000
%PV	.417	1.000	.916	1.000	.424	1.000
SFL: Modality Analysis						

%MA	.732	1.000	.362	1.000	.490	1.000
%CA	.592	1.000	.010	.116	.000	.000˜
%MO	.002	.049˜	.001	.022˜	.840	1.000
%IM	.033	.402	.908	1.000	.384	1.000
TNMR	.561	1.000	.000	.000˜	.000	.000˜
	SFL: Appraisal Analysis					
%AM	.456	1.000	.820	1.000	.664	1.000
%AF	.013	.215	.303	1.000	.065	1.000
%AP	.204	1.000	.009	.110	.187	1.000
%J	.347	1.000	.333	1.000	.930	1.000
T%A	.035	.409	.002	.037˜	.825	1.000
	SFL: Theme Analysis					
%INT	.070	.787	.412	1.000	.773	1.000
%TE	.336	1.000	.427	1.000	.956	1.000
%STR	.088	.918	.014	.154	.238	1.000
%MULT	.594	1.000	.203	1.000	.066	1.000
%MAR	.652	1.000	.882	1.000	.584	1.000
%CT	.665	1.000	.295	1.000	.591	1.000

˜Significant result for a false discovery rate threshold of *p**=.1

Table 2. General results for New Zealand (NZ) and American (US) AWNS: *Peabody Picture Vocabulary Test – Third Edition* (PPVT) and articulation rate in syllables per second (sps).

AWNS	PPVT	Articulation Rate (sps)
NZ 1	124	4.70
NZ 2	114	6.37
NZ 3	109	6.27
NZ 4	131	6.28
NZ 5	113	5.41
NZ 6	125	4.79
NZ 7	129	5.55
NZ 8	129	5.16
NZ 9	137	5.62
US 1	117	5.01
US 2	112	5.23
US 3	103	5.44
US 4	134	6.26
US 5	128	5.46
US 6	114	5.23
US 7	122	5.90
US 8	122	5.80
US 9	147	5.70
US 10	119	5.96
US 11	121	6.48
Mean	**122.50**	**5.63**
Standard Deviation	**10.49**	**0.53**

Table 3. General results for AWS at pre- and post-treatment: PPVT standard scores, percentage of syllables stuttered (% SS), *Stuttering Severity Instrument – Third Edition* (SSI-3), and articulation rate in syllables per second (sps).

AWS	**PPVT**	**% SS**		**SSI-3**		**Articulation Rate (sps)**	
		Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
NZ 1	111	4.53	1.43	19	10	5.03	4.61
NZ 2	101	4.42	1.81	22	6	5.07	5.89
NZ 3	103	3.73	2.72	17	10	5.93	6.62
NZ 4	135	19.64	5.23	29	13	5.54*	4.03
NZ 5	94	6.28	5.72	22	15	6.77	4.93
NZ 6	91	1.13	0.70	22	2	5.90	5.64
NZ 7	115	3.55	2.41	14	5	6.84	5.64
NZ 8	106	1.34	1.51	10	13	4.26	4.85
NZ 9	88	6.71	1.32	26	6	4.35	4.11
US 1	106	4.00	2.00	19	10	5.64	5.74
US 2	104	10.00	1.10	36	5	5.62	4.55
US 3	104	2.00	1.00	29	2	5.24	4.40
US 4	88	3.95	3.00	20	16	4.83	4.82
US 5	121	23.00	9.00	32	20	5.54*	5.59
US 6	112	11.60	0.50	30	5	5.01	3.48
US 7	80	15.00	4.00	25	11	5.34	5.43
US 8	111	11.79	5.87	28	19	4.90	4.56
US 9	111	3.00	1.57	27	13	6.46	5.77
US 10	111	13.00	3.00	36	15	6.11	3.18
US 11	95	13.88	3.09	17	12	6.41	5.59
Mean	**104.35**	**7.63**	**2.87**	**24.00**	**10.40**	**5.54**	**4.97**
Standard Deviation	**12.74**	**6.21**	**2.16**	**7.03**	**5.29**	**0.74**	**0.88**

*Mean substituted for missing value

Table 4. Rating scale results for AWNS: *Beck Depression Inventory* (BDI), *Liebowitz Social Anxiety Scale* (LSAS), *Locus of Control of Behaviour Scale* (LCB), and communication confidence and flexibility self-rating scales.

AWNS	BDI	LSAS: Fear/Anxiety	LSAS: Avoidance	LSAS: Total	LCB	Confidence	Flexibility
NZ 1	0.0	17.0	16.0	33.0	21.0	4.5	4.5
NZ 2	1.0	15.0	8.0	23.0	26.0	5.0	5.0
NZ 3	21.0	25.0	26.0	51.0	43.0	5.0	5.0
NZ 4	2.0	10.0	12.0	22.0	44.0	4.0	4.0
NZ 5	1.0	4.0	3.0	7.0	15.0	5.0	5.0
NZ 6	3.0	27.0	18.0	45.0	9.0	4.0	4.0
NZ 7	1.0	16.0	14.0	30.0	28.0	3.0	4.0
NZ 8	0.0	17.0	42.0	59.0	18.0	4.0	5.0
NZ 9	5.0	23.0	22.0	45.0	36.0	5.0	4.0
US 1	4.0	31.0	33.0	64.0	31.0	4.0	4.0
US 2	5.0	16.0	4.0	20.0	31.0	4.0	4.0
US 3	1.0	11.0	12.0	23.0	6.0	4.5	4.5
US 4	3.0	5.0	8.0	13.0	16.0	5.0	5.0
US 5	4.0	14.0	15.0	29.0	12.0	4.0	4.0
US 6	1.0	9.0	5.0	14.0	27.0	4.0	4.0
US 7	0.0	4.0	1.0	5.0	18.0	4.5	5.0
US 8	21.0	26.0	35.0	61.0	37.0	3.0	5.0
US 9	5.0	7.0	7.0	14.0	9.0	5.0	5.0
US 10	9.0	29.0	21.0	50.0	35.0	4.0	5.0
US 11	10.0	35.0	36.0	71.0	20.0	3.0	4.0
Mean	**4.85**	**17.05**	**16.90**	**33.95**	**24.10**	**4.23**	**4.50**
Standard Deviation	**6.18**	**9.43**	**12.10**	**20.32**	**11.43**	**0.68**	**0.49**

Table 5. Rating scale results for AWS: Stuttering severity self-rating scale, *Perceptions of Stuttering Inventory* (PSI), *Overall Assessment of the Speaker's Experience of Stuttering* (OASES); BDI, LSAS, LCB, and communication confidence and flexibility self-rating scales.

AWS	**Severity: 10 mins**		**Severity: Week**		**PSI**		**OASES 1**		**OASES 2**		**OASES 3**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
NZ 1	2	1	4	3	63.33	60.00	3.95	2.95	3.72	3.37	3.63	3.07
NZ 2	2	0	3	1	20.00	5.00	2.41	2.05	1.70	1.30	1.04	1.00
NZ 3	2	1	2	2.5	31.67	50.00	3.53	3.26	3.13	3.37	1.83	1.92
NZ 4	5	2	5	4	58.33	76.67	3.25	3.10	3.33	3.57	3.48	3.48
NZ 5	3	2	3	2	13.33	16.67	2.35	2.25	2.47	2.67	2.88	2.84
NZ 6	2	3	4	2	56.67	16.67	3.88	2.40	2.23	3.17	3.08	2.88
NZ 7	2	1	5	4	58.33	30.00	3.15	2.35	2.70	2.80	3.54	2.72
NZ 8	3	2	3	3	60.00	16.67	3.24	2.95	3.21	3.33	2.48	2.46
NZ 9	3	0	3	1	31.67	3.33	3.28*	2.38*	3.32	2.65*	3.68	2.57*
US 1	4	1.4*	5	2.6*	43.33	20.00	3.45	1.60	3.43	2.50	3.48	3.00
US 2	2	1	2	1	68.33	73.33	3.44	1.75	3.20	2.47	2.64	2.48
US 3	1	0	3	1	65.00	1.67	2.95	1.55	3.93	1.60	3.44	3.08
US 4	1	1	4	2	43.33	28.33	3.10	2.20	1.93	2.10	2.50	2.36
US 5	6	3	4	4	20.00	48.33	3.00	2.70	3.40	2.80	3.29	2.79
US 6	2	1	5	1	53.33	18.33	2.70	2.35	3.33	2.77	3.68	2.36
US 7	4	2	3	3	51.67	26.67	3.90	2.50	2.97	1.90	2.80	2.21
US 8	3	1	4	2	65.00	41.67	3.45	2.60	3.47	2.77	3.54	2.92
US 9	4	2	4	3	35.00	25.00	3.95	2.55	3.40	3.17	3.58	2.96
US 10	5	2	4	5	46.67	26.67	3.65	2.15	3.00	1.73	2.83	1.83
US 11	5	1	3	4	86.67	85.00	3.05	2.00	3.63	2.90	2.84	2.52
Mean	**3.05**	**1.37**	**3.65**	**2.55**	**48.58**	**33.50**	**3.28**	**2.38**	**3.08**	**2.65**	**3.01**	**2.57**
Standard Deviation	**1.43**	**0.87**	**0.93**	**1.22**	**18.79**	**24.67**	**0.47**	**0.47**	**0.59**	**0.64**	**0.69**	**0.55**

*Mean substituted for missing value

Table 5. (cont'd).

AWS	OASES 4		OASES Total		BDI		LSAS: Fear/Anxiety		LSAS: Avoidance		LSAS: Total		LCB	
	Pre	**Pre**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
NZ 1	2.88	2.72	3.53	3.05	10.0	10.5	44.0	47.5	47.0	39.0	91.0	86.5	31.0	33.0
NZ 2	1.04	1.00	1.48	1.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	9.0
NZ 3	1.92	1.75	2.58	2.59	7.5	1.0	13.0	19.0	7.0	7.0	20.0	26.0	33.0	30.0
NZ 4	3.16	3.44	3.31	3.42	0.0	0.5	28.0	40.0	25.0	36.0	53.0	76.0	29.0	35.0
NZ 5	2.16	2.12	2.47	2.47	10.0	4.0	31.0	26.0	29.0	23.0	60.0	49.0	36.0	39.0
NZ 6	3.24	2.64	2.97	2.81	6.0	2.0	37.0	25.0	39.0	16.0	76.0	41.0	37.0	37.0
NZ 7	4.32	2.72	3.40	2.67	15.0	3.0	33.0	28.0	32.0	22.0	65.0	50.0	35.0	27.0
NZ 8	1.84	1.92	2.66	2.69	5.0	13.0	32.0	32.0	41.0	39.0	73.0	71.0	32.0	26.53*
NZ 9	2.91	2.22*	2.97*	2.47*	0.0	3.0	21.0	0.0	36.0	0.0	57.0	0.0	19.0	53.0
US 1	3.76	2.5	3.53	2.36	8.0	0.0	34.0	23.0	34.0	10.0	68.0	33.0	37.0	29.0
US 2	2.72	1.56	2.98	2.10	1.0	0.0	17.0	20.0	16.0	18.0	33.0	38.0	10.0	5.0
US 3	3.60	1.92	3.53	2.06	3.0	2.0	36.0	10.0	28.0	8.0	64.0	18.0	21.0	14.0
US 4	2.60	2.08	2.47	2.17	1.0	0.0	54.0	25.0	54.0	25.0	108.0	50.0	14.0	31.0
US 5	3.60	3.20	3.34	2.88	0.0	0.0	31.0	36.0	26.0	29.0	57.0	65.0	20.0	30.0
US 6	3.20	2.60	3.26	2.57	8.0	5.0	55.0	38.0	45.0	11.0	100.0	49.0	28.0	22.0
US 7	2.72	1.88	2.24	2.09	9.0	6.0	20.0	11.0	12.0	9.0	32.0	20.0	32.0	34.0
US 8	3.00	2.20	3.36	2.63	6.0	4.0	43.0	25.0	42.0	24.0	85.0	49.0	29.0	22.0
US 9	2.64	2.44	3.36	2.81	5.0	0.0	36.0	32.0	18.0	12.0	54.0	44.0	28.0	19.0
US 10	1.58	1.05	2.80	1.70	0.0	0.0	23.0	9.0	23.0	12.0	46.0	21.0	27.16	7.0
US 11	2.84	2.40	3.12	2.50	17.0	10.0	23.0	22.0	32.0	18.0	55.0	40.0	31.0	28.0
Mean	**2.79**	**2.22**	**2.97**	**2.47**	**5.58**	**3.20**	**30.55**	**23.43**	**29.30**	**17.90**	**59.85**	**41.33**	**27.20**	**26.53**
Standard Deviation	**0.79**	**0.62**	**0.53**	**0.48**	**5.08**	**3.94**	**13.28**	**12.73**	**13.91**	**11.68**	**26.21**	**23.13**	**8.11**	**11.69**

*Mean substituted for missing value

Table 5. (cont'd).

