

**Measure of Emotional Anxiety and Attentional Bias to Emotional
Threat Words Using Emotional Stroop Task in Persons with Stuttering
(PWS)**

Sonam Belliappa

**Student Register Number
13SLP026**

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**All India Institute Of Speech and Hearing
Manasagangothri, Mysore-570006**

CERTIFICATE

This is to certify that this dissertation entitled “**Measure of Emotional Anxiety and Attentional Bias to Emotional Threat Words Using Emotional Stroop Task in Persons with Stuttering (PWS)**” is a bonafide work submitted in part fulfilment for degree of Master of Science (Speech-Language Pathology) of the student Registration Number: 13SLP026. This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore
May, 2015

Prof. S.R. Savithri
Director
All India Institute Of Speech and Hearing
Manasagangothri, Mysore-570006

CERTIFICATE

This is to certify that this dissertation entitled “**Measure of Emotional Anxiety and Attentional Bias to Emotional Threat Words Using Emotional Stroop Task in Persons with Stuttering (PWS)**” has been prepared under my supervision and guidance.

It is also been certified that this dissertation has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore
May, 2015

Guide

Dr. Y.V. Geetha

Professor in speech sciences,
Department of Speech-Language Sciences
All India Institute Of Speech and Hearing
Manasagangothri, Mysore-570006

DECLARATION

This is to certify that this dissertation entitled “**Measure of Emotional Anxiety and Attentional Bias to Emotional Threat Words Using Emotional Stroop Task in Persons with Stuttering (PWS)**” is the result of my own study under the guidance of Prof. Y.V. Geetha, Professor in speech sciences, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

*Mysore,
May, 2015*

Registration No. 13SLP026

Dedicated to,

My Beloved Grandparents, Parents

and

All Individuals with stuttering who participated in this study

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Chapter 1

Introduction

According to ASHA (1991, p.9) “Communication is the essence of human life”. Communication simply refers to the process of exchange of thought message and information between the individuals or groups using a common system of signs, signals, writing and behaviour.

Speech is a form of verbal communication which enables an individual to express his thoughts and ideas to the world, as rightly told by Skinner that speech is a “verbal behaviour”, a behaviour which essentially distinguishes the human from the other animal species. Speech is a means of expression of language which is a complex process requiring a great amount of cognitive processing.

Cognition is a “mental” process. In what is perhaps the most influential definition (Neisser, 1967), cognition indeed refers to the mental process by which external or internal input is transformed, reduced, elaborated, stored, recovered, and used. As such, it involves a variety of functions such as perception, attention, memory coding, retention, and recall, decision-making, reasoning, problem-solving, imaging, planning and executing actions.

Fluency is an essential part of speech which is derived from the Latin word “fluere” which means to flow. Stuttering is a speech disorder which interrupts the forward flow of speech, manifested mainly during childhood and is characterized by disfluent speech. Anxiety plays a major role in stuttering as it is a major component of advanced stuttering leading to the increase in the frequency and severity of disfluencies.

Severe stuttering is mainly associated with negative emotions i.e., embarrassment, frustration, and apprehension of negative social emotion. Because of this anxiety and negative emotions, persons with stuttering (PWS) exhibit maladaptive physical adjustment in their speech mechanism (Hulit, 2004).

The term anxiety generally refers to “a state of concern about a future event” (Reunett, 2006) and anxiety mainly consists of trait and state components. “Trait anxiety is defined as a general disposition in a person to experience feelings of anxiousness, nervousness or dread whereas state anxiety is a feeling of anxiousness, apprehension arising at a particular point in time or in a specific situation” (Blumgart, 2010; Mulcahy, 2008).

Stuttering is usually characterized by a high level of generalized anxiety which can result in severe distress and impede functioning (American Psychological Association, 2013a). There are many hypotheses made regarding the cause of stuttering, yet, even to this day, the exact cause is unknown. Many definitions given by various authors suggest the same. Few of the definitions from the psychological perspective are: “A person who stutters, does to avoid stuttering and it is an anticipatory apprehensive and hypertonic avoidance reaction” (Johnson, 1946). According to Brutton & Shoemaker (1967), “Stuttering is a form of fluency failure that results from conditioned negative emotion”.

Recently, Bloodstein and Ratner (2008) reviewed more than a dozen studies comparing persons with stuttering (PWS) and persons with no stuttering (PWNS) on

various measures of anxiety and found that a substantial number of them did find PWS to be more anxious on anxiety measures.

Many theories proposed on stuttering support the notion that anxiety plays an important role. The Two Factor theory of stuttering (Brutten & Shoemaker, 1967) suggests that the negative emotion to the speech of PWS conditions a link between speech and anxiety. Similar theories include the Anticipatory Struggle Hypothesis (Bloodstein, 1987) which supports the notion that stuttering occurs on considering speech as a demanding task mainly due to the negative feeling of difficulty and frustration. The approach avoidance conflict theory suggests that stuttering occurs due to the internal conflict of approaching to speak or avoiding it. This theory was revised by Miller in 1994 who proposed the double approach avoidance conflict theory. It explains that when individuals with stuttering desire to approach speaking to fulfil their social obligations, they are simultaneously faced with a fear of stuttering during their speaking attempts, leading to avoidance tendencies. One means of avoiding to speak in a situation is to remain silent which is considered as a social threat.

Models of anxiety, including those specific to social anxiety, (Morrison & Heimberg, 2013) emphasize interactions between behavioural, physiological and cognitive components (Balsamo 2013). Anxiety sometimes can interfere with the cognitive process of attention in PWS.

Cognitive influences of anxiety emphasises on the important role of cognitive processes focusing on the attention bias which might disrupt the ability of the PWS to

attend to the stimulus given. Lavie and Tsal (1994) see “selection of information as the primary concern of attention research.” Hence, these negative cognitive appraisals play an important role in the aetiology and maintenance factor in the attention bias in these individuals.

Freeman and Ushijima (1975, 1978) found that PWNS were quicker in initiating and terminating phonation when compared to the PWS. Umpteen number of studies have been done to investigate the voice initiation time, voice termination, oral and manual reaction times to give an insight into the physiological and psychological processing in PWS (Adams & Hayden, (1976); Cross 1978, Venkatagiri 1982c, Cross & Luper, 1983; Peters & Hulstijn, 1987, Webster & Ryan 1992).

Stroop task is one of the several ways to study attention. It is a psycho-social test to assess attention (selective) given by Ridley Stroop in 1930 which majorly checks for the reaction time of the task in the presence of some interference. The Stroop task demonstrates that we can read the colours quickly than naming them. For e.g., if the word red is written in green, it is easier to spell the word ‘red’ rather than naming the colour ‘green’. Word reading is an automatic process whereas naming a colour is a controlled process which leads to interference. The locus of the Stroop is at the level of the response selection (Fagot & Pashler, 1992).

Subramaniam and Yairi (2006) administered Stroop task on 3 groups, i.e., PWS, relatives of PWS and controls. They found that PWS group had shorter reaction time

when compared to its control group and the relatives of PWS. The authors speculated that the results correlated with their hypothesis that PWS may use different speech motor control (including stages of processing, planning and production) strategies leading to a shorter reaction time for this group. They even suggested that there is no difference in the attentional process to manage the Stroop effect.

Kishore and Geetha (2009) showed more Stroop effect in PWS than the control group only in two and four colour conditions which was non-insignificant. This implied that there could be some deficits in inhibiting interference caused by automaticity, in the word reading in PWS compared to the controls.

A slight variation to this task is the emotional Stroop task where the subject has to name the colour of the written words related to emotions (which may be either a fear word or a neutral word). It is a task to study the cognitive function related to the emotional disturbance. Blumgart, Tran and Craig (2009) studied 200 PWS and found that PWS with increased levels of severity may have higher risk of poor emotional functioning.

Researches done in 1960s have shown that PWS respond more slowly to words related to emotions. Many studies have tried to prove that the emotional Stroop effect is seen more for highly anxious subjects compared to the low anxious subjects, which are one of the probable reasons that act as an interference in both the verbal and manual tasks. Moreover, they support the notion that speech motor control is mainly influenced

by the emotional reactivity of PWS to threat words (Hennessey, Dourado & Beiby, 2013).

Need for the study:

PWS exhibit an attention bias which may or may not be directly related to their anxiety as such and there is a need to devise an objective method of measuring the attention bias related to the emotional disturbance.

Only a few studies have used Stroop task to investigate the cognitive and emotional abilities of PWS. Quantification of the attention in terms of reaction time will give an insight into the anxiety and emotional disturbance exhibited in PWS. There is a dearth of studies done on PWS using emotional Stroop task.

Aim:

The main aim of the study is to investigate if the measure of emotional anxiety and attentional bias to emotional threat words using emotional Stroop task differ in persons with stuttering (PWS) compared to persons with no stuttering (PWNS).

Objectives of the study:

The main objectives of the present study are:

- to see if PWS differ from PWNS on a subjective evaluation of anxiety
- to investigate if PWS differ from PWNS in attention as measured using reaction time
- to investigate if Stroop task can be used as an objective measure of attentional bias in PWS compared to PWNS

- to establish a relationship, if any, between negative emotions and speech production in PWS

Chapter 2

Literature Review

“When you stutter you are always in a country where you don’t speak a language.”

