NONWORD REPETITION SKILLS IN 5-6 YEAR OLD KANNADA SPEAKING CHILDREN WITH AND WITHOUT STUTTERING

Register No: 06SLP018

A Dissertation Submitted in Part Fulfillment for the Degree of

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ALL INDIA INSTITUTE OF SPEECH AND HEARING

MANASAGANGOTHRI

MYSORE-570006

DEDICATED TO ……..

……..MY LORD JESUS……

……...MY DEAREST MUMMY & DADDY……..

……..AND MY LOVING TWIN SIS SIMMY……..

……Who Have Been Close To My Heart Always……

Certificate

This is to certify that this dissertation entitled **"Nonword Repetition Skills In 5-6 Year Old Kannada Speaking Children With And Without Stuttering"** is a bonafide work in part fulfillment for the degree of Master of Science (Speech Language Pathology) of the student Registration No. 06SLP018. 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
April, 2008

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Certificate

This is to certify that this dissertation entitled **"Nonword Repetition Skills In 5-6 Year Old Kannada Speaking Children With And Without Stuttering"** has been prepared under my guidance and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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Declaration

This Dissertation entitled **"Nonword Repetition Skills In 5-6 Year Old Kannada Speaking Children With And Without Stuttering"** is the result of my own study under the guidance of Prof. Y. V. Geetha, Professor of Speech Sciences, Department of Speech Language Sciences, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier in any other University for the award of any Diploma or Degree.

Mysore

April, 2008 **Register No.** 06SLP018

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" THANKS is such a little word, no longer than a minute.
But.....there is a world of meaning and appreciation in it."

This little word is all I have to tell to all who helped, supported, and guided me to complete this study.

"Every good and perfect gift is from above, coming down from the Father of the heavenly lights, who does not change like shifting shadows."

- James 1:17

Thank you ***God Almighty*** for helping and guiding me to complete this study, and thank you for all those wonderful people who were there with me. God, your just too great……thanks for answering my every prayer, not the way I wanted, but in the way that seemed was the best for me.

"Blessed is the man who finds wisdom, the man who gains understanding……"

- Proverbs 3:13

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"Train a child in the way he should go, and when he is old he will not turn from it."

- Proverbs 22:6

Daddy and mummy, you both did just that. A perfect father and mother are very hard to find….. I guess, I am just too lucky.

"Two are better than one……"

- Ecclesiastes 4:9

Thank you God again, for blessing me with an other "me", yes, my twin. ***Simmy***, I know you took so much of trouble to make me understand things……. Thanks for being there by my side always. Hey, I really don't know if I would have made it this far in life, if you were not there with me.

"There is a time for everything, and a season for every activity under heaven:
a time to be born and a time to die,
a time to plant and a time to uproot,
a time to kill and a time to heal,
a time to tear down and a time to build,
a time to weep and a time to laugh,
a time to mourn and a time to dance,
a time to scatter stones and a time to gather them,
a time to embrace and a time to refrain,
a time to search and a time to give up,
a time to keep and a time to throw away,
a time to tear and a time to mend,
a time to be silent and a time to speak,
a time to love and a time to hate,
a time for war and a time for peace.

- Ecclesiastes 3: 1-8

My dearest friends, classmates, juniors, and seniors, thanks for being there through all times of my life and for making these six years in AIISH a very memorable one. Thank you all for your prayers…….. I know these pages aren't enough to mention each and every one of your names …….. **"I will surely miss you all".**

Thanks……..

A very big thanks to all those **little kids**, who participated in this study, and so attentively sat through the whole testing……. you kiddies sure have a lot of patience……

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CHAPTER I

INTRODUCTION

"Stuttering"……a riddle wrapped in a mystery inside an enigma.

-Winston Churchill, 1939

The World Health Organization (WHO, 1977) defined stuttering disorders as: 'Disorders in the rhythm of speech, in which the individual knows precisely what he wishes to say, but at the same time is unable to say it because of an involuntary repetition, prolongation or cessation of a sound.'