AWS	Confidence		Flexibility	
	Pre	**Post**	**Pre**	**Post**
NZ 1	3.5	4.0	4.0	4.0
NZ 2	4.5	5.0	4.0	5.0
NZ 3	5.0	5.0	3.0	4.0
NZ 4	3.0	5.0	5.0	5.0
NZ 5	3.0	4.0	3.0	3.0
NZ 6	3.0	3.0	2.5	4.0
NZ 7	2.5	3.5	3.5	4.0
NZ 8	4.0	4.0	4.0	4.0
NZ 9	2.0	5.0	3.5	5.0
US 1	3.0	4.0	3.0	4.0
US 2	4.5	5.0	4.0	5.0
US 3	2.5	5.0	3.5	5.0
US 4	4.0	4.0	3.0	4.0
US 5	3.0	3.0	3.0	3.0
US 6	3.0	4.0	4.5	5.0
US 7	2.5	4.0	4.0	4.5
US 8	3.0	4.0	4.0	4.0
US 9	4.0	4.0	4.0	4.0
US 10	4.0	5.0	5.0	5.0
US 11	4.0	4.0	4.0	4.0
Mean	**3.40**	**4.23**	**3.73**	**4.28**
Standard Deviation	**0.80**	**0.66**	**0.68**	**0.64**

*Mean substituted for missing value

Table 6. Naming task results for AWNS: percentages of responses scored 'dominant match' (%DM), 'non-dominant match' (%NDM), and 'no match' (%NM), and task difficulty and response consideration self-rating scales.

AWNS	%DM	%NDM	%NM	Difficulty	Response consideration
NZ 1	79.69	15.63	4.69	2.0	3.0
NZ 2	68.75	23.44	7.81	2.0	1.0
NZ 3	65.63	23.44	10.94	1.0	2.0
NZ 4	67.19	25.00	7.81	1.0	1.0
NZ 5	70.31	23.44	6.25	2.0	3.0
NZ 6	75.00	15.63	9.38	1.0	2.0
NZ 7	73.44	18.75	7.81	2.0	3.0
NZ 8	70.31	23.44	6.25	1.0	2.0
NZ 9	76.56	21.88	1.56	2.0	2.0
US 1	79.69	15.63	4.69	2.0	2.0
US 2	79.69	15.63	4.69	2.0	2.0
US 3	76.56	15.63	7.81	2.0	3.0
US 4	79.69	14.06	6.25	1.0	1.0
US 5	71.88	21.88	6.25	1.0	1.0
US 6	71.88	18.75	9.38	1.0	3.0
US 7	79.69	12.50	7.81	2.5	2.0
US 8	76.56	17.19	6.25	2.0	3.0
US 9	84.38	14.06	1.56	2.0	2.0
US 10	76.56	18.75	4.69	1.0	2.0
US 11	67.19	28.13	4.69	1.0	2.0
Mean	**74.53**	**19.14**	**6.33**	**1.58**	**2.10**
Standard Deviation	**5.22**	**4.38**	**2.40**	**0.54**	**0.72**

Table 7. Naming task results for AWS: percentages of responses scored ‘dominant match’ (%DM), ‘non-dominant match’ (%NDM), and ‘no match’ (%NM), and task difficulty and response consideration self-rating scales.

AWS	%DM		%NDM		%NM		Difficulty		Response consideration	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
NZ 1	70.31	73.44	26.56	23.44	3.13	3.13	2.0	3.0	2.0	1.0
NZ 2	68.75	73.44	25.00	25.00	6.25	1.56	1.0	1.0	2.5	1.0
NZ 3	62.50	57.81	21.88	26.56	15.63	15.63	1.0	1.0	1.0	1.0
NZ 4	73.44	76.56	20.31	17.19	6.25	6.25	4.0	1.0	2.0	2.0
NZ 5	71.88	76.56	18.75	20.31	9.38	3.13	2.0	2.0	2.0	2.0
NZ 6	67.19	67.19	25.00	25.00	7.81	7.81	1.5	2.0	3.0	1.0
NZ 7	68.75	70.31	20.31	21.88	10.92	7.81	1.0	1.0	5.0	2.0
NZ 8	64.06	62.50	15.63	17.19	20.31	20.31	1.0	2.0	5.0	4.0
NZ 9	71.88	68.75	18.75	21.88	9.38	9.38	3.0	1.0	3.0	1.0
US 1	73.44	65.63	25.00	28.13	1.56	6.25	2.0	1.0	1.0	2.0
US 2	92.19	85.94	6.25	14.06	1.56	0.00	2.0	1.0	2.0	1.0
US 3	87.50	84.38	9.38	14.06	3.13	1.56	1.0	1.0	1.0	1.0
US 4	71.88	73.44	20.31	21.88	7.81	4.69	1.0	2.0	1.0	2.0
US 5	73.44	81.25	20.31	14.06	6.25	4.69	5.0	1.0	3.0	2.0
US 6	93.75	82.81	4.69	15.63	1.56	1.56	1.0	1.5	2.0	2.0
US 7	51.56	60.94	23.44	21.88	25.00	17.19	1.0	1.0	2.0	1.5
US 8	78.13	79.69	21.88	18.75	0.00	1.56	1.0	2.0	3.0	2.0
US 9	79.69	76.56	17.19	17.19	3.13	6.25	2.0	1.0	1.0	2.0
US 10	70.31	78.13	25.00	15.63	4.69	6.25	3.0	1.0	2.5	1.0
US 11	76.56	68.75	18.75	23.44	4.69	7.81	1.5	2.0	2.0	4.0
Mean	**73.36**	**73.20**	**19.22**	**20.16**	**7.42**	**6.64**	**1.85**	**1.48**	**2.30**	**1.78**
Standard Deviation	**9.81**	**7.90**	**6.14**	**4.38**	**6.46**	**5.48**	**1.13**	**0.60**	**1.16**	**0.90**

Table 8. Conventional language results for AWNS: total numbers of utterances (TNU), words (TNW), and different word roots (NDWR), type-token ratio (TTR), mean length of utterance in words (MLUw), subordination index (SI), and verb frequency values according to SubtlexUS (VF SubtlexUS) and WordCount (VF WordCount).

AWNS	TNU	TNW	NDWR	TTR	MLUw	SI	VF SubtlexUS	VF WordCount
NZ 1	136	1551	392	0.28	10.30	1.44	1576.35	1971.63
NZ 2	162	1257	335	0.28	7.35	1.36	1583.22	1519.86
NZ 3	154	1470	394	0.31	8.13	1.27	1790.50	947.71
NZ 4	178	1661	358	0.24	8.30	1.39	2368.76	777.74
NZ 5	133	1517	422	0.32	9.77	1.62	1384.79	1474.17
NZ 6	175	1275	349	0.31	6.47	1.25	1493.29	678.31
NZ 7	163	1360	314	0.28	6.91	1.37	1786.19	1448.21
NZ 8	139	1239	344	0.31	8.07	1.50	1867.02	1966.17
NZ 9	185	1706	346	0.23	8.05	1.46	1898.19	559.82
US 1	212	1498	361	0.28	6.14	1.32	1875.40	707.49
US 2	165	2040	474	0.25	11.68	1.48	2333.65	988.46
US 3	180	1383	381	0.30	7.03	1.37	2353.10	913.00
US 4	180	1637	411	0.28	8.05	1.25	2115.99	1226.94
US 5	160	1150	357	0.33	6.84	1.39	2098.13	749.83
US 6	167	1442	370	0.28	7.79	1.44	1642.43	1506.41
US 7	109	1058	302	0.32	8.60	1.45	1919.05	566.79
US 8	175	1613	441	0.31	8.32	1.41	1520.60	1920.08
US 9	169	1303	385	0.33	6.96	1.28	1601.20	1781.39
US 10	191	1283	345	0.30	6.12	1.24	2112.32	1212.33
US 11	149	1093	287	0.31	6.26	1.20	1744.05	1355.77
Mean	**164.10**	**1426.80**	**368.40**	**0.29**	**7.86**	**1.37**	**1853.21**	**1213.61**
Standard Deviation	**23.17**	**237.53**	**45.99**	**0.03**	**1.44**	**0.11**	**297.99**	**475.21**

Table 9. Conventional language results for AWS: TNU, TNW, NDWR, TTR, MLUw, SI, VF SubtlexUS, and VF WordCount.

AWS	TNU		TNW		NDWR		TTR		MLUw		SI	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
NZ 1	195	110	1541	777	358	226	0.26	0.33	7.02	6.21	1.36	1.20
NZ 2	147	109	1426	1383	360	366	0.29	0.30	8.62	11.35	1.38	1.39
NZ 3	115	119	798	714	238	239	0.33	0.35	6.37	5.69	1.27	1.14
NZ 4	51	77	618	1065	166	310	0.37	0.36	8.75	11.34	1.50	1.85
NZ 5	150	109	1130	694	302	238	0.31	0.37	6.49	5.83	1.38	1.22
NZ 6	114	121	884	1108	259	289	0.32	0.30	7.04	8.09	1.32	1.33
NZ 7	189	201	1488	1629	333	339	0.27	0.24	6.61	7.08	1.28	1.41
NZ 8	144	164	885	1083	263	301	0.33	0.30	5.47	6.13	1.21	1.39
NZ 9	129	110	961	661	242	237	0.31	0.38	5.98	5.61	1.29	1.18
US 1	149	140	790	719	227	218	0.34	0.34	4.44	4.63	1.18	1.18
US 2	132	80	1051	992	275	270	0.31	0.32	6.75	10.60	1.29	1.86
US 3	22	125	122	607	70	203	0.64	0.36	4.95	4.49	1.07	1.15
US 4	151	120	910	765	276	237	0.32	0.33	5.64	6.03	1.19	1.26
US 5	46	106	298	775	114	225	0.45	0.32	5.48	6.59	1.23	1.38
US 6	83	57	833	653	250	239	0.38	0.42	7.98	10.05	1.28	1.21
US 7	73	137	415	1075	166	286	0.44	0.29	5.19	7.32	1.22	1.39
US 8	124	117	1231	987	292	280	0.28	0.31	8.45	7.73	1.39	1.45
US 9	174	119	1494	1027	323	293	0.24	0.30	7.76	8.12	1.35	1.31
US 10	121	74	795	521	240	209	0.35	0.42	5.74	6.80	1.18	1.15
US 11	196	138	1392	985	306	268	0.25	0.30	6.37	6.57	1.20	1.19
Mean	**125.25**	**116.65**	**953.10**	**911.00**	**253.00**	**263.65**	**0.34**	**0.33**	**6.56**	**7.31**	**1.28**	**1.33**
Standard Deviation	**49.34**	**32.03**	**402.74**	**275.56**	**76.37**	**44.12**	**0.09**	**0.04**	**1.25**	**2.06**	**0.10**	**0.21**

Table 9. (cont'd).