Kevin, an adult who stutters

Communication is an essence of human life. Speech is a verbal manifestation of communication which is made up of components such as voice, fluency, articulation and prosody.

2.1. Fluency

Fluency in simple terms is the ability to speak or read accurately and quickly along with appropriate expressions and without conscious effort. The flow of speech is easy and smooth with respect to the sound and information without any breakdown in the message being conveyed to the listener.

The term fluency derived from the Latin word for “flure” which describes what the listener perceives when listening to someone who is truly adept at producing speech. The speech flows easily and smoothly in terms of both sound and information, where there are no disruptions in the sequence of sounds and words and the listener comprehends the spoken message. The ability to speak fluently plays an important role in communication in the society and any disruption in this will have a negative impact on the quality of life.

Starkweather (1987) suggests that fluency can be considered as having both speech as well as language components and defines speech fluency in terms of continuity, rate, duration, coarticulation, and effort. He also suggests that fluent speech is characterized by little attention being paid to the process of production; speaking is “automatic”.

Stuttering is known to be one of the most commonly occurring fluency disorders with an incidence of 5% (Mansson, 2000) and a prevalence of less than 1% for adults (Andrews et al, 1983). It is a typical developmental disorder which begins in early childhood around 30 months (Yairi & Ambrose, 1992) and persists to adulthood (Gordon, 2002; Craig & Tran, 2005). It is a highly variable condition and depends on the situation involving cognitive or an emotional stress (Bosshardt, 2006). The term dysfluent is used to describe the abnormal fluency breaks of people who stutter (PWS).

2.2. Stuttering and its causes

Stuttering is a multifaceted and a mysterious disorder. Johnson (1946) defined stuttering as the behaviour exhibited by a person who stutters to avoid the dysfluent speech, reflecting on the etiology of the disorder. According to Brutton and Shoemaker (1968), stuttering is that form of fluency failure that results from a conditioned negative emotion”. Conversely, for those who viewed stuttering as a type of primary neurosis, a symptom of basic emotional or psychological conflict, there is the tendency to define stuttering by citing the presumed source of conflict (cause) rather than by describing the stuttering behaviour. Taking a similar approach Glauber (1958) described stuttering as a

“symptom in the psychopathological condition classified as a pregenital conversion neurosis”.

One of the most cited and comprehensive definition given by World Health Organisation (WHO) in 2005 based on the ICF classification, define stuttering in 3 levels: (1). Impairment: neuropsychological and neurophysiologic events that immediately precede and accompany the audible and visible events of stuttering. Disruptions of speech and language production typically characterized by certain interruptions in the forward flow of speech and any associated audible or visible characteristics of those interruptions if present; (2). Disability: the audible/visible events that are the behavioural manifestations of stuttering that put limitations on the individual’s ability to communicate and (3). Handicap: The disadvantages resulting from reactions of persons who stutter and listener to the audible and visible events of a person’s stuttering which create limitations on a person’s life, lack of fulfilment an individual has in his social life, school, job and community. Disability and handicap results from the way a person and significant listener respond to his stuttering rather than from stuttering itself.

Research since decades have tried to establish the cause of stuttering, yet, the sole cause of stuttering is not known. Is it the psychological constraints or emotions which lead to stuttering or is the disorder itself rooting to the psychological issues is still a debatable topic.

The primary components of stuttering includes the core behaviours, i.e., repetitions, prolongations and blocks (Van riper, 1971, 1982). The other components include the secondary behaviours such as the physical concomitants, escape and

avoidance behaviours and the feelings and attitudes. Stuttering usually tends to precipitate and leads to a handful of negative emotions such as a fear, frustration, anger, embarrassment etc. Situational fear and fear on a particular sound /word or fear for persons can increase tension and disrupt thinking leading to more stuttering which might lead to the development of negative feelings and attitudes.

One of the most frequent queries posed by an individual with stuttering or the parent of a child with stuttering is about the cause of stuttering. There are a variety of causes underlying this disorder and as yet there is no single cause which can be pinpointed as to the actual cause of stuttering. Many definitions have been put forth by many authors who define the disorder from different perspectives, yet there is no one generally accepted definition or description of the disorder. The description of stuttering makes it seem like a very complicated problem, one that will take a long time to learn about.

According to Perkins, Kent and Curlee (1991), speech involves linguistic and paralinguistic components where both the components have common output systems. However, each component is processed by separate neural systems. Both these components hence needs to be integrated in synchrony as it is an important requirement of fluent speech and any disruption in the synchrony can occur when the parts of speech plan are not timed correctly leading to stuttering.

Several theoretical perspectives have been proposed to account for constitutional factors in stuttering. They include views of stuttering: (1) as an anomaly of how the brain

is organised for speech and language (Lee Travis, 1927), (2) as a disorder of timing of the sequential movements for speech, (Van riper 1990), (3) as a result of deficits in the internal modelling process used to control speech production (Neilson & Neilson, 1987), (4) as a disorder of spoken language production (Kolk & Postma, 1997) and (5) as a result of physiological tremor in speech musculature. The first 4 views focus on dysfunctions of cortical and subcortical mechanisms that control the planning and production of speech and language to produce the initial repetitions and prolongations of early stuttering. The last view targets neuromuscular malfunction that may explain the tension and tremors of secondary stuttering.

Theories concerning developmental, cognitive, psychological and environmental factors include: (1) the diagnosogenic theory which implicates the listeners response to the disfluencies of the child (Wendell Johnson (1943), (2) the anticipatory struggle theory which suggests that a child may develop stuttering as a result of negative anticipation of speaking after he has had frustrating or embarrassing experiences in communicating (Bloodstein, 1987, 1997), and (3) the demands and capacities theory which postulated that stuttering arises when the child's capacity for rapid fluent utterances are unequal to the demands within the child himself or within the environment (Starkweather, 1987).

A two stage etiological model of stuttering was proposed by Guitar in 1998. According to this model the first stage is primary stuttering, which involves repetitions and prolongations that are frequently the first signs of stuttering. These signs are thought to be the result of constitutional factor: a dyssynchrony at some level of the speech and language production process. The second stage is secondary stuttering which involves the

tension, struggle, escape and avoidance behaviours that are often present in persisting stuttering. These behaviours are proposed to be the result of a separate constitutional factor: a reactive temperament that triggers a defence response from behavioural inhibition system that makes the individual more emotionally conditionable than the average speakers.

2.3. Stuttering as an emotional/ psychological disorder

The physiology of stuttering is better understood than the psychology of the fluency disorder. A sharp dichotomy exists between researchers who belong to the school of thought where stuttering is considered to occur as a symptom and result of emotional disturbance (Barbara, 1982). They suggested that stutters exhibit signs of psychological maladjustment. Alternating to this there were researchers from the second school of thought who viewed stuttering as a physiologically based disturbance with potential emotional concomitance (Rosenfield, 1984).

All psychological interpretations of stuttering believe that emotion of a negative character plays a central role in the occurrence of the dysfluencies.

Because people who stutter are a heterogeneous group, the relationship between emotion and stuttering like the relationship between language and stuttering, will vary among individuals. For some, emotion maybe an important etiological factor that triggers the onset of stuttering and makes recovery difficult for them. The experience of stuttering generates emotions such as frustration, fear and anger in everyone who stutters.

Wingate in 1976 reported that the periods of disfluency varied depending on the linguistic and emotional load by the environmental interaction in children between the ages ranges of 3-5 years.

2.4. Anxiety and Negative Emotion

Negative emotions related to stuttering extend to social anxiety in a subgroup of individuals with stuttering (Stein, 1996). Researchers following upon the impression that people stutter because they are nervous have used such terms such as “anxiety”, “autonomic arousal,” and “negative emotion” to specify the emotional states that may cause or accompany stuttering. In an early study of anxiety and stuttering, Horovitz (1978) looked at the phenomenon called stapedial reflex, which had been previously shown to increase during anxiety in normal speakers. He found that PWS demonstrated an increased stapedial reflex when they became more anxious compared with no anxiety condition. A group of matched PWNS showed no increase in stapedial reflex.

Several studies done to measure the anxiety levels in PWS using the physiological tests like heart rate, skin conductance etc found that PWS show high levels of autonomic arousal when they have to speak or read aloud and this was associated with more disfluencies in PWS (Caruso, 1994; Miller, 1993; Weber & Smith 1990).

Van Dam- Baggen and Kraaimaat (2002) examined social anxiety in 89 PWS and 131 PWNS by administering the inventory of Interpersonal Situations (IIS), a social anxiety inventory. The results revealed that PWS showed significantly higher levels of

emotional tension in social situations compared to PWNS. Moreover, about 50% of PWS had scores falling in the range of highly socially anxious psychiatric patients and they concluded that the measurement of social anxiety thus plays an important role in the assessment of adults who stutter.

2.5. Anxiety and types

Anxiety can be classified as trait and state anxiety. Trait anxiety refers to a more general and a relatively stable tendency to respond with anxiety, whereas state anxiety reflects a more transitory and a temporary condition of anxiety that can differ between situations (Laux, 1981).