According to The Stuttering Foundation of America (1997): 'Stuttering is a communication disorder characterized by excessive involuntary disruptions in the smooth and rhythmic flow of speech, particularly when such disruptions consist of repetitions or prolongations of a sound or syllable and when they are accompanied by emotions such as fear and anxiety and behaviors such as avoidance and struggle' (Cited by Kalinowski & Saltuklaroglu, 2006).

Disfluency behaviors in the speech of individuals who stutter and who do not, have been categorized in several ways by linguists (Maclay & Osgood, 1959; Blankenship & Kay, 1964; Levin & Silverman, 1965; Goldman- Eisler, 1968; Mahl, 1981) and by speech pathologists (Starkweather, 1987). The disfluencies, as given by Wendell Johnson and his associates (Johnson & associates, 1959; Johnson, 1961; Williams, Silverman & Kools, 1968), are mostly used to differentiate between those who

stutter and who do not. It includes the part-word repetitions, word repetitions, phrase repetitions, interjections of sounds, syllables, words and phrases, revisions, disrhythmic phonations and tense pauses. Among these, certain types of disfluencies are more characteristic of stuttering behavior than of the normal disfluencies that commonly occur alongside the development of speech and language skills in the preschool years as well as in adults. These include an increase in the number of repeated part-word units, decrease in rhythmic stress patterns in repetitions, increase in speed of repetitions (Yairi & Lewis, 1984; Yairi, 1997).

Though clinicians are aware of the types of disfluencies characteristic of stuttering behavior and the normal disfluencies seen in individuals who stutter, they must be cautious in diagnosing the condition because stuttering is a disorder of high variability, showing both inter- and intra- individual variability. This variability is with respect to the type of disfluencies (sound/syllable repetitions- its frequency, number of unit repetitions, presence of schwa vowel during repetitions, prolongations and hard articulatory fixations), frequency and duration of disfluencies and presence of secondaries (eye blinking, nose flaring, facial grimaces, head or limb movements associated with stuttering block). Stuttering also varies with respect to situations, particularly with places, people and language. Diagnosis of stuttering, hence, is a challenging task for the clinician.

Another challenge is regarding an explanation for stuttering. Since long, researchers have been trying to find the etiology of stuttering. Among the various theories of stuttering, some theories attempt to explain why people begin to stutter or the factors

that cause them to be at greater or lesser risk for stuttering. Others attempt to explain the symptomatology and phenomenology of moments of stuttering, and still others attempt to explain why the disorder persists after it has begun.

But, till date no theory or hypothesis exists which is generally accepted as being adequate to provide a conceptual framework regarding an explanation for stuttering. The fact that researchers do not agree upon a common etiology for stuttering has several implications for clinicians.

First, the clinicians themselves have to decide which explanations for stuttering are the most plausible, which are the most consistent with both research on the disorder and information they have received from their clients (Perkins, 1990). Thus, competent clinicians can differ on how they explain aspects of its etiology. For example, Cooper and Rustin (1985) reported that 32 % of a sample of 371 speech language pathologists in the U.S. whom they surveyed agreed with the fact that stuttering is the result of an underlying physiological impairment. The others either were 'undecided' or disagreed. Such results only confuse the clinician more. Also, new information obtained regarding this could either strengthen the clinician's confidence in the plausibility of the explanation or cause him or her to change it.

A second implication of the lack of agreement about the etiology of stuttering is that it results in a lack of agreement about how to treat the disorder. The approach a clinician uses to treat a disorder should be based, at least in part, on the assumptions he or

she makes about its etiology (Williams, 1968). If, for example, a clinician believes that a client's stuttering is a symptom of psychopathology, he or she should treat the disorder, at least in part, by means of psychotherapy. On the other hand, if a clinician believes that an aspect of client's stuttering is a learned behavior, he or she should treat it by means of learning-theory-based behavior modification strategies.