AWS	VF SubtlexUS		VF WordCount	
	Pre	**Post**	**Pre**	**Post**
NZ 1	2473.22	1773.08	663.70	669.89
NZ 2	2290.10	2216.07	676.25	2670.12
NZ 3	1557.98	2177.93	3620.03	1911.16
NZ 4	1769.76	1853.93	1631.21	1525.05
NZ 5	2184.98	1497.71	550.14	706.98
NZ 6	1578.59	1880.48	1430.21	1634.19
NZ 7	1356.23	1666.77	1178.28	2126.53
NZ 8	1715.12	2075.82	419.20	918.84
NZ 9	2119.04	1629.38	746.45	703.28
US 1	1851.15	2102.70	902.18	1051.39
US 2	1712.91	1598.30	726.91	1305.42
US 3	861.96	2901.57	740.86	603.13
US 4	1954.73	1831.93	605.38	1372.89
US 5	1899.23	1625.49	1303.43	792.55
US 6	1723.68	1122.77	946.86	1343.85
US 7	1708.64	1631.86	923.90	824.05
US 8	1386.66	1686.91	1504.71	679.53
US 9	2240.34	1808.36	567.04	919.33
US 10	2822.04	2487.21	1076.17	846.91
US 11	2148.35	2242.00	1811.60	803.53
Mean	**1867.74**	**1890.51**	**1101.23**	**1170.43**
Standard Deviation	**437.28**	**392.10**	**711.23**	**563.40**

Table 10a. General systemic functional linguistics (SFL) results for AWNS: total numbers of clauses (TNC), major clauses (NMC), and minor clauses (NmC), and grammatical intricacy (GI).

AWNS	TNC	NMC	NmC	GI
NZ 1	225	209	16	4.64
NZ 2	242	190	52	3.22
NZ 3	238	216	22	4.41
NZ 4	285	258	27	5.16
NZ 5	239	222	17	4.83
NZ 6	231	189	42	3.05
NZ 7	227	191	36	3.08
NZ 8	225	193	32	4.20
NZ 9	298	281	17	5.51
US 1	302	265	37	3.96
US 2	295	283	12	6.15
US 3	275	235	40	3.67
US 4	263	241	22	5.13
US 5	231	185	46	3.49
US 6	253	227	26	5.16
US 7	185	158	27	5.10
US 8	284	240	44	4.44
US 9	241	218	23	4.56
US 10	235	181	54	3.69
US 11	197	159	38	3.18
Mean	**248.55**	**217.05**	**31.50**	**4.33**
Standard Deviation	**32.72**	**36.98**	**12.42**	**0.89**

Table 10b. General SFL results for AWS: TNC, NMC, NmC, and GI.

AWS	TNC		NMC		NmC		GI	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
NZ 1	24	20	251	124	3.75	3.18	275	144
NZ 2	38	12	177	190	2.57	3.88	215	202
NZ 3	30	42	113	94	2.46	1.74	143	136
NZ 4	2	10	73	150	5.21	5.36	75	160
NZ 5	50	39	134	89	2.23	2.41	184	128
NZ 6	25	17	136	184	3.49	4.18	161	201
NZ 7	23	37	225	261	4.69	4.14	248	298
NZ 8	50	53	126	177	2.52	2.72	176	230
NZ 9	33	20	137	110	3.29	2.62	170	130
US 1	73	25	105	102	2.28	2.27	178	127
US 2	37	26	140	149	4.24	4.81	177	175
US 3	5	48	21	108	2.33	2.57	26	156
US 4	48	42	139	127	2.44	3.10	187	169
US 5	21	20	46	169	3.29	4.45	67	189
US 6	23	25	101	79	4.04	4.94	124	104
US 7	31	23	66	184	2.20	4.38	97	207
US 8	23	30	174	147	4.35	3.87	197	177
US 9	26	11	239	176	5.83	4.40	265	187
US 10	39	14	107	84	2.18	2.80	146	98
US 11	33	21	235	165	3.51	4.85	268	186
Mean	**31.70**	**26.75**	**137.25**	**143.45**	**3.35**	**3.63**	**168.95**	**170.20**
Standard Deviation	**15.96**	**12.70**	**64.29**	**46.17**	**1.10**	**1.06**	**68.17**	**46.57**

Table 11a. Verb process analysis results for AWNS: percentages of clauses containing behavioural processes (%PB), causative processes (%PC), existential processes (%PE), material processes (%PM), mental processes (%PMe), relational processes (%PR), and verbal processes (%PV).

AWNS	%PB	%PC	%PE	%PM	%PMe	%PR	%PV
NZ 1	2.39	0.48	0.96	38.76	10.53	45.45	0.96
NZ 2	4.21	0.53	5.26	31.05	17.89	38.95	0.53
NZ 3	1.39	0.00	2.78	52.78	8.33	32.87	1.39
NZ 4	0.39	0.78	3.88	37.60	15.89	39.15	1.55
NZ 5	4.05	0.90	4.05	36.94	12.16	37.84	2.70
NZ 6	0.00	0.00	2.12	38.10	9.52	47.62	0.53
NZ 7	2.09	2.62	3.66	32.46	24.61	30.89	0.52
NZ 8	3.11	1.04	2.07	31.09	13.99	44.04	2.07
NZ 9	3.56	0.00	5.34	30.96	12.81	43.42	3.20
US 1	3.40	0.38	0.38	30.57	27.17	36.98	0.00
US 2	1.77	0.35	3.53	39.93	9.54	41.70	2.12
US 3	2.13	0.85	2.13	34.47	20.85	37.02	0.43
US 4	1.24	0.41	2.49	43.15	9.54	41.08	1.24
US 5	0.54	0.00	0.00	35.14	17.84	42.16	3.78
US 6	1.76	0.88	8.81	29.96	14.98	40.09	3.08
US 7	5.06	0.00	1.27	41.77	10.76	37.34	0.00
US 8	2.92	0.42	3.33	41.67	11.67	37.92	0.83
US 9	1.38	0.46	1.83	40.37	15.14	36.70	2.75
US 10	1.10	0.00	0.55	46.41	14.36	33.70	1.10
US 11	1.26	0.00	1.89	25.79	16.35	49.69	1.89
Mean	**2.19**	**0.50**	**2.82**	**36.95**	**14.70**	**39.73**	**1.53**
Standard Deviation	**1.38**	**0.61**	**2.06**	**6.48**	**5.07**	**4.80**	**1.12**

Table 11b. Verb process analysis results for AWS: %PB, %PC, %PE, %PM, %PMe, %PR, and %PV.

AWS	%PB		%PC		%PE		%PM		%PMe		%PR		%PV	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
NZ 1	0.80	0.00	1.20	0.00	6.37	4.84	30.28	29.84	17.13	16.94	43.03	41.94	1.20	1.61
NZ 2	2.82	1.58	0.00	0.00	3.39	5.26	39.55	60.53	6.21	5.79	49.72	26.32	0.56	0.53
NZ 3	0.00	1.06	0.00	0.00	4.42	6.38	38.94	26.60	14.16	10.64	39.82	46.81	0.00	0.00
NZ 4	0.00	2.00	0.00	0.67	12.33	5.33	32.88	28.00	12.33	15.33	43.84	45.33	0.00	2.00
NZ 5	0.75	1.12	0.00	0.00	2.99	1.12	43.28	42.70	14.18	5.62	38.81	49.44	0.00	0.00
NZ 6	0.74	4.89	1.47	0.00	3.68	3.26	45.59	44.57	13.97	14.67	30.15	29.89	2.21	2.17
NZ 7	0.44	0.77	0.00	0.77	3.11	2.68	28.89	38.31	10.67	14.56	56.44	37.55	0.00	2.30
NZ 8	5.56	4.52	0.00	0.00	3.17	3.39	30.95	35.03	15.87	20.34	39.68	31.07	3.17	2.26
NZ 9	1.46	1.82	0.00	0.00	1.46	0.00	32.12	40.91	15.33	15.45	43.80	39.09	4.38	0.91
US 1	0.95	0.98	0.00	0.00	0.95	0.98	22.86	29.41	18.10	11.76	52.38	46.08	2.86	7.84
US 2	0.00	5.37	1.43	2.01	5.71	2.01	26.43	30.87	9.29	14.77	55.00	42.28	2.14	2.01
US 3	9.52	2.78	0.00	0.00	0.00	0.93	52.38	39.81	0.00	16.67	38.10	37.04	0.00	0.93
US 4	1.44	4.72	0.72	1.57	1.44	0.00	32.37	47.24	15.11	7.87	43.17	34.65	2.88	2.36
US 5	2.17	1.18	0.00	2.37	0.00	1.18	30.43	28.99	41.30	26.04	21.74	34.32	0.00	0.59
US 6	2.97	6.33	0.99	0.00	2.97	1.27	38.61	70.89	17.82	5.06	36.63	12.66	0.00	2.53
US 7	4.55	1.63	0.00	0.00	0.00	1.63	43.94	40.22	18.18	26.63	27.27	25.00	6.06	3.80
US 8	4.02	3.40	0.00	0.00	1.72	3.40	30.46	28.57	17.24	19.05	42.53	39.46	2.30	3.40
US 9	2.09	2.27	0.00	0.00	5.44	3.41	31.80	46.59	17.15	13.64	42.68	33.52	0.84	0.00
US 10	5.61	2.38	0.00	0.00	4.67	2.38	24.30	45.24	14.02	17.86	47.66	30.95	0.93	1.19
US 11	1.28	3.03	0.00	0.00	3.83	6.06	38.72	32.12	16.17	19.39	36.60	37.58	2.13	1.82
Mean	**2.36**	**2.59**	**0.29**	**0.37**	**3.38**	**2.78**	**34.74**	**39.32**	**15.21**	**14.90**	**41.45**	**36.05**	**1.58**	**1.91**
Standard Deviation	**2.44**	**1.75**	**0.54**	**0.74**	**2.83**	**1.97**	**7.63**	**11.43**	**7.61**	**6.03**	**8.71**	**8.72**	**1.70**	**1.76**

Table 12a. Modality analysis results for AWNS: percentages of clauses containing mood adjuncts (%MA), comment adjuncts (%CA), modal operators (%MO), and interpersonal metaphor (%IM), and total number of modality resources (TNMR).