Catell, (1966) was the first person to discriminate between trait and state anxiety. Spielberger (1966, 1972, & 1976) further elaborated on these types of anxiety. Spielberger (1983) described the trait anxiety as a stable susceptibility or a proneness to experience a state anxiety. He described state anxiety as existing in a transitory emotional state that varies in intensity and fluctuates over time. He describes the process of experiencing anxiety as an interaction between the internal and external stimuli, defence mechanism and cognitive processes in a temporal sequence. According to the model of state – trait anxiety proposed by Spielberger (1983), an anxious state which is manifested in the form of any physiological change and arousal of negative thoughts is triggered by either an external stimuli (e.g., a threat/ shock) or an internal stressor (muscular or peripheral activity). The cognitive appraisal of an internal or external cue as threatening leads to a state of anxiety and a behavioural as well as cognitive defence processes are activated in order to fight the anxiety.

Trait anxiety is a reflection of the state anxiety experienced in the past, hence increasing an individual's sensitivity to experience further anxiety by interacting with the cognitive appraisal of a negative internal or an external stressor.

2.6. Tool for assessing anxiety

One of the widely used inventories to assess the trait as well as state anxiety is the State Trait Anxiety Inventory (STAI) given by Spielberger (1968, 1977). The STAI is a diagnostic instrument sensitive in measuring anxiety in adults which distinguishes between the temporary state anxiety and a comparatively stable and a long standing trait anxiety. It is a tool in the form of a self-evaluation questionnaire for assessing personal anxiety worldwide. This tool is made up of 2 subscales with 20 items in each subsection, with a total of 40 items. In the state anxiety questionnaire the clinician asks the clients how they feel "right now". This scale consists of statements regarding subjective feelings of nervousness, apprehension, confusion and tension. The trait anxiety questionnaire consists of statements to indicate how the clients generally feel which evaluates generally stable conditions of thoughts, calmness, contentment and security. The client is instructed to respond to these statements by circling the appropriate number to the right side of the statement on a four point rating scale and similarly for the state anxiety questionnaire.

Craig and Hancock (1995) did find that adults who experienced self-defined relapse were 3 times more likely to indicate more trait anxiety levels. There is a need to distinguish between the behavioural, physiological and cognitive- verbal components of anxiety in PWS to understand the underlying cause of the problem. This distinction plays

an important role in the diagnoses and treatment of anxiety associated with stuttering (Lang, 1971).

2.7. Stuttering and cognition

Stuttering is made up of 3 components: the ABC components, where A stands for Affective, B stands for Behavioural and C stands for Cognitive. Cognitive processes play an important role in influencing human behaviour. Cognitive process refers to a broad concept which involves the higher order executive functions of planning, attention processing, problem solving, verbal reasoning, and task switching (Monsell, 2003) and the initiation and monitoring of actions (Chan, Shum, Toulopoulou & Chen, 2008). The area in the brain responsible for the cognitive control is the frontal cortex (Wagner, Bunge & Badre, 2004). These processes making up cognition include language and perception, which refer to the organization, identification and interpretation of all the sensory information present in the environment.

Cognition and fluency share a complex relationship. Persons with cognitive deficits, especially when deficits are relatively severe, have a high incidence of stuttering (Van riper, 1982). This may occur for more than one reason. In the first place, typically rapid and complex speech and language production depends on fully functioning perception, attention, working memory and executive functions. A compromise in these process results in a breakdown in the spoken language.

Many studies have been done to understand the exact nature and the etiology of stuttering as to whether they have a deficient sensory motor control system or deficiency in the cognitive processing.

Ingham and Cordes (1997) viewed both the cognitive effort necessary for concentrating on a message and the muscular effort on exertion necessary for fluent speech production. Howell (2004) put forth his view on stuttering as it is a speech disorder which results from an impaired interaction between linguistic planning and execution of speech movements. He further explains that stuttering results when the cognitive and linguistic planning lags the speech production, hence supporting the assumption of a cognitive as well as a temporal discoordination.

One of the widely used measures to assess the cognition is the reaction time experiment. Reaction time experiments mainly involve tasks where the participants are asked to respond to the stimuli appearing on the screen as soon as possible, the instant it appears. The time between the appearance of an object on the screen and the response made by the participant is the reaction time. Tasks related to reaction time involve sensory analysis, cognitive processing, response planning, and response execution. Hence, reaction time is a potentially useful measure in stuttering research if it is thought that the core deficit is a delay in some aspect of sensory processing, planning or motor execution. The first experiments on people who stutter found that they were slower than PWNS in initiating and terminating vowel in response to a buzzer (Adams & Hayden 1976; Starkweather, Hirschman & Tannenbaum, 1976).

Later experiments showed that individual who stutter were slower whether they were responding to auditory or visual signals (Cross & Cooke, 1979). Following the wake of these studies which reported that PWS had slower reaction times and slower segments in their fluent speech, researchers began to examine complex motor coordination of non-speech muscles and structures. In a study of both sequential finger movements and sequential counting aloud fluently, Borden (1983) found that persons with severe stuttering, but not mild ones, were slower than PWNS in executing both finger movements and speech tasks. Thus, persons with severe stuttering may have substantial deficits in certain sensory-motor tasks, but mild ones may have only slight deficits in certain sensory-motor tasks.

Webster in 1993 developed a finger movement task in which participants tapped four number keys in a predetermined sequence. To make the task somewhat like speech, participants were assigned a novel sequence of keys at the beginning of each trial. In both timed and untimed tests, PWS made more errors in sequencing and were slower in initiating the task but were comparable to PWNS in execution time. Webster suggested that PWS may have difficulty in “response planning, organisation and initiation” (Webster 1993).

Yairi (1996) studied two groups of children who stutter (those who recovered and those who did not) and normal controls on an intelligence test, The Arthur Adaptation of the Leiter International Performance Test (Arthur, 1952). The group of children who continued to stutter scored significantly lower than the non-stuttering control group. However, children in the recovered group did not score significantly lower

than the controls. Hence, some cognitive abilities may be related to a neural resilience allowing recovery from stuttering. In other words, children with slightly higher cognitive functioning may have the extra resources needed to reorganize their speech and language processing, allowing them to develop a workaround for the problem causing them to stutter. Some aspects of cognitive development may compete with spoken language development for the same neuronal resources, thereby jeopardizing fluency.

Between the ages of 3 and 4 years, children's cognition mature enough so that they internalize the standards of behaviour of those around them including their peers. According to Lewis (2000), at this point children can evaluate how they are performing in comparison to others and will experience the "self - conscious" emotions of embarrassment, pride, shame and guilt. These emotions may play an important role in stuttering and its persistence.

2.8. Attention and cognition in relation to stuttering

Attention is one of an important component of higher cognitive processes which involves the behavioural control and judgemental actions or the ability to modify the strategies or use feedback functions in persons with fluency disorders. Attention, means concentrating on a particular aspect of the environment in the presence of distracters.

The central features of the cognitive and psychological theories of stuttering lies in attentional bias. The cognitive models and theories of stuttering assumed that the emotional status of the PWS not only leads to an attentional bias, it also plays an important role in its causation and maintenance.

The focus of attentional bias varies with the type of emotional trauma experienced by an individual, there exists a “vicious cycle” wherein the attentional process becomes hyper vigilant with respect to the areas of concern (e.g. threat of social harm or negative appraisals of others), leading to an emotional response (e.g. increased anxiety). Thus, this increase in the conscious awareness to those areas of concern tends to overestimate the level of threat ultimately resulting in an emotional disturbance. Results from a large number of studies done in this area of research confirmed that there is an attentional bias in individuals with emotional disorders as the attentional process in these individuals are biased to the threat related information. PWS exhibit a deficit in cognitive flexibility and they can adopt their strategy to succeed on a certain task, but this change in strategy is less flexible compared to people who do not stutter.

PWS exhibit attentional problem causing stuttering (Bosshardt, 2002; Vasic & Wijnen, 2005). In order to focus attention on relevant stimuli in the environment, cognitive control is necessary which puts forth a question as to whether there is an indeed attentional problem associated with the emotional disturbances or there is a broader problem in other cognitive control abilities.

PWS are conscious about their speech and are aware of the listeners’ reaction to their speech and as such it can be expected that these individuals have better ability in the process of shifting attention compared to the persons with cluttering. But individuals with cluttering seem to have a better ability in sustaining attention compared to persons with stuttering.

PWS show increased demands on the attentional resources when performing speech and language tasks under dual task conditions (Bosshardt, 2006; Jones, Fox, & Jacewicz, 2012; Heitmann et al., 2004; Smits- Bandstra & De Nil, 2009).

In a study done by Loisy and Roulin (2003) using dual task experiments where the subjects were asked to carry out 2 or more tasks simultaneously (e.g., to process both visual and verbal material simultaneously). The authors reported that the stuttering frequency decreased in PWS when the focus of attention was drawn away from speech production with a secondary task. Few other studies done with respect to this topic show an opposite result of the dual task experiments on the stuttering frequency (Bosshardt, 2002; Caruso, Chodzko, Zajko, Bidinger & Sommers, 1994) whereas some studies showed that there was no effects of these tasks (Kamhi & Mc Osker, 1982; Thompson, 1984). The nature of these attentional tasks is not completely understood.