A third implication is that each clinician has to decide the best way to answer a client on the etiology of stuttering. Researchers disagree not only about the cause of stuttering, but about whether it always has the same cause (Van Riper, 1982). The manner in which the question is answered can affect the person asking it in various ways. For example, for some the answer is more likely to have a negative impact if it indicates that the cause is "psychological" rather than "physiological".

These have added on to the challenges faced by clinicians. Hence, for decades researchers have been trying to identify differences among persons with stuttering and their normal counterparts in order to prove these theories of etiology. This is more important as early differentiation of children with stuttering from so called 'normally disfluent' has posed a great challenge to clinicians in view of overlapping symptoms and its episodic nature in the early stages of development of stuttering. Studies have found that children who stutter (CWS) tend to differ from their peers in a range of skills.

Among these, language and linguistic aspects share a major concern. Breakdown in fluency of speech has been viewed as a subtle expression of some level of language

processing problem. Murray & Reed (1977), Byrd & Cooper (1989), Ryan (1992) and others have noted that majority of children who stutter (CWS) consistently score lower than children who do not stutter (CWNS) on standardized language tests. There is also evidence that there may be a link between early stuttering and phonological deficit (Louko, Edwards & Conture, 1990; Postma & Kolk, 1993; Kolk & Postma, 1997; Louko, Conture & Edwards, 1999), which have led to the development of the Covert Repair Hypothesis (Postma & Kolk, 1993), arguing that stuttering is related to an unstable phonological system.

However, these studies have been done using standardized language tests or spontaneous speech sampling, which are primarily designed to identify frank language disability for diagnostic and therapeutic purposes and so are unlikely to provide the more precise discrimination between the groups that may be required when either subtle depression of skills or weakness in a very specific domain of language exists (Bernstein & Ratner, 1997). Search for more measures capable of distinguishing between groups of children have led to a more sensitive measure of children's linguistic ability, that is, "nonword repetition".

Nonword repetition tasks have been used mainly for testing phonological working memory skills in children (e.g., Dollaghan, Biber & Campbell, 1993, 1995; Gathercole & Baddeley, 1996; Dollaghan & Campbell, 1998) and adults (Gupta, 2003). However, Dollaghan and Campbell (1998) found that the differences in language skills between children enrolled in language intervention and those with normal language skills could be

better distinguished using a nonword repetition task than a norm- referenced language test. The relationship between performance on a nonword repetition task and actual language ability was further confirmed by Botting & Conti-Ramsden (2001).

There are only a handful of studies done with respect to nonword repetition in children with stuttering (CWS) (eg., Hakim & Ratner, 2004; Anderson, Wagovich & Hall, 2006; Seery, Watkins, Ambrose & Throneburg, 2006; Bakhtiar, Abad Ali & Sadegh, 2007). These studies examined how the number of correct responses, phoneme errors and fluency varied across different syllable lengths, during a nonword repetition task in CWS compared to children with no stuttering (CWNS). They also examined the relationship between language skills/phonology and nonword repetition skills.

Although linguistic and phonological skills in general in CWS have been studied to some extent, studies related to nonword repetition in particular, have not been attempted in the Indian context. The results of performance of CWS on nonword repetition skills studied in the English language (eg., Hakim & Ratner, 2004; Anderson et al., 2006; Seery et al., 2006) and Persian language (Bakhtiar et al., 2007) cannot be generalized to the CWS in India without ample research. Also, India being a multi-lingual country has various linguistic issues on its own. These support the need for the present research which aims to study the nonword repetition skills in Kannada speaking CWS.

Need for the study

In the Indian context there is a dearth of research pertaining to stuttering in general and CWS in particular. India being a multi-lingual country, there is vast scope for research pertaining to linguistic issues influencing stuttering. Also, studies related to nonword repetition have not been attempted in the Indian context and hence the need for this study. It is also interesting to know the differences if any in nonword repetition skills in Kannada, a Dravidian syllabic language, compared to English.

Aim of the study

This study is aimed to probe into the nonword repetition skills of young children with and without stuttering. The objectives of the study are aimed to answer the following hypotheses:

- Children with stuttering (CWS) do not differ from children without stuttering (CWNS) in the number of correct responses produced on a nonword repetition task compared to a word repetition task.