AWNS	%MA	%CA	%MO	%IM	TNMR
NZ 1	27.11	0.89	11.11	2.67	108
NZ 2	37.19	0.83	7.44	8.26	161
NZ 3	16.81	0.84	7.56	0.42	68
NZ 4	29.82	0.80	7.02	4.91	163
NZ 5	23.85	0.84	9.62	2.93	109
NZ 6	24.24	0.87	5.63	3.03	97
NZ 7	44.93	0.88	11.01	9.69	190
NZ 8	32.89	0.89	8.89	4.44	130
NZ 9	35.57	0.67	6.38	4.70	167
US 1	18.21	0.66	7.95	12.25	129
US 2	32.54	0.68	12.88	1.36	161
US 3	26.18	0.73	4.36	5.45	104
US 4	29.66	0.76	12.55	3.04	139
US 5	17.32	0.87	8.23	4.76	81
US 6	23.72	0.79	7.11	3.95	107
US 7	25.95	1.08	14.59	3.24	105
US 8	27.82	0.70	5.63	1.76	124
US 9	28.63	0.83	7.05	7.47	129
US 10	26.38	0.85	16.60	2.55	125
US 11	31.98	1.02	8.63	14.72	130
Mean	**28.04**	**0.82**	**9.01**	**5.08**	**126.35**
Standard Deviation	**6.85**	**0.11**	**3.20**	**3.69**	**30.73**

Table 12b. Modality analysis results for AWS: %MA, %CA, %MO, %IM, and TNMR.

AWS	%MA		%CA		%MO		%IM		TNMR	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
NZ 1	29.82	29.17	0.73	1.39	8.73	4.86	4.00	5.56	137	66
NZ 2	29.30	20.30	0.93	2.97	6.98	12.38	0.93	0.00	106	82
NZ 3	29.37	37.50	1.40	1.47	4.20	7.35	3.50	2.21	60	78
NZ 4	38.67	41.88	2.67	1.25	6.67	10.63	5.33	5.00	49	124
NZ 5	44.57	34.38	1.09	1.56	4.89	6.25	4.89	0.78	125	71
NZ 6	32.92	36.32	1.24	1.00	10.56	7.46	6.83	4.48	108	116
NZ 7	18.15	23.83	0.81	0.67	6.85	11.41	4.03	2.01	77	131
NZ 8	25.57	25.22	1.14	0.87	4.55	10.43	0.57	2.61	58	96
NZ 9	33.53	30.00	1.18	1.54	8.24	12.31	4.12	2.31	83	65
US 1	20.79	36.22	1.12	1.57	4.49	5.51	6.74	2.36	61	70
US 2	36.16	38.86	1.13	1.14	3.95	12.57	4.52	4.57	106	130
US 3	19.23	26.28	0.00	1.28	7.69	1.92	3.85	1.28	13	55
US 4	42.25	21.89	1.07	1.78	4.28	5.33	2.67	1.78	114	63
US 5	35.82	24.34	2.99	14.81	2.99	6.35	20.90	14.81	46	96
US 6	29.84	26.92	1.61	0.00	4.03	13.46	3.23	0.00	57	50
US 7	24.74	29.47	2.06	10.63	4.12	12.08	11.34	10.63	44	114
US 8	35.03	34.46	1.02	9.60	4.06	10.17	8.12	9.60	114	115
US 9	16.60	25.67	0.75	6.42	10.19	13.90	3.02	6.42	94	100
US 10	31.51	27.55	1.37	4.08	6.85	17.35	3.42	4.08	70	57
US 11	29.48	19.89	0.75	0.00	1.87	3.23	2.61	0.00	99	53
Mean	**30.17**	**29.51**	**1.25**	**1.36**	**5.81**	**9.25**	**5.23**	**4.02**	**81.05**	**86.60**
Standard Deviation	**7.70**	**6.46**	**0.67**	**0.51**	**2.40**	**4.07**	**4.42**	**3.89**	**32.49**	**27.57**

Table 13a. Appraisal analysis results for AWNS: percentages of words expressing amplification (%AM), affect (%AF), appreciation (%AP), and total appraisal (T%A).

AWNS	%AM	%AF	%AP	%J	T%A
NZ 1	7.41	2.64	16.44	6.58	33.08
NZ 2	12.65	4.69	14.72	2.86	34.92
NZ 3	10.54	2.24	5.03	14.56	32.38
NZ 4	9.69	6.38	14.21	3.61	33.90
NZ 5	7.19	1.98	10.42	13.58	33.16
NZ 6	9.02	3.22	22.27	4.86	39.37
NZ 7	10.37	4.12	11.84	2.79	29.12
NZ 8	11.22	4.85	20.26	7.43	43.74
NZ 9	11.55	3.93	14.24	1.58	31.30
US 1	7.54	4.14	9.28	3.54	24.50
US 2	8.48	4.22	16.32	4.90	33.92
US 3	6.51	8.89	17.21	2.17	34.78
US 4	9.59	1.59	12.46	2.44	26.08
US 5	8.09	2.26	16.43	7.22	34.00
US 6	8.81	3.74	11.86	3.05	27.46
US 7	9.55	4.16	19.28	3.02	36.01
US 8	8.62	4.59	14.76	4.65	32.61
US 9	8.21	5.99	14.97	3.61	32.77
US 10	5.92	3.12	15.28	2.81	27.12
US 11	10.16	5.95	14.82	0.37	31.29
Mean	**9.06**	**4.13**	**14.60**	**4.78**	**32.58**
Standard Deviation	**1.73**	**1.75**	**3.89**	**3.65**	**4.46**

Table 13b. Appraisal analysis results for AWS: %AM, %AF, %AP, %J, and T%A.

AWS	%AM		%AF		%AP		%J		T%A	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
NZ 1	9.54	5.66	5.65	7.98	10.32	8.88	1.17	6.31	26.67	28.83
NZ 2	17.53	14.90	0.91	0.80	6.80	4.34	0.63	1.59	25.88	21.62
NZ 3	10.90	9.66	0.63	0.84	7.39	7.70	9.27	3.50	28.20	21.71
NZ 4	7.61	12.77	4.69	6.95	8.90	14.65	0.00	6.10	21.20	40.47
NZ 5	11.33	7.93	3.10	6.63	4.69	8.21	2.21	6.20	21.33	28.96
NZ 6	11.09	9.21	2.60	3.25	20.81	14.26	4.30	4.33	38.80	31.05
NZ 7	6.85	8.35	2.08	3.81	17.41	22.04	3.09	2.70	29.44	36.89
NZ 8	6.21	5.82	2.03	3.97	9.15	15.79	3.16	6.19	20.56	31.76
NZ 9	6.14	7.41	6.87	5.60	9.37	21.33	8.74	1.97	31.11	36.31
US 1	8.10	9.32	0.63	5.01	5.95	9.60	0.00	0.00	14.68	23.92
US 2	9.90	11.09	1.71	8.17	19.60	12.30	1.71	14.01	32.92	45.56
US 3	4.92	7.91	2.46	12.69	18.03	10.21	0.00	2.80	25.41	33.61
US 4	14.18	10.20	3.85	5.62	14.95	7.19	2.20	8.10	35.16	31.11
US 5	7.05	8.65	1.01	2.58	11.07	15.74	2.01	14.71	21.14	41.68
US 6	10.08	5.67	10.20	1.07	9.36	1.99	3.84	1.99	33.49	10.72
US 7	10.84	9.49	1.45	3.07	0.72	13.40	6.51	7.44	19.52	33.40
US 8	8.77	8.61	4.63	6.18	9.75	16.51	0.65	0.00	23.80	31.31
US 9	5.35	7.79	4.48	9.74	11.65	15.48	9.30	5.36	30.79	38.36
US 10	10.57	6.53	4.78	11.32	7.04	19.96	7.30	1.73	29.69	39.54
US 11	7.76	8.53	4.96	11.68	8.84	12.49	7.97	2.74	29.53	35.43
Mean	**9.24**	**8.77**	**3.44**	**5.85**	**10.59**	**12.60**	**3.70**	**4.89**	**26.97**	**32.11**
Standard Deviation	**3.07**	**2.30**	**2.42**	**3.59**	**5.18**	**5.39**	**3.29**	**4.01**	**6.06**	**8.14**

Table 14a. Theme analysis results for AWNS: percentages of clauses containing interpersonal theme (%INT), textual theme (%TE), structural theme (%STR), multiple theme (%MULT), marked theme (%MAR), and instances of 'clause as theme' (%CT).

AWNS	%INT	%TE	%STR	%MULT	%MAR	%CT
NZ 1	9.33	38.38	15.56	58.22	2.22	1.78
NZ 2	20.25	55.11	13.64	39.26	0.41	0.83
NZ 3	4.62	40.50	15.13	33.19	4.20	3.36
NZ 4	12.28	31.09	14.39	52.63	0.70	1.40
NZ 5	11.72	31.47	18.83	45.19	2.51	2.09
NZ 6	42.86	45.89	12.12	40.26	3.03	0.87
NZ 7	17.62	44.93	9.69	47.58	3.52	0.88
NZ 8	8.44	44.89	18.22	48.89	1.33	2.67
NZ 9	7.72	52.01	16.44	58.39	3.36	3.02
US 1	14.90	35.43	9.60	41.72	3.64	0.33
US 2	6.10	35.59	20.34	47.12	4.41	2.71
US 3	9.82	42.91	16.73	45.82	5.45	1.09
US 4	10.65	53.99	14.07	57.03	3.04	1.52
US 5	11.26	46.75	11.69	40.69	6.93	5.19
US 6	8.30	43.48	20.55	51.38	4.35	0.79
US 7	8.65	49.47	16.76	31.35	3.24	4.32
US 8	13.38	37.66	17.61	40.49	3.87	1.76
US 9	10.37	40.14	10.79	41.49	0.83	1.66
US 10	11.49	38.17	11.06	40.85	1.70	1.28
US 11	21.83	45.11	4.06	36.55	2.03	0.51
Mean	**13.08**	**42.65**	**14.36**	**44.91**	**3.04**	**1.90**
Standard Deviation	**8.26**	**6.87**	**4.13**	**7.80**	**1.64**	**1.29**

Table 14b. Theme analysis results for AWS: %INT, %TE, %STR, %MULT, %MAR, and %CT.