2.9. Measure of attention : Stroop Task

Currently, Stroop task is one of the sensitive tasks of measuring the attentional bias (Williams, 1996). Stroop task is one of the most valid and reliable psychometric test (Jenson & Uechi, 1972). It measures the Stroop effect which reflects the attentional vitality and flexibility and is related to the ability to read the words quickly and automatically than naming the colour of the ink of the word. For example, if a word red is written in green ink then it takes a longer time to notice the green ink compared to reading the word as red which is a more automatic process.

This effect was first described by Ridley J Stroop in 1935 in his thesis. The area in the brain responsible for the accurate response during these tasks has been located in the anterior Cingulate which lies between the two hemispheres and is involved in a wide range of cognitive processes.

2.10. Emotional Stroop Task

Many variants of Stroop tasks are recently being used in many studies to compare across different psychological conditions to assess the nature and extent of the interaction between attention and psychopathology. The task varied with respect to colour and lexicality (threat and neutral).

A large body of research in the field of attentional bias towards linguistic materials had used the emotional Stroop task. Emotional stimuli attract more attention than neutral stimuli (Lang & Davis, 2006).

Emotionally loaded words led to the slowing in naming the ink colour when compared to the neutral words which suggests that there is a biasing of attention towards the words which are emotionally salient (Williams, Mathews & MacLeod, 1996).

Compton in 2003 compared the emotional words with low and high arousal in healthy individuals and found that there was a greater interference seen for highly arousing stimulus compared to the low arousing ones. He even noted a pronounced effect for negative words compared to its positive counterparts.

Both the neutral Stroop task as well as the emotional Stroop task makes an interpretation implying the suppression of the subject's responses to the information from the distracting word.

The emotional Stroop task showed that the patients with depression were slower in naming the colour of the depressed words as they had difficulty inhibiting careful thoughts which was initiated by the presentation of the negative words compared to the non depressive words (Gotlib & McCann, 1984).

The authors examined early as well as later effects of the emotional interference of the emotional Stroop stimuli on the attentional process (Bar-Haim , 2007; Franken, Gootijes, & Van strien, 2009; Sass et al.,2010; Taake, Jaspers- Fayer, & Liotti, 2009; Thomas, Johnstone, & Gonsalvez, 2007; Van Hooff, Dietz, Sharma & Bowman, 2008). Early effects (<300 ms after stimulus presentation) include increased early positive amplitudes like p1 (Sass et al., 2010;Taake et al., 2009; Thomas et al., 2007) and P2 (Carretie, Mercado, Tapia, & Hinojosa, 2001), as well as negative amplitudes, like the early posterior negativity around 200-300ms (Franken, 2009). Thus, the emotional content of the words is evaluated at an early stage. Later emotion modulations are interpreted as reflecting sustained emotional attention towards emotional Stroop words.

A research done by Sass recently in 2010 suggested that the N400 component was affected by the emotional value as it was found to have smaller values which indicated the semantic processing of emotional words.

MacLeod, (1991) reported that patients with anxiety disorder exhibit greater Stroop effect for the emotionally threatening words when compared to the neutral words. The patients with anxiety took longer time to name the ink colour of the emotionally threatening word such as 'tragedy' opposed to the neutral word such as 'corner' and such an effect was not seen in normal control individuals.

There are limited studies done to examine the influences of the trait as well as the state anxiety and the interactions between them on the emotional interference especially in individuals with stuttering (Broadbent & Broadbent 1988; Eglo & Hock 2001). Carusoet (1994) proposed that individuals with stuttering are comparatively slower in naming the ink colour of the incongruent words due to an increased cognitive load for these tasks.

The results of many of the studies done on the attentional processing in PWS suggested a greater interference between speaking and attention – demanding processing in individuals with stuttering compared to the speakers who do not stutter.

All the studies compiled so far mainly explain the importance of attention, a cognitive aspect which possibly acts as a predisposing and precipitating factor of anxiety in individuals who stutter. These studies mainly try to evaluate the findings of the study with respect to the relationship between anxiety, attention and its bias to the emotionally loaded words (either a neutral or a threat word).

It is not just the disfluencies in the verbal output of language, i.e., the speech which is usually highlighted when the topic of stuttering arises; there is more to stuttering including the psychological as well as cognitive perspective of the disorder. The reaction time tasks used in the studies mentioned previously add on to the available information about the impact of emotion on the cognition and fluency in persons with stuttering. The responses associated with emotional anxiety in these tasks highlights the role of emotional process in the cause and maintenance of stuttering (Kleinow & Smith, 2006).

The measures of emotional anxiety has shown a positive correlation between increase in stuttering utterances and the occurrence of a threat word., Further, the studies done in determining the attentional bias also support the notion that there exists an attentional bias. Several studies quoted have shown that the individuals with stuttering may have a deficient muscle command preparation which in turn affects the reaction time by increasing it compared to the control group (Grosjean, Van Galen, Peters, Van Lieshout, & Hulstijn, 1997; Hennessey, Nang & Beilby, 2008, Van Lieshout, Hulstijn & Peters, 1996a, 1996 b; Peters, 2000).

It was therefore interesting to compare the attentional bias in PWS in emotional neutral and threat words under different word lengths and verbal and nonverbal conditions compared to normal controls. The present study was hence planned to measure emotional anxiety and attentional bias to emotional threat words using emotional Stroop task.

Chapter 3

Method

The present study examined the attentional biases in persons who stutter (PWS), with their severity ranging from mild to severe by measuring the reaction time using verbal and manual emotional Stroop tasks. This was compared to the results of the State Trait Anxiety Inventory and all the variables were compared across the age and gender matched persons with no stuttering (PWNS).

3.1. Participants

The participants for the study were divided into 2 groups. The experimental group consisted of persons who stutter (PWS) and the control group consisted of persons with no stuttering (PWNS). The experimental group consisting of PWS was further divided into 3 subgroups based on the severity levels i.e., mild, moderate and severe.

Experimental group:

24 adult PWS, including 22 male and 2 female participants between the age ranges of eighteen to thirty years were considered for the experiment with 8 participants each in the mild, moderate and severe subgroups of PWS. The participants were recruited from the Department of Clinical Services, AIISH, Mysore, who were recently availing the therapy services or individuals who were just done with the OPD evaluation at the institute. All the participants were native Kannada speakers.

Inclusion criteria for the experimental group were:

- must be a literate with a minimum of class X
- must know to read and write Kannada fluently

- Normal hearing sensitivity
- Normal/ corrected vision
- No cognitive deficits
- No neurological deficits
- No sensory impairments
- No motor or physical impairments
- No other associated speech and hearing problems
- No orofacial anomalies
- No exposure to fluency modification or fluency shaping techniques for at least a year
- Should be diagnosed as having mild –moderate- severe stuttering by a qualified speech language pathologist

3.1.1. Control group:

The control group included age and gender matched 24 normal healthy individuals consisting of 22 males and 2 females, with no history of speech and language problems or any medical problems.

3.2. Instrumentation and materials

1. The testing was carried out using a dell vostro laptop with a 17 inch display screen.

2. The emotional Stroop task was programmed and the data was collected using reaction time software DMDX (5.0).
3. The levels of anxiety was measured using a tool known as the State Trait Anxiety Inventory (STAI) (Spielberger, 1968, 1977) which was translated to Kannada and again back-translated to English to check for the correctness of translated materials by 2 experienced Kannada speakers (see Appendix B).
4. Materials for Stroop task: Initially a list of 30 neutral and 30 threat words were prepared and was given to 20 normal individuals for a familiarity check. Words from both the sets were phonemically balanced with 10 words having 2, 3, and 4 syllables each. Based on the percentage scores obtained 15 threat as well as 15 neutral words were finalized with 5 words each in 2, 3 and 4 syllables groups. (see Appendix A for details). 2 sets of word lists, namely threat and neutral words, with 15 words in each list were prepared. The words were either in red or green colour. The coloured words were in Tunga font, with font size '72'. The finalized lists were programmed for the task using DMDX version 5.0 software for both the manual and verbal emotional Stroop tasks. The words were assigned with either red or green colour randomly with 15 red and 15 green stimuli in each task.
5. SPSS software version _17.0 was used for statistical analysis

3.3. Procedure

The experiment was carried out in a quiet room. The participants were made to sit in front of the laptop on a comfortable chair with arm rest with adequate light in the room. Initially informed written consent was obtained from all the participants and the tasks were carried out individually.

Initially the participants were instructed to complete the STAI inventory. Subsequently, the participants were given instructions for both the manual and verbal emotional Stroop tasks after a trial task using 4 stimuli (names of animals) was done for familiarity following the instruction after which the actual tasks were given.