- There is no difference in the fluency of nonword repetition responses as nonword length (in syllables) increases.

- There is no relationship between language performance and nonword repetition performance for CWS and CWNS.

- There is no relationship between the phonological/phonetic development and nonword repetition abilities.

CHAPTER II

REVIEW OF LITERATURE

Stuttering is a disorder of high variability and is often described as a mystery, enigma or a puzzle. There are various questions about stuttering which are unanswered even after decades of research by people from various disciplines or answered inadequately. Some of these are: Is stuttering physical, psychological both or neither? Can parents cause it, exacerbate it, and cure it or neither? Is it a relatively straightforward speech disorder or is it impairment or a disability and/or a handicap, all of which represent complex interactions of neurological, physiological, anatomical, linguistic, emotional, social and other characteristics? Can it be treated? Should it be treated? By whom, when and how and why? What treatment results should be demanded or expected? What constitutes acceptable evidence that a reported result has truly been obtained? What constitutes acceptable evidence that a certain treatment was directly responsible for the obtained results? One is overwhelmed by the complexity and perplexity of the disorder, challenged or even excited by the difficulties that surround our attempts at understanding the management aspects of the problem.

In the quest to answer these questions, researchers have found a number of factors that place an individual at an increased risk for developing stuttering. Some of these factors are:

1. **Age -** The incidence figures show that preschool children are at greatest risk of developing a stutter. Three-quarters of all who stutter will have started before the age of six years and nearly all stuttering starts before age twelve (Andrews & Harris, 1964; Andrews, 1984; Kloth, Janssen, Kraaimaat & Brutten, 1995; Proctor, Duff & Yairi, 2002; Yairi & Ambrose, 2005).

2. **Genetic predisposition -** Stuttering tends to run in families. Children who have first-degree relatives who stutter are three times as likely to go on to develop a stutter. Male relatives of females who stutter shows the highest risk for developing stuttering (Andrews, 1984).

3. **Male-female ratio -** The ratio of male to female CWS is around 2:1 in very young preschool children (Yairi & Ambrose, 1992a, 1992b; Ambrose & Yairi, 1999). Seider, Gladstein and Kidd (1983b) found sex and type of relative to be a significant variable in the distribution of recovery and persistence of stuttering. Spontaneous recovery is common in both male and female children but the sex ratio in adults is around 4:1, indicating that more females than males spontaneously recover.

4. **Children with co-occurring speech and language problems -** Some research has shown that children who have concomitant language delay are at greater risk of stuttering than those who do not (Andrews & Harris, 1964; St. Louis & Hinzman, 1988). Similarly, some experts believe that those with a phonological

disorder are placed at increased risk of stuttering (Louko, Edwards & Conture, 1990). However, there are some researchers who have questioned these claims, arguing that better controlled studies are needed to confirm these findings (Nippold, 1990). A recent study found that a third of all children who stuttered also had co-occurring articulation disorders, while only less than thirteen percent of the 2628 normal children presented with phonological disorders. In total, around two-thirds of all the children who stuttered had some form of speech, language or non-speech disorder (Blood, Ridenour, Qualls & Hammer, 2003). However, there are many children who stutter who do not have a history of delayed speech and language, phonological or other language related disorders and most children who have such a history did not stutter (Silverman, 1992).

5. **Learning disorders -** Stuttering appears to be more prevalent amongst the learning disabled (LD). Blood et al. (2003) found that children with LD made up fifteen percent of their large sample of children who stuttered.

6. **Children with poor motor control -** Children who stutter are more likely to be late in achieving speech milestones and may have depressed articulatory skills (Wolk, Edwards & Conture, 1993).