AWS	%INT		%TE		%STR		%MULT		%MAR		%CT	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
NZ 1	11.64	18.06	22.68	35.75	14.91	11.81	49.82	46.53	3.27	3.47	2.18	1.39
NZ 2	14.42	7.92	41.82	40.28	12.56	18.81	44.19	41.58	4.65	2.97	1.40	3.47
NZ 3	11.89	25.00	43.72	42.08	6.29	5.15	38.46	38.97	4.20	0.00	0.70	0.00
NZ 4	17.33	10.63	47.55	47.79	24.00	23.75	61.33	53.75	4.00	2.50	4.00	2.50
NZ 5	25.54	23.44	44.03	50.00	11.41	7.81	35.33	33.59	2.17	3.13	1.09	0.78
NZ 6	13.66	8.96	33.54	42.79	10.56	13.93	36.65	39.30	2.48	3.98	1.86	1.49
NZ 7	6.45	4.70	47.98	42.95	13.31	19.13	53.63	49.66	3.63	4.70	0.00	4.70
NZ 8	8.52	8.70	47.16	40.87	11.36	14.35	36.36	36.52	1.14	1.30	0.57	2.17
NZ 9	12.35	10.00	51.76	40.00	9.41	10.00	50.59	40.00	1.18	2.31	1.76	2.31
US 1	16.85	20.47	47.19	60.63	6.18	10.24	37.08	45.67	1.69	1.57	1.12	0.00
US 2	12.43	8.00	44.63	32.00	12.99	26.29	42.37	39.43	3.39	5.71	1.13	0.00
US 3	15.38	10.90	26.92	35.26	3.85	7.69	34.62	23.72	0.00	0.64	0.00	0.00
US 4	18.18	7.10	37.43	49.70	6.95	9.47	37.97	34.91	3.21	4.14	0.53	0.59
US 5	14.93	11.64	16.42	33.33	5.97	9.52	22.39	38.62	5.97	1.06	1.49	2.65
US 6	15.32	4.81	47.58	58.65	8.87	5.77	39.52	26.92	4.03	6.73	0.81	0.96
US 7	23.71	18.36	49.33	41.25	5.15	13.04	24.74	43.48	6.19	4.35	1.03	4.35
US 8	16.24	18.64	27.72	37.50	19.29	14.69	47.72	38.42	3.05	2.26	3.05	0.56
US 9	9.06	8.02	45.18	41.24	12.83	11.23	47.17	42.78	3.77	3.74	4.15	3.21
US 10	19.18	16.33	46.04	39.57	8.22	9.18	39.73	43.88	2.05	9.18	2.74	0.00
US 11	13.81	6.45	41.10	38.78	9.33	7.53	48.13	50.00	2.24	3.76	0.00	2.15
Mean	**14.85**	**12.41**	**40.49**	**42.52**	**10.67**	**12.47**	**41.39**	**40.39**	**3.12**	**3.38**	**1.48**	**1.66**
Standard Deviation	**4.66**	**6.26**	**9.86**	**7.55**	**4.90**	**5.72**	**9.30**	**7.30**	**1.56**	**2.17**	**1.22**	**1.49**

Appendix 4

Statistical tables for analysis of correlations between variables

Table 15. Pearson *r*-values, *p*-values, and *p**-values for adults with stuttering (AWS) at pre-treatment for correlations between percentage of syllables stuttered (% SS), *Stuttering Severity Instrument – Third Edition* (SSI-3), and stuttering severity self-rating scales, and: (a) rating scale measures: *Peabody Picture Vocabulary Test* (PPVT), *Liebowitz Social Anxiety Scale* (LSAS), *Overall Assessment of the Speaker's Experience of Stuttering* (OASES), communication confidence and flexibility self-rating scales; (b) conventional language measures: total numbers of utterances (TNU), words (TNW), and different word roots (NDWR), mean length of utterance in words (MLUw), subordination index (SI); (c) systemic functional linguistics (SFL) measures: grammatical intricacy (GI), total numbers of clauses (TNC), major clauses (NMC), and modality resources (TNMR), percentages of clauses containing comment adjuncts (%CA) and modal operators (%MO), percentages of words expressing appreciation (%AP) and total appraisal (T%A).

	% SS			**SSI-3**			**Severity: 10 mins**			**Severity: Week**		
	r	***p***	***p*****	***r***	***p***	***p*****	***r***	***p***	***p*****	***r***	***p***	***p*****
% SS	1.000	-	-	.642	.002	.161	.625	.003	.219	.228	.334	1.000
SSI-3	.642	.002	.161	1.000	-	-	.256	.276	1.000	.024	.920	1.000
Severity: 10 mins	.625	.003	.219	.256	.276	1.000	1.000	-	-	.211	.373	1.000
Severity: Week	.228	.334	1.000	.024	.920	1.000	.211	.373	1.000	1.000	-	-
PPVT	.436	.055	1.000	.246	.296	1.000	.337	.147	1.000	.515	.020	1.000
LSAS: Fear/Anxiety	-.051	.831	1.000	-.029	.902	1.000	-.217	.357	1.000	.598	.005	.353
LSAS: Avoidance	-.162	.495	1.000	-.219	.354	1.000	-.204	.388	1.000	.475	.034	1.000
LSAS: Total	-.112	.639	1.000	-.131	.582	1.000	-.219	.355	1.000	.555	.011	.654
OASES 1	-.032	.893	1.000	0.45	.852	1.000	.138	.563	1.000	.050	.833	1.000
OASES 3	.203	.390	1.000	.233	.324	1.000	.198	.403	1.000	.589	.006	.411
OASES 4	.125	.600	1.000	.029	.902	1.000	.027	.911	1.000	.540	.014	.772
OASES Total	.096	.687	1.000	.161	.498	1.000	.170	.475	1.000	.499	.025	1.000
Confidence	-.226	.337	1.000	-.107	.654	1.000	-.087	.716	1.000	-.435	.056	1.000
Flexibility	.395	.085	1.000	.381	.098	1.000	.313	.179	1.000	.173	.467	1.000
TNU	-.576	.008	.517	-.548	.012	.678	-.131	.581	1.000	-.007	.976	1.000
TNW	-.442	.051	1.000	-.368	.111	1.000	-.167	.480	1.000	.052	.827	1.000
NDWR	-.474	.035	1.000	-.405	.077	1.000	-.258	.272	1.000	.009	.970	1.000
MLUw	.144	.544	1.000	.169	.476	1.000	-.076	.751	1.000	.196	.407	1.000
SI	.236	.316	1.000	.059	.806	1.000	.083	.728	1.000	.183	.439	1.000
GI	.168	.480	1.000	.194	.412	1.000	.129	.588	1.000	.389	.090	1.000
TNC	-.524	.018	.946	-.469	.037	1.000	-.118	.620	1.000	.026	.913	1.000
NMC	-.472	.036	1.000	-.410	.073	1.000	-.127	.593	1.000	.055	.818	1.000
TNMR	-.223	.067	1.000	-.088	.566	1.000	-.269	.100	1.000	-.200	.535	1.000

%CA	.834	.000	.000~[a]	.349	.131	1.000	.512	.021	1.000	.097	.024	1.000
%MO	-.258	.272	1.000	.101	.672	1.000	-.281	.230	1.000	.042	.862	1.000
%AP	-.297	.203	1.000	.102	.668	1.000	-.476	.034	1.000	.045	.849	1.000
T%A	-.307	.188	1.000	.146	.540	1.000	-.450	.046	1.000	-.074	.755	1.000

~Significant correlation for a false discovery rate threshold of p*=.05

[a] See **Section 4.2.5. Comment Adjuncts**

Table 16. Pearson *r*-values, *p*-values, and *p**-values for adults with stuttering (AWS) at post-treatment for correlations between % SS, SSI-3, and severity self-rating scale, and: (a) rating scale measures: PPVT, LSAS, OASES, communication confidence and flexibility self-rating scales; (b) conventional language measures: TNU, TNW, NDWR, MLUw, SI; (c) SFL measures: GI, TNC, NMC, TNMR, %CA, %MO, %AP, T%A.

	% SS			**SSI-3**			**Severity: 10 mins**			**Severity: Week**		
	r	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****
% SS	1.000	-	-	.796	.000	.000˜	.442	.051	1.000	.434	.056	1.000
SSI-3	.796	.000	.000	1.000	-	-	.423	.063	1.000	.517	.020	.886
Severity: 10 mins	.442	.051	1.000	.423	.063	1.000	1.000	-	-	.550	.012	.646
Severity: Week	.434	.056	1.000	.517	.020	.886	.550	.012	.646	1.000	-	-
PPVT	.269	.252	1.000	.221	.350	1.000	.181	.445	1.000	.408	.074	1.000
LSAS: Fear/Anxiety	.208	.380	1.000	.297	.204	1.000	.464	.039	1.000	.327	.160	1.000
LSAS: Avoidance	.370	.108	1.000	.466	.038	1.000	.437	.054	1.000	.435	.055	1.000
LSAS: Total	.301	.197	1.000	.399	.082	1.000	.476	.034	1.000	.400	.081	1.000
OASES 1	.293	.210	1.000	.366	.112	1.000	.352	.128	1.000	.340	.143	1.000
OASES 3	.175	.460	1.000	.096	.686	1.000	.290	.215	1.000	.154	.518	1.000
OASES 4	.321	.167	1.000	.140	.556	1.000	.388	.091	1.000	.286	.222	1.000
OASES Total	.237	.314	1.000	.204	.389	1.000	.435	.056	1.000	.317	.174	1.000
Confidence	-.282	.228	1.000	-.216	.360	1.000	-.611	.004	.266	-.262	.264	1.000
Flexibility	-.555	.011	.638	-.205	.014	.703	-.524	.018	.866	-.308	.186	1.000
TNU	-.056	.816	1.000	-.070	.768	1.000	-.032	.892	1.000	.222	.346	1.000
TNW	-.055	.817	1.000	-.205	.385	1.000	.028	.908	1.000	.125	.601	1.000
NDWR	-.075	.754	1.000	-.166	.484	1.000	-.007	.978	1.000	.022	.928	1.000
MLUw	-.052	.828	1.000	-.162	.494	1.000	.035	.884	1.000	-.136	.567	1.000
SI	.197	.406	1.000	.024	.918	1.000	.184	.437	1.000	.019	.937	1.000
GI	.140	.557	1.000	-.028	.905	1.000	.245	.298	1.000	.149	.531	1.000
TNC	.043	.859	1.000	-.106	.658	1.000	.121	.611	1.000	.196	.407	1.000
NMC	.060	.802	1.000	-.100	.674	1.000	.180	.449	1.000	.260	.268	1.000
TNMR	.204	.389	1.000	-.004	.987	1.000	.375	.103	1.000	.143	.549	1.000
%CA	-.173	.466	1.000	-.142	.550	1.000	-.396	.084	1.000	-.312	.180	1.000
%MO	-.148	.533	1.000	-.016	.947	1.000	.080	.736	1.000	.084	.725	1.000
%AP	.180	.447	1.000	.157	.508	1.000	.248	.291	1.000	.499	.025	.991
T%A	.311	.447	1.000	.235	.319	1.000	.285	.224	1.000	.424	.063	1.000

˜Significant correlation for a false discovery rate threshold of *p**=.05

Table 17. Pearson *r*-values, *p*-values, and *p**-values for AWNS for correlations between LSAS and communication confidence and flexibility self-rating scales, and: (a) conventional language measures: TNU, TNW, (NDWR), MLUw, SI; (b) SFL measures: GI, TNC, NMC, TNMR, %CA, %MO, %AP, T%A.