Either red or green, neutral or threat stimuli word appeared randomly on the laptop screen, one after the other with an inter stimulus interval of 2000 ms and the interval for which the stimulus remained on the laptop screen was 1500 ms. For the manual task the experimenter instructed the participants to press the right control button whenever a word with red colour appeared on the screen, and left control button whenever a green stimulus appeared as quickly as possible. For the verbal task the experimenter instructed the participants to verbally name the colour of the stimulus word appearing on the laptop screen, loudly and as quickly as possible. The verbal responses were recorded by an inbuilt microphone of the laptop. After the trial task, making sure that the participants have clearly understood the tasks, they were asked to complete the actual task.

The data of the tasks, i.e., the reaction time as well as accuracy for each task were retrieved using DMDX software and analysis was done using SPSS software. The

normality of the data was tested using Shapiro Wilks test of normality. The variables following the normality were subjected to parametric tests such as multivariate analysis of variance and the variables which did not show normality were subjected to the non parametric tests such as Mann Whitney's Test and Kruskal wallis Test to check for the significance. The interaction effects between the variables were determined using tests of within subject effect. The correlational analysis was done using the Pearsons correlational test.

Chapter 4

Results and Discussion

The primary objective of the present study was mainly to determine if PWS differed from PWNS in attention which was measured using the emotional stroop task and to further check if there is any attentional bias to threat and neutral words used as a stimulus in the task and to correlate the findings with the scores of state – trait anxiety. The secondary objective was to compare the same objective between mild, moderate and severe group of persons who stutter.

The study was designed using cross-sectional and counterbalanced design. The dependent variables considered in the study were scores of state trait anxiety inventory, reaction time and accuracy on Stroop tasks. The independent variables included presence and severity of stuttering.

For the statistical analysis, SPSS (Statistical Package for the Social Sciences) – Version 17.0 software was used. Descriptive statistics, parametric and non-parametric tests were used to arrive at various statistical values.

A total of four conditions were employed in the study to examine the objectives using the stroop task including neutral and threat words under manual and verbal tasks. Reaction time and accuracy for all these four conditions was analysed and then compared as per the objective. The results of the present study are discussed under the following sub headings:

- I. Anxiety in PWS and PWNS -STAI
- II. Attention bias in PWS and PWNS

1. Stroop task: Manual - for neutral and threat words
2. Stroop task: Verbal task - neutral and threat words

The current experiment had a total of 60 stimuli, with 30 belonging to the verbal task and the rest 30 belonging to the manual task and each task having 15 neutral and 15 threat words.

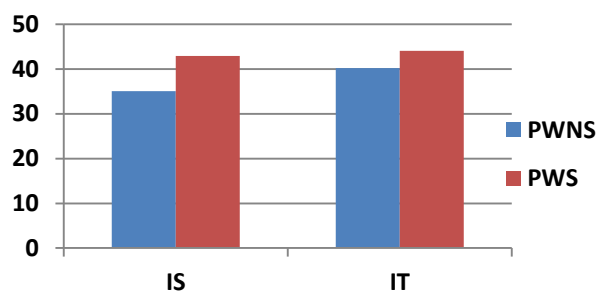
To compare between the groups, a test of normality, (Shapiro Wilks test of normality) was administered and it was observed that all the parameters followed normal distribution except for the severe group. The verbal tasks did not follow the normal distribution.

4.1. Anxiety in PWS and PWNS assed using STAI

The emotional anxiety between PWS and PWNS was estimated using the State Trait Anxiety Inventory (STAI).

4. 1: Mean and SD values of state and trait anxiety scores in PWS and PWNS

Inventory scores	PWNS	PWS
State anxiety scores (IS)	35.08 (10.1)	42.95 (9.9)
Trait anxiety scores (IT)	40.20 (7.37)	44.91 (9.15)



[Note: IS - Scores of State Anxiety, IT- Scores of Trait Anxiety, ACMT - accuracy of responses for manual task using threat words]

Figure 4. 1: Mean scores of state and trait anxiety in PWNS and PWS

As seen in table and figure 1, PWS had higher anxiety scores in both trait and state anxiety and slightly higher in trait scores compared to state anxiety levels compared to PWNS. Trait anxiety refers to a more general and a relatively stable tendency to respond with anxiety, which is typical of PWS because of their stuttering. There was a significant difference ($t = -2.716$; $p < 0.05$) seen in the State anxiety between PWNS and PWS.

Table 4. 2: Mean and SD values of state and trait anxiety scores in PWNS and PWS with mild, moderate and severe stuttering

Inventory scores	PWNS	Mild PWS	Moderate PWS	Severe PWS
IS	35.08 (10.10)	37.75 (10)	43.37 (9.86)	47.37 (8.43)
IT	40.20 (7.37)	39.13 (11.03)	45.0 (6.76)	50.37 (5.68)

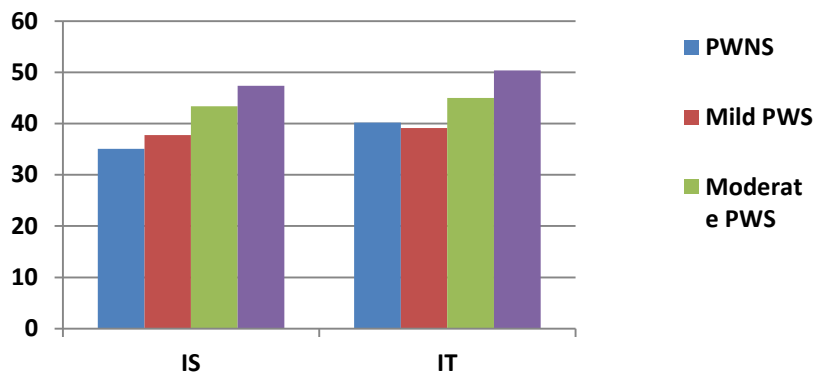


Figure 4. 2: Mean scores of state and trait anxiety in PWNS and PWS with mild, moderate and severe stuttering

The table and figure 2 show that the state and trait anxiety scores are increasingly higher with respect to severity of stuttering in PWS when compared to the PWNS. There is a significant difference seen in the state anxiety across the groups. The Pearson's correlation done resulted in a significant correlation between the state anxiety and the verbal tasks moderate and severe PWS compared to the other groups.

These findings regarding the state and trait anxiety is in consonance with the study done by Van Dam- Baggen and Kraaimaat (2002) which revealed that PWS showed significantly higher levels of emotional tension in social situations compared to PWNS. Moreover, about 50% of PWS had scores falling in the range of highly socially anxious psychiatric patients and they concluded that the measurement of social anxiety thus plays an important role in the assessment of adults who stutter.

PWS showed slightly higher levels of STAI state anxiety when compared to the trait anxiety which increases with the increased severity of stuttering which is corresponding to the previously quoted studies.

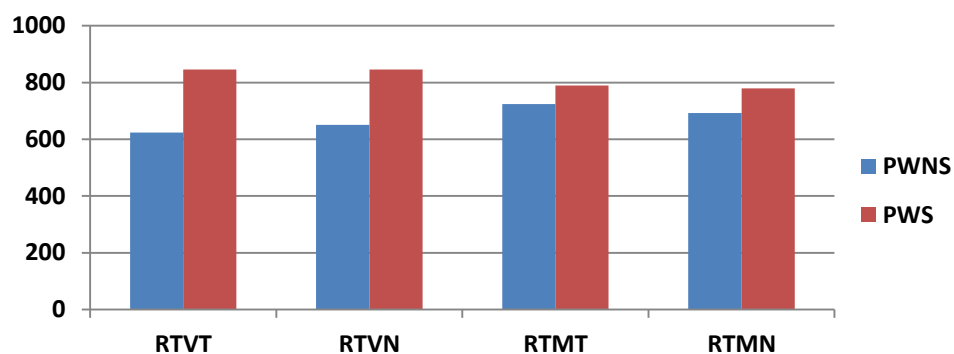
II. Attention bias in PWS and PWNS

1. Stroop task: Manual - for neutral and threat words
2. Stroop task: Verbal task - neutral and threat words

The main objective of the study was to compare the reaction time values between PWNS and PWS for both the manual and verbal emotional stroop task and to determine if there were any differences seen in the reaction time for neutral and threat words. The objective of this study was extended to compare the same among 3 groups of PWS (i.e. individuals with mild, moderate and severe stuttering).

Table 4. 3: Mean and SD values of reaction times for all the 4 conditions in PWS and PWNS

Tasks	Word Conditions	PWNS		PWS	
		Mean	SD	Mean	SD
Verbal	Threat	623.62	105.51	845.65	304.31
	Neutral	650.9	113.50	845.47	270.45
Manual	Threat	724.27	192.13	789.84	231.09
	Neutral	692.22	179.42	779.70	254.52



(Note: RTMT: reaction time for manual task using threat words, RTMN: reaction time for manual task using neutral words, RTVT: reaction time for verbal task using threat words, RTVN: reaction time for verbal task using neutral words)

Figure 4. 3: Mean reaction times for manual and emotional stroop tasks for both neutral and threat word condition in normal individuals as well as PWS

The Pearson's correlation done resulted in a significant correlation between the state anxiety and the verbal tasks moderate and severe PWS compared to the other groups. The mean values show an increased reaction time for PWS in both manual as well as verbal emotional stroop task compared to PWNS, however not significant. The reaction times were more for verbal tasks in PWS than PWNS compared to manual tasks. Same pattern of results were obtained on comparison of the reaction time means between the neutral and the threat words with increased reaction time seen for the threat words in the manual emotional task however not significant.