7. **Environmental factors -** In addition to a genetic component, stuttering can be imitative and it is possible in some cases that a child who stutters may be picking up on a disfluent model. Some researchers have claimed that the extra pressure or

demands (for example, increased time pressure on verbal responses; being told to respond using advanced language; generally high level of expectation) can lead to increased risk of stuttering (Rustin, Botterill & Kelman, 1996; Stewart, 1960), as can negative listener reactions (Johnson, 1959).

Researchers studying these factors (eg., Andrews & Harris, 1964; Louko, Edwards & Conture, 1990, Yairi & Ambrose, 2005) have also found that children who stutter (CWS) tend to differ from their peers in a range of skills, including language (Hall, 2004; Weiss, 2004).

Johnson's (1959) study in which he looked at 150 CWS and 150 CWNS in the age range of 2;0-8;0 years, found no significant differences in the physical development of the two groups. This included such speech milestones as first word and first use of sentences. However, Andrews and Harris (1964) found that poor and delayed speech was clearly associated with stuttering. The stuttering groups were around four months retarded in the acquisition of first phrases and more of them had articulatory defects than the control group. If the variable of a positive family history is added to this, the result is a group which is five times more 'at risk' for developing a stutter than those children without these factors. In an earlier study by Morley (1957), similar findings were reported: as a group, the children who stutter were around three months delayed in the production of their first word, five months delayed in the use of first phrases and nearly a year delayed in the acquisition of intelligible speech.

Schwartz and Conture (1998) addressed the need to consider subgroups of individuals who stutter who exhibit certain patterns of skills. The presence of phonological disorders (Arndt & Healey, 2001) and language differences are among the prominent concomitant problems in stuttering, often reported in the literature. Studies have well documented that children who stutter differ in their speech and language skills, therefore requiring sub-grouping (eg. Louko, Edwards & Conture, 1990; Bloodstein, 1995; Ramig & Bennett, 1995, 1997a; Bernstein & Ratner, 1997b; Guitar, 1998; Melnick & Conture, 2000; Conture, 2001; Yairi, 2004).

Language and stuttering

Linguistic and language variables play such an important role in the moments of stuttering that it has attracted wider research during the past four to five decades. There are a number of findings which support the association between linguistic variables and stuttering (Wall & Meyers, 1982; Hamre, 1984; Homzie & Lindsay, 1984; Blood et al., 2003), indicating a linguistic basis for stuttering.

a. Loci of stuttering- Studies have investigated the loci and frequency of stuttered events related to the phonetic, lexical, syntactic and pragmatic components of language, which suggest there may be an interaction between linguistic processing and instances of stuttering.

- More stuttering is seen on the first few words of an utterance (Brown, 1938; Wingate, 1979; Wall, Starkweather, & Cairns, 1981; Howell & Au-Yeung, 1995).

- Decrease in stuttering is found on consecutive words in a sentence (Hejna, 1955).
- Children's stuttering occurs often at sentence initial position (Bernstein, 1981).
- Conspicuous words carry more severe stuttering (Trotter, 1959).
- More unpredictable words are more likely to be stuttered (Quarrington, 1965).
- Word position was a more accurate determiner of loci of stuttering than length of word or phonetic identity of the syllables (Taylor, 1966).
- Stuttering tends to occur at or near the beginning of a sentence (Griggs & Still, 1979).
- Initial word is more susceptible to stuttering than medial or final words (Conway & Quarrington, 1963).
- Stuttering in children who stutter tends to occur on low frequency words (Hejna, 1955; Soderberg, 1966; Palen & Peterson, 1982; Anderson, 2007), although some researchers have found exceptions. For example, Wingate (1976) found that a word frequency effect was only seen with lists of short rather than longer words.
- Stuttering in children who stutter is seen more on function words (Bernstein, 1981; Bloodstein & Grossman, 1981; Howell, Au-Yeung & Sackin, 1999; Natke, Sandreiser, Van Ark, Pietrowsky & Kalveram, 2004).
- Children show stuttering on longer or grammatically more complex utterances (Kadi-Hanifi & Howell, 1992; Howell & Au-Yeung, 1995; Logan & Conture, 1995, 1997; Logan & LaSalle, 1999; Yaruss, 1999; Melnick & Conture, 2000), although some authors have suggested that this effect diminishes in adults (Logan, 2001).