	LSAS: Fear/Anxiety			LSAS: Avoidance			LSAS: Total			Confidence			Flexibility		
	r	*p*	*p**	*r*	*p*	*p**	*r*	*p*	*p**	*r*	*p*	*p**	*r*	*p*	*p**
LSAS: Fear/Anxiety	1.000	-	-	.778	.000	.000˜	.927	.000	.000˜	-.483	.031	1.000	-.281	.230	1.000
LSAS: Avoidance	.778	.000	.000	1.000	-	-	.957	.000	˜	-.466	.039	1.000	-.036	.881	1.000
LSAS: Total	.927	.000	.000	.957	.000	.000	1.000	-	-	-.501	.024	.903	-.152	.523	1.000
Confidence	-.483	.031	1.000	-.466	.039	1.000	-.501	.024	.903	1.000	-	-	.439	.053	1.000
Flexibility	-.281	.230	1.000	-.036	.881	1.000	-.152	.523	1.000	.439	.053	1.000	1.000	-	-
TNU	.398	.082	1.000	.219	.353	1.000	.316	.175	1.000	-.100	.674	1.000	-.331	.153	1.000
TNW	-.073	.761	1.000	-.155	.515	1.000	-.126	.597	1.000	.131	.583	1.000	-.193	.415	1.000
NDWR	-.218	.356	1.000	-.203	.392	1.000	-.222	.347	1.000	.221	.350	1.000	.192	.418	1.000
MLUw	-.403	.078	1.000	-.364	.115	1.000	-.404	.078	1.000	.238	.312	1.000	.110	.645	1.000
SI	-.486	.030	1.000	-.260	.268	1.000	-.380	.098	1.000	.150	.528	1.000	.041	.864	1.000
GI	-.439	.053	1.000	-.362	.117	1.000	-.419	.066	1.000	.362	.117	1.000	.051	.832	1.000
TNC	.078	.744	1.000	.042	.862	1.000	.061	.799	1.000	.088	.713	1.000	-.276	.239	1.000
NMC	-.070	.770	1.000	-.072	.763	1.000	-.075	.752	1.000	.215	.363	1.000	-.262	.265	1.000
TNMR	-.023	.924	1.000	-.062	.796	1.000	-.047	.843	1.000	-.205	.387	1.000	-.238	.313	1.000
%CA	-.054	.820	1.000	-.030	.899	1.000	-.043	.856	1.000	-.115	.629	1.000	.232	.324	1.000
%MO	-.120	.614	1.000	-.250	.287	1.000	-.205	.386	1.000	-.005	.984	1.000	.255	.278	1.000
%AP	-.062	.795	1.000	-.015	.949	1.000	-.038	.874	1.000	-.176	.457	1.000	-.057	.812	1.000
T%A	-.134	.573	1.000	.106	.657	1.000	.001	.998	1.000	.051	.831	1.000	.169	.476	1.000

˜Significant correlation for a false discovery rate threshold of *p**=.075

Table 18. Pearson *r*-values, *p*-values, and *p**-values for AWS at pre-treatment for correlations between LSAS, OASES, and communication confidence and flexibility self-rating scales, and: (a) conventional language measures: TNU, TNW, NDWR, MLUw, SI; (b) SFL measures: GI, TNC, NMC, TNMR, %CA, %MO, %AP, T%A.

	LSAS: Fear/Anxiety			LSAS: Avoidance			LSAS: Total			OASES 1			OASES 3		
	r	*p*	*p**	*r*	*p*	*p**	*r*	*p*	*p**	*r*	*p*	*p**	*r*	*p*	*p**
LSAS: Fear/Anxiety	1.000	-	-	.859	.000	.000˜	.962	.000	.000˜	.090	.707	1.000	.639	.002	.161
LSAS: Avoidance	.859	.000	.000	1.000	-	-	.966	.000	.000˜	.037	.877	1.000	.560	.010	.611
LSAS: Total	.962	.000	.000	.966	.000	.000	1.000	-	-	.065	.785	1.000	.621	.003	.219
OASES 1	.090	.707	1.000	.037	.877	1.000	.065	.785	1.000	1.000	-	-	.287	.220	1.000
OASES 3	.639	.002	.161	.560	.010	.611	.621	.003	.219	.287	.220	1.000	1.000	-	-
OASES 4	.496	.026	1.000	.412	.071	1.000	.470	.036	1.000	.134	.575	1.000	.767	.000	.000
OASES Total	.559	.010	.611	.471	.036	1.000	.533	.015	.807	.317	.173	1.000	.870	.000	.000
Confidence	-.337	.146	1.000	-.362	.117	1.000	-.363	.116	1.000	.035	.885	1.000	-.710	.000	.000
Flexibility	-.099	.677	1.000	-.139	.560	1.000	-.124	.603	1.000	.062	.796	1.000	.089	.708	1.000
TNU	-.001	.998	1.000	.183	.439	1.000	.097	.684	1.000	.119	.618	1.000	-.113	.636	1.000
TNW	-.028	.905	1.000	.080	.736	1.000	.028	.906	1.000	.034	.888	1.000	-.083	.729	1.000
NDWR	-.026	.915	1.000	.098	.682	1.000	.039	.871	1.000	.003	.990	1.000	-.226	.339	1.000
MLUw	-.018	.940	1.000	-.114	.622	1.000	-.070	.771	1.000	-.121	.613	1.000	-.046	.848	1.000
SI	-.092	.701	1.000	-.114	.632	1.000	-.107	.653	1.000	-.017	.944	1.000	.027	.909	1.000
GI	.227	.335	1.000	.077	.747	1.000	.156	.511	1.000	.243	.302	1.000	.487	.029	1.000
TNC	.020	.934	1.000	.159	.504	1.000	.094	.693	1.000	.153	.521	1.000	-.065	.784	1.000
NMC	.042	.860	1.000	.147	.536	1.000	.099	.677	1.000	.183	.439	1.000	.009	.970	1.000
TNMR	.061	.561	1.000	.185	.257	1.000	.129	.372	1.000	.006	.976	1.000	-.175	.671	1.000
%CA	-.106	.656	1.000	-.170	.473	1.000	-.144	.545	1.000	-.009	.968	1.000	-.018	.939	1.000
%MO	.020	.932	1.000	-.029	.903	1.000	-.005	.983	1.000	.299	.201	1.000	.144	.545	1.000
%AP	.288	.219	1.000	.278	.236	1.000	.293	.210	1.000	.101	.670	1.000	.196	.407	1.000
T%A	.190	.422	1.000	.202	.392	1.000	.204	.389	1.000	.131	.582	1.000	-.027	.911	1.000

˜Significant correlation for a false discovery rate threshold of $p^*=.05$

Table 18. (cont'd).

	OASES 4			OASES Total			Confidence			Flexibility		
	r	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****
LSAS: Fear/Anxiety	.496	.026	1.000	.559	.010	.611	-.337	.146	1.000	-.099	.677	1.000
LSAS: Avoidance	.412	.071	1.000	.471	.036	1.000	-.362	.117	1.000	-.139	.560	1.000
LSAS: Total	.470	.036	1.000	.533	.015	.807	-.363	.116	1.000	-.124	.603	1.000
OASES 1	.134	.575	1.000	.317	.173	1.000	.035	.885	1.000	.062	.796	1.000
OASES 3	.767	.000	.000˜	.870	.000	.000˜	-.710	.000	.000˜	.089	.708	1.000
OASES 4	1.000	-	-	.780	.000	.000˜	-.672	.001	.087	-.261	.267	1.000
OASES Total	.780	.000	.000	1.000	-	-	-.405	.077	1.000	.039	.869	1.000
Confidence	-.672	.001	.087	-.405	.077	1.000	1.000	-	-	.116	.627	1.000
Flexibility	-.261	.267	1.000	.039	.869	1.000	.116	.627	1.000	1.000	-	-
TNU	-.181	.446	1.000	-.073	.759	1.000	.343	.138	1.000	-.078	.744	1.000
TNW	-.199	.399	1.000	-.067	.778	1.000	.318	.171	1.000	.103	.666	1.000
NDWR	-.336	.148	1.000	-.237	.314	1.000	.398	.082	1.000	.055	.817	1.000
MLUw	-.186	.434	1.000	-.071	.765	1.000	.182	.442	1.000	.420	.065	1.000
SI	-.144	.544	1.000	-.083	.728	1.000	.035	.885	1.000	.238	.311	1.000
GI	.382	.097	1.000	.512	.021	1.000	-.070	.770	1.000	.333	.151	1.000
TNC	-.161	.497	1.000	-.032	.894	1.000	.332	.152	1.000	-.012	.961	1.000
NMC	-.095	.691	1.000	.050	.833	1.000	.287	.220	1.000	.064	.789	1.000
TNMR	-.343	.347	1.000	-.256	.589	1.000	.296	.314	1.000	-.036	.425	1.000
%CA	-.037	.878	1.000	-.136	.566	1.000	-.077	.748	1.000	.215	.363	1.000
%MO	-.082	.730	1.000	.021	.929	1.000	-.129	.588	1.000	.076	.750	1.000
%AP	.428	.060	1.000	.373	.105	1.000	-.013	.958	1.000	-.282	.229	1.000
T%A	-.035	.884	1.000	-.026	.915	1.000	.212	.370	1.000	-.073	.758	1.000

˜Significant correlation for a false discovery rate threshold of *p**=.05

Table 19. Pearson *r*-values, *p*-values, and *p**-values for AWS at post-treatment for correlations between LSAS, OASES, and communication confidence and flexibility self-rating scales, and: (a) conventional language measures: TNU, TNW, NDWR, MLUw, SI; (b) SFL measures: GI, TNC, NMC, TNMR, %CA, %MO, %AP, T%A.

	LSAS: Fear/Anxiety			LSAS: Avoidance			LSAS: Total			OASES 1			OASES 3		
	r	***p***	***p*****	***r***	***p***	***p*****	***r***	***p***	***p*****	***r***	***p***	***p*****	***r***	***p***	***p*****
LSAS: Fear/Anxiety	1.000	-	-	.795	.000	.000˜	.952	.000	.000˜	.485	.030	1.000	.599	.005	.314
LSAS: Avoidance	.795	.000	.000	1.000	-	-	.942	.000	.000˜	.480	.032	1.000	.515	.020	.886
LSAS: Total	.952	.000	.000	.942	.000	.000	1.000	-	-	.509	.022	.938	.590	.006	.367
OASES 1	.485	.030	1.000	.480	.032	1.000	.509	.022	.938	1.000	-	-	.101	.673	1.000
OASES 3	.599	.005	.314	.515	.020	.886	.590	.006	.367	.101	.673	1.000	1.000	-	-
OASES 4	.732	.000	.000	.514	.021	.913	.662	.001	.090	.354	.125	1.000	.783	.000	.000
OASES Total	.799	.000	.000	.639	.002	.161	.763	.000	.000	.634	.003	.205	.773	.000	.000
Confidence	-.517	.019	.876	-.380	.098	1.000	-.477	.034	1.000	-.128	.590	1.000	-.327	.159	1.000
Flexibility	-.443	.051	1.000	-.430	.058	1.000	-.461	.041	1.000	-.258	.271	1.000	-.282	.229	1.000
TNU	-.046	.848	1.000	.109	.646	1.000	.030	.900	1.000	-.007	.978	1.000	.087	.715	1.000
TNW	.034	.886	1.000	.125	.601	1.000	.082	.732	1.000	.111	.641	1.000	-.119	.618	1.000
NDWR	-.043	.858	1.000	.045	.851	1.000	-.001	.997	1.000	.195	.411	1.000	-.245	.297	1.000
MLUw	.103	.666	1.000	.010	.966	1.000	.062	.795	1.000	.107	.654	1.000	-.219	.353	1.000
SI	.212	.369	1.000	.366	.113	1.000	.302	.196	1.000	.136	.568	1.000	.193	.415	1.000
GI	.327	.159	1.000	.190	.422	1.000	.276	.239	1.000	.042	.860	1.000	.151	.526	1.000
TNC	.068	.776	1.000	.240	.308	1.000	.159	.504	1.000	.105	.660	1.000	.002	.993	1.000
NMC	.066	.781	1.000	.191	.419	1.000	.133	.576	1.000	.112	.638	1.000	-.009	.969	1.000
TNMR	.178	.452	1.000	.279	.233	1.000	.239	.309	1.000	.274	.243	1.000	.221	.349	1.000
%CA	-.427	.060	1.000	-.494	.027	1.000	-.485	.030	1.000	-.226	.338	1.000	-.645	.002	.161
%MO	-.208	.379	1.000	-.241	.305	1.000	-.236	.316	1.000	.140	.557	1.000	-.394	.086	1.000
%AP	-.121	.612	1.000	.131	.581	1.000	.000	1.000	1.000	.135	.569	1.000	.265	.259	1.000
T%A	-.035	.883	1.000	.281	.230	1.000	.123	.607	1.000	-.040	.869	1.000	.326	.161	1.000

˜Significant correlation for a false discovery rate threshold of $p^*=.05$

Table 19. (cont'd).