Table 4. 4: Mean and SD values of reaction times for all the 4 conditions in different sub-groups of PWS and PWNS

Groups	RTM		RTMN		RTVT		RTVN	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PWNS	724.27	192.13	692.22	179.42	623.62	105.51	650.90	113.50
Mild PWS	627.15	109.94	614.76	143.34	638.50	162.06	701.08	223.6
Moderate PWS	884.86	223.24	911.64	261.5	848.35	193.41	864.31	167.90
Severe PWS	857.52	260.26	812.70	267.75	1050.11	379.18	971.02	346.22

Note: RTMT: reaction time for manual task using threat words, RTMN: reaction time for manual task using neutral words, RTVT: reaction time for verbal task using threat words, RTVN: reaction time for verbal task using neutral words.

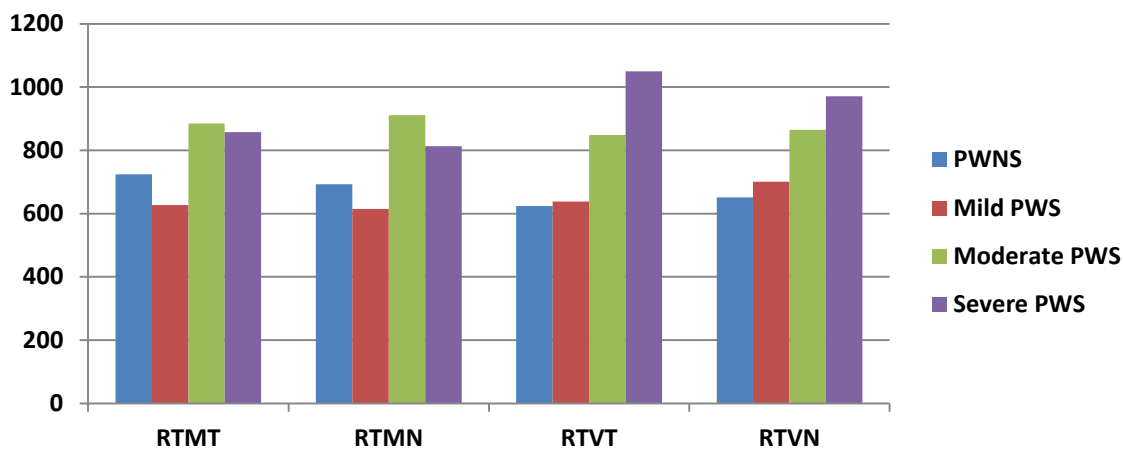


Figure 4. 4: Mean reaction times for manual and emotional stroop tasks for both neutral and threat word condition in PWNS and sub-groups of PWS

Table 4 and figure 4 show that the overall reaction time is lesser in PWNS as well as individuals with mild stuttering when compared to the moderate and severe PWS in both the verbal and manual emotional stroop tasks. However, the reaction times seemed to be high in the verbal tasks when compared to the manual tasks in severe PWS when compared to all the other groups. The mean reaction time is least (623.62 ms; SD=105.51) for the verbal threat condition (RTVT) in normal individuals and the highest (1050.11 ms; SD=379.18) was for the verbal threat condition (RTVT) seen in severe PWS.

Since the manual task followed the normal distribution, Levene's test for equality of variances as well as an independent sample t test was done which showed no significant differences between the manual task for both the threat as well as neutral condition in both PWNS as well as PWS. RTMT and RTMN followed a normal distribution and significant and therefore MANOVA was administered. Overall there was

no significant difference observed in the manual task therefore a least significant difference (LSD) test was administered to explore further and compare the mean of the first group with the other means, which is a form of extended T Test and only in the moderate to severe group a significant difference was observed.

Since the verbal tasks did not follow the normal distribution, Mann Whitney U test was performed which revealed significant differences between the tasks: RTVT ($Z = -2.784$; $P < 0.05$) and RTVN ($Z = -3.175$; $P < .0.05$).

On comparing the reaction times for verbal tasks across different groups, significant difference was found in the RTVT condition between mild-severe PWS ($Z = -2.42$; $p < 0.05$) as well as PWNS – severe PWS ($z = 2.84$; $p < 0.05$).

Wilcoxon signed rank test was done to examine the significance between the subject effects in all the four conditions. As per the results, there was no significant difference found between any of the four conditions in the group with severe PWS. There was no significant difference seen between the lexicality of words (neutral or threat words).

In the RTVN condition significant difference was seen in the reaction time scores whereas no significant difference was seen in the RTVT condition. The mild to severe group showed significant difference only for RTVT condition, whereas mild to moderate and moderate to severe showed no significant difference.

There was no significant difference seen between the manual and verbal emotional stroop tasks but between the task and the words there was an interaction effect

taking place which was seen only in PWNS. Participant mean reaction time was calculated for each condition. The means were analysed using multivariate analysis of variance. With the groups [PWNS vs. PWS (mild, moderate, severe)] and emotionality (neutral vs. threat) as independent variables. The comparison and the effect contrast for significant interaction were determined using least significant difference test and an alpha level of 0.05 was used with a significant difference of 0.061,0.812. This implies that there was a greater level of interaction occurring between the tasks given and the words taken, mainly seen in the severe group of PWS compared to the other groups.

Reaction was slightly increased in PWS when compared to PWNS, however was not significant and the same finding was seen in severe group of PWS when compared to mild and moderate PWS for verbal tasks. This result indicates that manual tasks irrespective of the motoric perspectives had the same amount of cognitive ability to name the colour despite of the stroop task. Significant difference exhibited by the group of persons with severe stuttering supports the previous studies of an impaired cognitive processing and an attentional bias which increases as the severity increases. This effect was seen more for the verbal task compared to the manual task. However, the lexicality effect was not seen in PWS suggesting impairment in the multitasking capability in these individuals, where they are paying attention only to the colour of the word and not on the semantic information as such the emotional bias is not seen. This finding is replicating with a large body of experimental results using emotional stroop tasks in individual with stuttering which reveals that they are slow at responding to the word. The results support previous research showing differences between PWS and controls in attentional processes

(e.g., Bosshardt, 2006; Eggers, De Nil, & Van den Bergh, 2010; Eggers et al., 2012, 2013; Heitmann et al., 2004; Karrass et al., 2006; Smits-Bandstra & De Nil, 2009) and in responses to emotion words (e.g., Adams & Dietze, 1965). The increased reaction time values in verbal tasks is suggestive of the problems faced by the PWS at the peripheral level in initiating the response due to increased anxiety and reduced attention.

In the manual emotional Stroop task, the participants pressed the corresponding colour button as quickly as possible. Unlike the verbal task, there was no significant difference in overall mean reaction time, collapsing across colour and length of button press, for threat and neutral words for either PWS or controls. Demands on the attention is lesser in a manual task compared to the verbal tasks in PWS.

For PWS, the reaction times in the manual task were significantly longer than the verbal task suggesting processing was not easier. Response choice in the manual task was challenged in a similar way to the verbal task by the additional requirement to respond with either a short or long button press. Furthermore, the manual task did reveal some processing differences between PWS and controls.

A number of studies report PWS can perform worse than fluent controls in non-verbal motor tasks, including finger tapping, suggesting an underlying deficit in movement control or timing (Max, Caruso, & Gracco, 2003; Olander, Smith, & Zelaznik, 2010; Smits-Bandstra et al., 2006). Broader limitations in motor skills, therefore, might explain slower responding for PWS in this manual task.

PWS show increased demands on the attentional resources when performing speech and language tasks under dual task conditions (Bosshardt, 2006; Jones, Fox, & Jacewicz, 2012; Heitmann et al., 2004; Smits- Bandstra & De Nil, 2009). The results contradict the study by Subramaniam and Yairi (2006), where they administered Stroop task on 3 groups, i.e., PWS, relatives of PWS and controls. They found that PWS group had shorter reaction time when compared to its control group and the relatives of PWS. The authors speculated that the results correlated with their hypothesis that PWS may use different speech motor control (including stages of processing, planning and production) strategies leading to a shorter reaction time for this group. They even suggested that there is no difference in the attentional process to manage the stroop effect.

4.2. Accuracy of responses

The next objective of the study mainly focused on the accuracy rates of the responses for both the manual as well as the verbal emotional stroop tasks. Accuracy was analysed with respect to correct and incorrect responses. The DMDX software saved the correct responses as '+' and incorrect responses as '-' which were then coded as 'RIGHT CONTROL' and 'LEFT CONTROL' respectively for the manual task but the percentage of accuracy had to be calculated by the experimenter by listening to the responses. The coded mean values of all correct and incorrect responses were analysed. The percentage of accuracy in responding to all the experimental conditions varied from 92% to 98%. The error rates were comparatively lesser in most of the paradigms.

The accuracy scores did not follow a normal distribution and there was a high percentage of accuracy across all the groups with a similar percentage of accuracy seen in the PWNS group as well as mild and moderate PWS and comparatively lesser percentage of accuracy seen in severe PWS.