	OASES 4			OASES Total			Confidence			Flexibility		
	r	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****
LSAS: Fear/Anxiety	.732	.000	.000˜	.799	.000	.000˜	-.517	.019	.876	-.443	.051	1.000
LSAS: Avoidance	.514	.021	.913	.639	.002	.161	-.380	.098	1.000	-.430	.058	1.000
LSAS: Total	.662	.001	.090	.763	.000	.000˜	-.477	.034	1.000	-.461	.041	1.000
OASES 1	.354	.125	1.000	.634	.003	.205	-.128	.590	1.000	-.258	.271	1.000
OASES 3	.783	.000	.000˜	.773	.000	.000˜	-.327	.159	1.000	-.282	.229	1.000
OASES 4	1.000	-	-	.881	.000	.000˜	-.548	.012	.646	-.372	.106	1.000
OASES Total	.881	.000	.000	1.000	-	-	-.418	.066	1.000	-.391	.088	1.000
Confidence	-.548	.012	.646	-.418	.066	1.000	1.000	-	-	.722	.000	.000˜
Flexibility	-.372	.106	1.000	-.391	.088	1.000	.722	.000	.000	1.000	-	-
TNU	.077	.746	1.000	.067	.780	1.000	-.395	.084	1.000	-.402	.079	1.000
TNW	.080	.736	1.000	.045	.852	1.000	-.248	.292	1.000	-.018	.940	1.000
NDWR	-.029	.904	1.000	-.013	.958	1.000	-.065	.785	1.000	.120	.616	1.000
MLUw	-.001	.998	1.000	-.025	.917	1.000	.184	.437	1.000	.450	.046	1.000
SI	.188	.428	1.000	.217	.357	1.000	.121	.611	1.000	.225	.341	1.000
GI	.402	.079	1.000	.254	.280	1.000	-.248	.292	1.000	.182	.443	1.000
TNC	.138	.561	1.000	.100	.674	1.000	-.426	.061	1.000	-.221	.350	1.000
NMC	.186	.433	1.000	.115	.630	1.000	-.422	.064	1.000	-.152	.523	1.000
TNMR	.231	.328	1.000	.303	.194	1.000	-.221	.349	1.000	-.070	.770	1.000
%CA	-.520	.019	.876	-.603	.005	.314	.501	.024	.986	.412	.071	1.000
%MO	-.322	.166	1.000	-.223	.344	1.000	.263	.263	1.000	.470	.036	1.000
%AP	.149	.530	1.000	.224	.342	1.000	-.107	.652	1.000	-.027	.909	1.000
T%A	.117	.622	1.000	.148	.534	1.000	.031	.897	1.000	-.028	.908	1.000

˜Significant correlation for a false discovery rate threshold of *p**=.05

Table 20. Pearson *r*-values, *p*-values, and *p**-values for AWNS and AWS at pre- and post-treatment for correlations between language productivity measures from (a) conventional analyses: TNU, TNW, NDWR, MLUw; (b) SFL measures: TNC, NMC, TNMR.

	TNU			TNW			NDWR			MLUw		
	r	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****
	AWNS											
TNU	1.000	-	-	.350	.131	1.000	.155	.515	1.000	-.452	.046	1.000
TNW	.350	.131	1.000	1.000	-	-	.768	.000	.000˜	.653	.002	.098
NDWR	.155	.515	1.000	.768	.000	.000	1.000	-	-	.646	.002	.098
MLUw	-.452	.046	1.000	.653	.002	.098	.646	.002	.098	1.000	-	-
TNC	.739	.000	.000	.792	.000	.000	.571	.009	.400	.174	.463	1.000
NMC	.551	.012	.489	.896	.000	.000	.651	.002	.098	.400	.081	1.000
TNMR	.270	.249	1.000	.365	.114	1.000	-.107	.653	1.000	.080	.738	1.000
	AWS Pre-treatment											
TNU	1.000	-	-	.901	.000	.000˜	.901	.041	1.000˜	.108	.651	1.000
TNW	.901	.000	.000	1.000	-	-	.965	.000	.000˜	.504	.024	1.000
NDWR	.901	.041	1.000	.965	.000	.000	1.000	-	-	.460	.041	1.000
MLUw	.108	.651	1.000	.504	.024	1.000	.460	.041	1.000	1.000	-	-
TNC	.974	.000	.000	.958	.000	.000	.932	.000	.000	.273	.244	1.000
NMC	.911	.000	.000	.967	.000	.000	.903	.000	.000	.400	.081	1.000
TNMR	.602	.001	.087	.729	.000	.000	.758	.000	.000	.497	.131	1.000
	AWS Post-treatment											
TNU	1.000	-	-	.547	.012	.646	.340	.143	1.000	.474	.035	1.000
TNW	.547	.012	.646	1.000	-	-	.936	.000	.000˜	.464	.039	1.000
NDWR	.340	.143	1.000	.936	.000	.000	1.000	-	-	.629	.003	.205
MLUw	-.474	.035	1.000	.464	.039	1.000	.629	.003	.205	1.000	-	-
TNC	.749	.000	.000	.888	.000	.000	.734	.000	.000	.135	.570	1.000
NMC	.629	.003	.205	.926	.000	.000	.796	.000	.000	.285	.222	1.000
TNMR	.248	.292	1.000	.702	.001	.090	.637	.003	.205	.456	.043	1.000

˜Significant correlation for a false discovery rate threshold of *p**=.075 for AWNS, or *p**=.05 for AWS

Table 20. (cont'd).

	TNC			NMC			TNMR		
	r	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****
					AWNS				
TNU	.739	.000	.000˜	.551	.012	.489	.270	.249	1.000
TNW	.792	.000	.000˜	.896	.000	.000˜	.365	.114	1.000
NDWR	.571	.009	.400	.651	.002	.098	-.107	.653	1.000
MLUw	.174	.463	1.000	.400	.081	1.000	.080	.738	1.000
TNC	1.000	-	-	.944	.000	.000˜	.342	.141	1.000
NMC	.944	.000	.000	1.000	-	-	.323	.164	1.000
TNMR	.342	.141	1.000	.323	.164	1.000	1.000	-	-
					AWS Pre-treatment				
TNU	.974	.000	.000˜	.911	.000	.000˜	.602	.001	.087
TNW	.958	.000	.000˜	.967	.000	.000˜	.729	.000	.000˜
NDWR	.932	.000	.000˜	.903	.000	.000˜	.758	.000	.000˜
MLUw	.273	.244	1.000	.400	.081	1.000	.497	.131	1.000
TNC	1.000	-	-	.973	.000	.000˜	.666	.001	.087
NMC	.973	.000	.000	1.000	-	-	.700	.001	.087
TNMR	.666	.001	.087	.700	.001	.087	1.000	-	-
					AWS Post-treatment				
TNU	.749	.000	.000˜	.629	.003	.205	.248	.292	1.000
TNW	.888	.000	.000˜	.926	.000	.000˜	.702	.001	.090
NDWR	.734	.000	.000˜	.796	.000	.000˜	.637	.003	.205
MLUw	.135	.570	1.000	.285	.222	1.000	.456	.043	1.000
TNC	1.000	-	-	.963	.000	.000˜	.656	.002	.161
NMC	.963	.000	.000	1.000	-	-	.698	.001	.090
TNMR	.656	.002	.161	.698	.001	.090	1.000	-	-

˜Significant correlation for a false discovery rate threshold of *p**=.075 for AWNS, or *p**=.05 for AWS

Table 21. Pearson *r*-values, *p*-values, and *p**-values for AWNS and AWS at pre- and post-treatment for correlations between the language complexity measures of SI and GI, and the language productivity measures of TNW, MLUw, NMC, and TNMR.

	SI			**GI**		
	r	***p***	***p****	***r***	***p***	***p****
			AWNS			
TNW	.316	.175	1.000	.698	.001	.061˜
MLUw	.676	.001	.061˜	.746	.000	.000˜
NMC	.276	.238	1.000	.641	.002	.098
TNMR	.092	.701	1.000	.130	.584	1.000
			AWS Pre-treatment			
TNW	.468	.037	1.000	.422	.064	1.000
MLUw	.843	.000	.000˜	.662	.001	.071
NMC	.353	.127	1.000	.450	.047	1.000
TNMR	.507	.105	1.000	.242	.581	1.000
			AWS Post-treatment			
TNW	.493	.027	1.000	.471	.036	1.000
MLUw	.712	.000	.000˜	.747	.000	.000˜
NMC	.423	.063	1.000	.491	.028	1.000
TNMR	.792	.000	.000˜	.472	.035	1.000

˜Significant correlation for a false discovery rate threshold of *p**=.075 for AWNS, or *p**=.05 for AWS

Table 22. Pearson *r*-values, *p*-values, and *p**-values for AWNS and AWS at pre- and post-treatment for correlations between %CA and the language productivity measures of TNU, TNW, NDWR, TNC, and NMC.

	AWNS			**AWS Pre-treatment**			**AWS Post-treatment**		
	r	***p***	***p****	***r***	***p***	***p****	***r***	***p***	***p****
TNU	-.756	.000	.000˜	-.505	.023	1.000	-.504	.023	.963
TNW	-.785	.000	.000˜	-.387	.092	1.000	-.201	.396	1.000
NDWR	-.606	.005	.233	-.367	.112	1.000	.008	.972	1.000
TNC	-.988	.000	.000˜	-.466	.039	1.000	-.495	.027	1.000
NMC	-.925	.000	.000˜	-.403	.078	1.000	-.407	.075	1.000

˜Significant correlation for a false discovery rate threshold of *p**=.075 for AWNS, or *p**=.05 for AWS

Appendix 5

Statistical tables for subgroup analyses

Table 23. Original *p*-values and *p**-values from all means comparisons between adults with no stuttering (AWNS) and adults with stuttering (AWS) at pre- and post-treatment, and for AWS between pre- and post-treatment, for the NZ participant group.

Measure	AWS Pre vs. Post		AWNS vs. AWS Pre		AWNS vs. AWS Post	
	p	*p**	*p*	*p**	*p*	*p**
			General Results			
PPVT	-	-	.011	.615	-	-
% SS	.071	1.000	-	-	-	-
SSI-3	.002	.584	-	-	-	-
Articulation Rate	.284	1.000	.891	1.000	.251	1.000
			Rating Scales			
Severity: 10 mins	.011	.643	-	-	-	-
Severity: Week	.007	.643	-	-	-	-
PSI	.133	1.000	-	-	-	-
OASES 1	.005	.643	-	-	-	-
OASES 2	.774	1.000	-	-	-	-
OASES 3	.068	1.000	-	-	-	-
OASES 4	.123	1.000	-	-	-	-
OASES Total	.062	1.000	-	-	-	-
BDI	.381	1.000	.387	1.000	.546	1.000
LSAS: Fear/Anxiety	.488	1.000	.063	1.000	.136	1.000
LSAS: Avoidance	.113	1.000	.161	1.000	.863	1.000
LSAS: Total	.212	1.000	.087	1.000	.489	1.000
LCB	.549	1.000	.546	1.000	.340	1.000
Confidence	.031	1.000	.031	.944	.796	1.000
Flexibility	.023	1.000	.014	.615	.436	1.000
			Naming Task			
%DM	.468	1.000	.133	1.000	.402	1.000
%NDM	.446	1.000	.921	1.000	.604	1.000
%NM	.094	1.000	.159	1.000	.548	1.000
Difficulty	.554	1.000	.863	1.000	.863	1.000
Response consideration	.011	.643	.340	1.000	.222	1.000
			Conventional Language Measures			
TNU	.326	1.000	.204	1.000	.029	.887
TNW	.601	1.000	.012	.615	.005	.535
NDWR	.917	1.000	.005	.615	.002	.428
TTR	.297	1.000	.118	1.000	.041	1.000
MLUw	.258	1.000	.043	.944	.461	1.000
SI	.827	1.000	.138	1.000	.466	1.000
VF SubtlexUS	.856	1.000	.666	1.000	.387	1.000
VF WordCount	.526	1.000	.297	1.000	.605	1.000
			SFL: General Analyses			
TNC	.931	1.000	.042	.944	.010	.642
NMC	.971	1.000	.036	.944	.012	.642
NmC	.545	1.000	.817	1.000	.855	1.000
GI	.993	1.000	.095	1.000	.090	1.000
			SFL: Verb Process Analysis			
%PB	.337	1.000	.239	1.000	.620	1.000
%PC	.599	1.000	.245	1.000	.092	1.000
%PE	.309	1.000	.329	1.000	.785	1.000
%PM	.428	1.000	.796	1.000	.664	1.000
%PMe	.967	1.000	.748	1.000	.766	1.000
%PR	.293	1.000	.381	1.000	.673	1.000
%PV	.960	1.000	.740	1.000	.692	1.000
			SFL: Modality Analysis			

%MA	.866	1.000	.783	1.000	.854	1.000
%CA	.597	1.000	.061	1.000	.028	.887
%MO	.081	1.000	.153	1.000	.425	1.000
%IM	.148	1.000	.524	1.000	.141	1.000
TNMR	.864	1.000	.022	.805	.023	.887
	SFL: Appraisal Analysis					
%AM	.542	1.000	.845	1.000	.472	1.000
%AF	.036	1.000	.488	1.000	.524	1.000
%AP	.219	1.000	.134	1.000	.619	1.000
%J	.655	1.000	.166	1.000	.242	1.000
T%A	.233	1.000	.008	.615	.178	1.000
	SFL: Theme Analysis					
%INT	.826	1.000	.740	1.000	.677	1.000
%TE	.926	1.000	.854	1.000	.838	1.000
%STR	.342	1.000	.258	1.000	.648	1.000
%MULT	.064	1.000	.654	1.000	.196	1.000
%MAR	.684	1.000	.340	1.000	.602	1.000
%CT	.391	1.000	.473	1.000	.715	1.000

˜Significant result for a false discovery rate threshold of $p^*=.1$

Table 24. Original *p*-values and *p**-values from all means comparisons between AWNS and AWS at pre- and post-treatment, and for AWS between pre- and post-treatment, for the US participant group.

Measure	AWS Pre vs. Post		AWNS vs. AWS Pre		AWNS vs. AWS Post	
	p	*p**	*p*	*p**	*p*	*p**
			General Results			
PPVT	-	-	.001	.073˜	-	-
% SS	.003	.110˜	-	-	-	-
SSI-3	.000	.000˜	-	-	-	-
Articulation Rate	.024	.412	.583	1.000	.014	.375
			Rating Scales			
Severity: 10 mins	.000	.000˜	-	-	-	-
Severity: Week	.036	.584	-	-	-	-
PSI	.039	.600	-	-	-	-
OASES 1	.000	.000˜	-	-	-	-
OASES 2	.002	.083˜	-	-	-	-
OASES 3	.000	.000˜	-	-	-	-
OASES 4	.000	.000˜	-	-	-	-
OASES Total	.000	.000˜	-	-	-	-
BDI	.007	.186	.898	1.000	.101	1.000
LSAS: Fear/Anxiety	.008	.195	.004	.110˜	.243	1.000
LSAS: Avoidance	.004	.117˜	.028	.361	.606	1.000
LSAS: Total	.004	.117˜	.013	.259	.438	1.000
LCB	.296	1.000	.478	1.000	.949	1.000
Confidence	.009	.202	.047	.516	.898	1.000
Flexibility	.013	.271	.023	.361	.606	1.000
			Naming Task			
%DM	.653	1.000	.913	1.000	.844	1.000
%NDM	.545	1.000	1.000	1.000	.564	1.000
%NM	.896	1.000	.848	1.000	.720	1.000
Difficulty	.336	1.000	.949	1.000	.519	1.000
Response consideration	1.000	1.000	.562	1.000	.365	1.000
			Conventional Language Measures			
TNU	.760	1.000	.010	.219	.000	.000˜
TNW	.863	1.000	.002	.073˜	.000	.000˜
NDWR	.422	1.000	.000	.000˜	.000	.000˜
TTR	.450	1.000	.095	.978	.027	.642
MLUw	.044	.612	.042	.485	.566	1.000
SI	.139	1.000	.009	.219	.697	1.000
VF SubtlexUS	.763	1.000	.652	1.000	.699	1.000
VF WordCount	.770	1.000	.401	1.000	.332	1.000
			SFL: General Analyses			
TNC	.873	1.000	.002	.073˜	.000	.000˜
NMC	.615	1.000	.002	.073˜	.000	.000˜
NmC	.338	1.000	.890	1.000	.143	1.000
GI	.100	1.000	.028	.361	.187	1.000
			SFL: Verb Process Analysis			
%PB	.964	1.000	.244	1.000	.125	1.000
%PC	.964	1.000	.766	1.000	.518	1.000
%PE	.333	1.000	.962	1.000	.765	1.000
%PM	.158	1.000	.324	1.000	.523	1.000
%PMe	.862	1.000	.667	1.000	.714	1.000
%PR	.054	.682	.797	1.000	.087	1.000
%PV	.340	1.000	.694	1.000	.278	1.000
			SFL: Modality Analysis			

%MA	.294	1.000	.777	1.000	.377	1.000
%CA	.847	1.000	.220	1.000	.001	.036˜
%MO	.044	.612	.003	.094˜	.863	1.000
%IM	.102	1.000	.898	1.000	.818	1.000
TNMR	.725	1.000	.001	.073˜	.002	.061˜
	SFL: Appraisal Analysis					
%AM	.686	1.000	.547	1.000	.733	1.000
%AF	.050	.664	.457	1.000	.073	1.000
%AP	.514	1.000	.039	.476	.158	1.000
%J	.430	1.000	.774	1.000	.268	1.000
T%A	.098	1.000	.098	.978	.491	1.000
	SFL: Theme Analysis					
%INT	.016	.310	.018	.329	.866	1.000
%TE	.287	1.000	.289	1.000	.922	1.000
%STR	.177	1.000	.026	.361	.264	1.000
%MULT	.858	1.000	.165	1.000	.197	1.000
%MAR	.466	1.000	.643	1.000	.727	1.000
%CT	.801	1.000	.459	1.000	.366	1.000

˜Significant result for a false discovery rate threshold of 1) *p**=.12 for AWS Pre vs. Post comparisons, 2) *p**=.2 for AWNS vs. AWS Pre and Post comparisons

Table 25. Mean values for NZ AWNS and AWS at pre- and post-treatment, for SFL (a) general analysis: total numbers of clauses (TNC), major clauses (NMC), and minor clauses (NmC), grammatical intricacy (GI); (b) verb process analysis: percentages of clauses containing behavioural processes (%PB), causative processes (%PC), existential processes (%PE), material processes (%PM), mental processes (%PMe), relational processes (%PR), and verbal processes (%PV); (c) modality analysis: percentages of clauses containing mood adjuncts (%MA), comment adjuncts (%CA), modal operators (%MO), and interpersonal metaphor (%IM), total number of modality resources (TNMR); (d) appraisal analysis: percentages of words expressing amplification (%AM), affect (%AF), appreciation (%AP), judgment (%J), and total appraisal (T%A); (e) theme analysis: percentages of clauses containing interpersonal theme (%INT), textual theme (%TE), structural theme (%STR), multiple theme (%MULT), marked theme (%MAR), and instances of 'clause as theme' (%CT).

	AWNS	**AWS Pre-treatment**	**AWS Post-treatment**
		General Analysis	
TNC	245.56	30.25	28.75
NMC	216.56	154.38	158.63
NmC	29	3.37	3.45
GI	4.23	184.63	187.38
		Verb Process Analysis	
%PB	2.35	1.40	1.97
%PC	0.71	0.30	0.16
%PE	3.35	4.55	3.58
%PM	36.64	35.83	38.50
%PMe	13.97	13.32	13.26
%PR	40.03	42.81	38.60
%PV	1.49	1.28	1.31
		Modality Analysis	
%MA	30.27	31.32	30.96
%CA	0.83	1.24	1.41
%MO	8.30	6.85	9.23
%IM	4.56	3.80	2.77
TNMR	132.56	89.22	92.11
		Appraisal Analysis	
%AM	9.96	9.69	9.08
%AF	3.78	3.17	4.43
%AP	14.38	10.54	13.02
%J	6.43	3.62	4.32
T%A	34.55	27.02	30.84
		Theme Analysis	
%INT	14.98	13.53	13.05
%TE	42.70	42.25	42.50
%STR	14.89	12.65	13.86
%MULT	47.07	45.15	42.21
%MAR	2.36	2.97	2.71
%CT	1.88	1.51	2.09

Table 26. Mean values for US AWNS and AWS at pre- and post-treatment, for SFL (a) general analysis: TNC, NMC, NmC, and GI; (b) verb process analysis: %PB, %PC, %PE, %PM, %PMe, %PR, and %PV; (c) modality analysis: %MA, %CA, %MO, %IM, and TNMR; (d) appraisal analysis: %AM, %AF, %AP, %J, and T%A; (e) theme analysis: %INT, %TE, %STR, %MULT, %MAR, and %CT.

	AWNS	**AWS Pre-treatment**	**AWS Post-treatment**
		General Analysis	
TNC	251.00	32.64	25.91
NMC	217.45	124.82	135.45
NmC	33.55	3.34	3.86
GI	4.41	157.45	161.36
		Verb Process Analysis	
%PB	2.05	3.15	3.10
%PC	0.34	0.29	0.54
%PE	2.38	2.43	2.11
%PM	37.20	33.85	40.00
%PMe	15.29	16.76	16.25
%PR	39.49	40.34	33.96
%PV	1.57	1.83	2.41
		Modality Analysis	
%MA	26.22	29.22	28.32
%CA	0.82	1.26	4.66
%MO	9.60	4.96	9.26
%IM	5.50	6.40	5.05
TNMR	121.27	74.36	82.09
		Appraisal Analysis	
%AM	8.32	8.87	8.53
%AF	4.42	3.65	7.01
%AP	14.79	10.63	12.26
%J	3.43	3.77	5.35
T%A	30.96	26.92	33.15
		Theme Analysis	
%INT	11.52	15.92	11.88
%TE	42.61	39.05	42.54
%STR	13.93	9.06	11.33
%MULT	43.14	38.31	38.89
%MAR	3.59	3.24	3.92
%CT	1.92	1.46	1.32