Table 4. 5: *Mean Percentage of the accuracy rates for all the 4 conditions in PWS and PWNS*

Groups	ACMT	ACMN	ACVT	ACVN
PWNS	98.83	98.05	100	100
PWS	97.20	97.49	96.65	96.93

[Note : ACMT: accuracy percentage for manual threat words, ACMN: accuracy percentage for manual neutral words, ACVT: accuracy percentage for verbal threat words, ACVN : accuracy percentage for verbal neutral words.]

Table 4. 6: *Mean accuracy percentage scores for all the 4 conditions in different sub-groups of PWS and PWNS retain this table in place of table 5*

Groups	ACMT	ACMN	ACVT	ACVN
PWNS	98.83	98.05	100	100
Mild PWS	96.66	96.66	98.33	98.32
Moderate PWS	98.33	98.33	97.49	95.83
Severe PWS	96.6	97.48	94.15	96.65

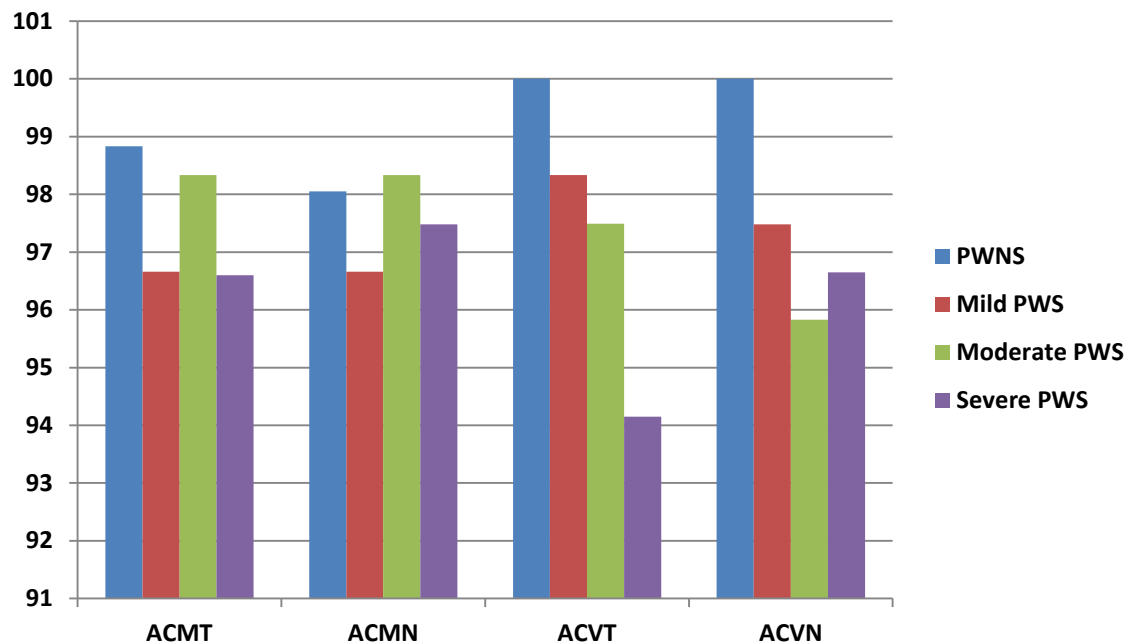


Figure 4. 5: Mean accuracy percentage scores for all the 4 conditions in different subgroups of PWS and PWNS

The high percentage of accuracy across different groups in the experiment reveals that the processing of the instruction to name the colours occur same as in the PWNS. Moreover, using only 2 colours in the experiment, made the task less ambiguous and easy to respond, with minimal effort on the cognitive output. Therefore the accuracy percentages of PWS were as good as the PWNS.

Hence, clearly there is no significant association of the emotionality or the lexicality of the words taken with the anxiety levels of an individual performing the task.

To conclude with the results of the study, there is no much significant effect of the lexicality of the words used in both the groups of participants taken for the study. However a significant difference seen between the tasks especially in the severe PWS

with an increased reaction time is suggestive of an increased cognitive loading as well as the effect of emotional anxiety on the tasks in these individuals.

Chapter 5

Summary and Conclusion

PWS exhibit an attention bias which may or may not be directly related to their anxiety as such and there is a need to devise an objective method of measuring the attention bias related to the emotional disturbance.

Only a few studies have used Stroop task to investigate the cognitive and emotional abilities of PWS. Quantification of the attention in terms of reaction time will give an insight into the anxiety and emotional disturbance exhibited in PWS. There is a dearth of studies done on PWS using emotional Stroop task.

The current study mainly aimed to determine and compare the emotional anxiety and the attentional bias in 4 groups of participants, (PWNS, mild, moderate and severe PWS) for neutral and threat words in 2 variants of stroop task. The emotional anxiety in the present study was determined using State Trait Anxiety inventory for all the 4 groups of participants. Investigating the stroop effect in both the tasks by measuring the reaction time and the accuracy across neutral and threat condition would reveal whether there exists any attentional bias between the PWNS and PWS in their ability to immediately react to name the colour of the word. This would also give us an insight about the emotionality effects, whether the lexicality (neutral or threat) has some effects on the reaction time and accuracy of the tasks. The STAI scores would reveal and support the emotional anxiety which would be one of the precipitating factors of the attentional bias between all the groups of participants taken.

The study included 24 PWS and age and gender matched 24 PWNS, the former with 8 participants each in mild, moderate and severe degree of stuttering. All the participants were initially administered the State Trait Anxiety Inventory. The experiment mainly consisted of 2 tasks. Task 1 probed into the attentional bias using the verbal emotional stroop task, where the participants had to verbally name the print colour of the neutral and the threat words presented randomly on the laptop screen using DMDX software and task 2 probed into the attentional bias when the manual mode was used for responding to the stimulus. Here the participants had to press the keys corresponding to the colour of the words that appeared on the screen.

The effect of this cognitive loading was compared across the severity groups among the PWS. This would reveal the possible attentional processing and the effect of emotional processing on it in the groups of participants taken for the study.

The results revealed the following:

1. There was only a slight difference seen in the anxiety levels between PWNS and PWS as a group, with a significant difference seen in the state anxiety, with PWS exhibiting a slightly greater state anxiety scores. Hence, supporting the previous studies that PWS exhibiting greater anxiety while performing a task.
2. Persons with severe stuttering showed increased state anxiety levels compared to the other groups. However there was no significant difference seen in the trait anxiety levels which explains that PWS show an increased levels of

anxiety under pressure due to cognitive loading when any task is given to them. This is evident from the state anxiety scores of the severe group.

3. The result of the current study also indicated the absence of the lexicality effect on the reaction time of the tasks used irrespective of their emotional loading. The results of the Manual stroop task showed no significant difference in the reaction time for both neutral and threat words on comparing between the PWNS and PWS indicating that the motoric perspectives of the manual movement is not having a great impact on the reaction time in PWS.
4. Though the reaction time exhibited by both groups of participants did not exhibit any significant difference between the neutral and the threat words in the verbal variant of emotional stroop task, the severe PWS showed slightly higher reaction time values overall.
5. It was observed that there was a significant difference seen between the PWNS and persons with severe stuttering as well as between the mild and severe ones with the severe ones exhibiting an increased reaction time values for the verbal tasks compared to the other groups. However, the presence of higher scores in severe PWS supports the finding that the verbal tasks lead to an increasing cognitive loading and an attentional bias towards the verbal task.
6. There was a high percentage of accuracy across all the groups taken and no significant difference was observed between the groups.

To conclude with the findings of the experiment, there exists a subtle difference between the reaction time of PWS and PWNS for manual and verbal tasks with an increased reaction time seen for the verbal tasks in PWS. However, the lexicality effects of the words taken do not have an influencing role in the emotional loading which in turn affects the attentional processing in PWS.

Yet it is still not clear whether the emotional anxiety has its own impact on the cognitive processing leading to attentional bias in PWS. There is clear evidence from the study that no significant difference in the reaction time is seen in PWNS irrespective of the tasks or lexicality but there exists a difference between the groups of PWS based on severity, especially in the severe group. Hence, this may aid in the categorization of PWS into different groups based on the cognitive processing ability.

5.1. Clinical implications

People who stutter usually tend to have increased levels of anxiety, particularly in social situations. The levels of anxiety will give us an insight regarding the severity as well as the impaired motor control for speech production in PWS.

The goals of the treatment involve helping PWS to not only change the obvious relatively overt behaviors of stuttering but also to improve the quality of life. The improvement in the emotional stability said to be lacking in PWS can be targeted during therapy which will aid the PWS to reduce the anxiety which is situation and person specific.

The objective measurement of the reaction time will help the speech language pathologists to probe into the cognitive deficits present in the persons with stuttering. The cause of stuttering whether it is the attentional bias or cognitive avoidance can be probed in. As the emotional stroop task here involves 2 modes of response (i.e., the verbal and the manual mode), the impaired mode or the better mode of response can directly be detected.

5.2. Limitations

- The study considered limited number of participants.
- The words used as neutral words in the study are a sort of positive valence emotional stimuli.
- The task probably is an easy task, hence leading to a decreased cognitive loading as only 2 color conditions were used.

5.3.Future directions

- To replicate the same study with increased number of participants and to compare between the reaction times using stroop tasks before therapy and after therapy among PWS
- To determine the effect of various colors with tasks using stimulus with 4-5 color condition and comparing between PWNS and PWS
- To check for the effect of the length of the syllables on the reaction time in both the emotional stroop tasks in PWNS and groups of PWS

- To probe into the speech motor aspects of the stroop effect response by determining the kinematic measures of speech motor control
- To provide increased insight into the cognitive ability of PWS using other cognitive tests such as visual processing or visual detection test (e.g Dot Probe Task , Macleod & Mathews, 1988)

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Appendix A: Stimulus used for the study

	2 syllable		3 syllable		4syllable	
	Threat	Neutral	Threat	Neutral	Threat	Neutral
1	ದುಷ್ಠ	ಸುಖ	ನಿರಾಸೆ	ಯಷಸ್ಸು	ಅಸಮರ್ಥ	ಪ್ರಾಮಾಣಿಕ
2	ಕೆಟ್ಟ	ಸ್ನೇಹ	ಕರುಣೆ	ಉನ್ನತ	ಕಿರುಕುಳ	ಪುರಸ್ಕಾರ
3	ದ್ವೇಶ	ವೀರ	ಕಡಿಮೆ	ಪ್ರಶಾಂತ	ಅನಾರೋಗ್ಯ	ಸ್ವಾಭಿಮಾನ
4	ಹಿಂಸೆ	ಆಸೆ	ದುರಾಸೆ	ಆರಾಮ	ಅಪಚಾರ	ಉಪಚಾರ
5	ಮೂರ್ಖ	ಜಾಣ	ವಿಫಲ	ಸುರಕ್ಷೆ	ಮುಜುಗರ	ಪ್ರಯೋಜಕ

Appendix B: Translated State Trait Anxiety Inventory in Kannada

State Anxiety:

1. ನಾನು ಶಾಂತವಾಗಿದ್ದೇನೆ	1	2	3	4
2. ನಾನು ಸುರಕ್ಷಿತವಾಗಿದ್ದೇನೆ	1	2	3	4
3. ನಾನು ಉದ್ವಿಗ್ನನಾಗಿದ್ದೇನೆ	1	2	3	4
4. ನಾನು ದಣಿವಾದಂತಿದ್ದೇನೆ	1	2	3	4
5. ನಾನು ನಿರಾಳನಾಗಿದ್ದೇನೆ	1	2	3	4
6. ನಾನು ನಿರಾಶನಾಗಿದ್ದೇನೆ	1	2	3	4
7. ನಾನು ನನ್ನ ದೌರ್ಭಾಗ್ಯಕ್ಕಾಗಿ ಈಗ ಚಿಂತಿಸುತ್ತಿದ್ದೇನೆ	1	2	3	4
8. ನಾನು ತ್ಯಾಜನಾಗಿದ್ದೇನೆ	1	2	3	4
9. ನನಗೆ ತುಂಬಾ ಭಯವಾದಂತಿದೆ	1	2	3	4
10. ನಾನು ಹಾಯಾಗಿದ್ದೇನೆ	1	2	3	4
11. ನಾನು ಆತ್ಮವಿಶ್ವಾಸದಿಂದಿದ್ದೇನೆ	1	2	3	4
12. ನಾನು ಒತ್ತಡದಲ್ಲಿದ್ದೇನೆ	1	2	3	4
13. ನಾನು ಭಯಗ್ರಸ್ತನಾಗಿದ್ದೇನೆ	1	2	3	4
14. ನಾನು ತೀರ್ಮಾನಕ್ಕೆ/ನಿರ್ಧಾರಕ್ಕೆ ಬಾರದ ಸ್ಥಿತಿಯಲ್ಲಿದ್ದೇನೆ	1	2	3	4
15. ನಾನು ಆರಾಮಾಗಿದ್ದೇನೆ	1	2	3	4
16. ನಾನು ಸಂತುಷ್ಟನಾಗಿದ್ದೇನೆ	1	2	3	4
17. ನಾನು ಚಿಂತಿತನಾಗಿದ್ದೇನೆ	1	2	3	4
18. ನಾನು ಗೊಂದಲದಲ್ಲಿದ್ದೇನೆ	1	2	3	4
19. ನಾನು ಸ್ಥಿರ ಸ್ಥಿತಿಯಲ್ಲಿದ್ದೇನೆ	1	2	3	4
20. ನಾನು ಅಹ್ಲಾದಕರ ಸ್ಥಿತಿಯಲ್ಲಿದ್ದೇನೆ	1	2	3	4

Trait Anxiety:

- | | | | | |
|--|---|---|---|---|
| 1. ನಾನು ಆರಾಮಗಿ/ಸುಖವಾಗಿರುತ್ತೇನೆ | 1 | 2 | 3 | 4 |
| 2. ನಾನು ಒತ್ತಡ ಹಾಗೂ ಆತಂಕದಿಂದಿರುತ್ತೇನೆ | 1 | 2 | 3 | 4 |
| 3. ನನ್ನ ಬಗ್ಗೆ ನನಗೆ ತೃಪ್ತಿಯಿದೆ | 1 | 2 | 3 | 4 |
| 4. ಇತರರಂತೆ ನಾನು ಸಹ ಸಂತೋಷದಿಂದಿರಬೇಕೆನಿಸುತ್ತದೆ | 1 | 2 | 3 | 4 |
| 5. ನಾನು ಸೋತವನಂತನಿಸುತ್ತದೆ | 1 | 2 | 3 | 4 |
| 6. ನಾನು ವಿಶ್ರಾಂತಿಯಿಂದಿರುವಂತಿದೆ | 1 | 2 | 3 | 4 |
| 7. ನಾನು ಸ್ಥಿತಪ್ರಜ್ಞನಾಗಿದ್ದೇನೆ | 1 | 2 | 3 | 4 |
| 8. ತೊಂದರೆಗಳು ರಾಶಿಯಾಗುತ್ತಿದ್ದು ನನ್ನಿಂದ ಅದನ್ನು ಎದುರಿಸಲು ಸಾಧ್ಯವಾಗುತ್ತಿಲ್ಲವೆಂದೆನಿಸುತ್ತಿದೆ | 1 | 2 | 3 | 4 |
| 9. ಮುಖ್ಯವಲ್ಲದ ವಿಚಾರಗಳ ಬಗ್ಗೆ ನಾನು ಹೆಚ್ಚು ಚಿಂತಿಸುತ್ತೇನೆ | 1 | 2 | 3 | 4 |
| 10. ನಾನು ಸಂತೋಷದಿಂದಿದ್ದೇನೆ | 1 | 2 | 3 | 4 |
| 11. ನನಗೆ ಗೊಂದಲದ ಆಲೋಚನೆಗಳಿವೆ | 1 | 2 | 3 | 4 |
| 12. ನನಗೆ ಆತ್ಮವಿಶ್ವಾಸ ಕಡಿಮೆ | 1 | 2 | 3 | 4 |
| 13. ನಾನು ನಿರ್ಭಯದಿಂದಿದ್ದೇನೆ | 1 | 2 | 3 | 4 |
| 14. ನಾನು ನಿರ್ಧಾರಗಳನ್ನು ಸುಲಭವಾಗಿ ತೆಗೆದುಕೊಳ್ಳುತ್ತೇನೆ | 1 | 2 | 3 | 4 |
| 15. ನಾನು ಸಂಪೂರ್ಣನಾಗಿಲ್ಲವೆಂದೆನಿಸುತ್ತದೆ | 1 | 2 | 3 | 4 |
| 16. ನಾನು ತೃಪ್ತನಾಗಿರುವಂತಿದೆ | 1 | 2 | 3 | 4 |
| 17. ಕೆಲವು ಮುಖ್ಯವಲ್ಲದ ಯೋಚನೆಗಳು ಮನಸ್ಸಿನಲ್ಲಿ ಬಂದು ನನ್ನನ್ನು ಕಾಡುತ್ತವೆ | 1 | 2 | 3 | 4 |
| 18. ನಾನು ನಿರಾಶೆಗಳಿಗೆ ಪ್ರಾಮುಖ್ಯತೆ ಕೊಡುತ್ತೇನೆ ಹಾಗೂ ಅವುಗಳನ್ನು ಮನಸ್ಸಿನಿಂದ ತೆಗೆಯಲು ಆಗುವುದಿಲ್ಲ | 1 | 2 | 3 | 4 |

19. ನಾನು ಸ್ಥಿರ ವ್ಯಕ್ತಿ 1 2 3 4
20. ನನ್ನ ಇತ್ತೀಚಿನ ಕಾಳಜಿ ಹಾಗೂ ಆಸಕ್ತಿಗಳ ಬಗ್ಗೆ ಯೋಚಿಸಿದಾಗ ನಾನು ಒತ್ತಡ ಹಾಗೂ ಗೊಂದಲ
ಸ್ಥಿತಿಗೆ ಹೋಗುತ್ತೇನೆ 1 2 3 4