- Longer the word, the greater the likelihood of stuttering (Hejna, 1955; Silverman, 1972; Soderberg, 1966, 1967; Griggs & Still, 1979).
- CWS exhibit more stuttering when attempting to produce sentences with increased mean length of utterance (MLU), which is a measure of linguistic proficiency, (Weiss & Zebrowski, 1992; Yaruss, 1999) and particularly on structures which exceed mean length of utterance (Zackheim & Conture, 2003).

However, some of the studies which provided these data contained some significant design weaknesses, for example, failing to control for word frequency or potential phonetic influences. Jayaram (1979), in his study, found the following results in bilingual (Kannada-English) individuals who stutter:

- Stuttering is seen to occur more on lexical words than functional words.
- Stuttering increases with increase in sentence length, whether it is a simple or complex sentence.
- Stuttering is seen more on verbs in spontaneous speech in Kannada, while it is more on nouns in English.
- Significantly less stuttering occurs on reading a meaningful passage than on nonsense passage.
- In a meaningful passage, significantly more stuttering occurred on the initial syllable of words, while in nonsense passage more stuttering occurred on the medial and final syllables of words.
- More stuttering was seen on more familiar words than less familiar words.

b. Language abilities in individuals who stutter **-** A further consistent finding is that stuttering tends to begin at a time of intense language development (Kloth et al., 1995; Yairi et al., 1996; Yaruss, LaSalle & Conture, 1998). Alongside this, children who stutter have been shown to have lower scores for receptive and expressive language (Murray & Reed, 1977; St. Louis & Hinzman, 1988; Byrd & Cooper, 1989; Anderson & Conture, 2000), have more immature language (Howell & Au-Yeung, 1995; Wall, 1980), have less well-developed articulatory systems (Melnick & Conture, 2000) and have poorer grammar (Westby, 1974). However, findings to the contrary have also been found. Watkins, Yairi and Ambrose (1999), in a longitudinal study of preschool children who stutter, found that on virtually all the measures of expressive language employed, the groups of children were similar in skill and near or above developmental levels. Studies have also shown children who stutter to have advanced linguistic skill (Starkweather, 1987, 1997).

The link between language delay and stuttering in children (Wall, 1977) and specifically the development of stuttering as language begins to emerge (Merits-Patterson & Reed, 1981; Bernstein & Ratner, 1997) all appear consistent with the notion of an underlying problem with linguistic processing. As Starkweather (1987, 1997) pointed out however, there are also many children advanced in language development who stutter. While it is known that children who stutter as a group score lower on tests of language than their fluent peers (Andrews, Craig, Feyer, Hoddinott, Howie & Neilson, 1983), it has been suggested that this may be an artifact of the

psychological effects of stuttering itself rather than a reflection of the pure language ability of the child who stutters.

Research in the area of semantic and syntactic development of children who stutter is thus conflicting and may reflect the particular sample of young CWS investigated, as it is clear that people who stutter are a heterogeneous group rather than a homogenous group. There does seem to be a group of children (Van Riper's Track II) who do present with speech and language delay, while other children who stutter have followed a normal developmental path. According to Watkins and Yairi (1997), CWS exhibit greater variability in their language production skills.

Wall (1980) made a comparative study of syntax in a small group of four male CWS (aged 5;6- 6;6) matched for age, sex, parental occupation and birth order with a group of four children who did not stutter. The results suggested that the children who stuttered used 'simpler, less mature language' than those who did not stutter. A study by Kadi-Hainifi and Howell (1992) looked at syntax in the spontaneous speech of a group of seventeen subjects between the ages of 2;7 and 12;6 years, matched with a group of fluent controls. They found no evidence that the experimental group used less developed syntax than their controls. The mean length of utterance of the children who stuttered was in line with normal language development. In the preliminary findings of their five-year longitudinal study, Rommel, Hage, Kalehne & Johannsen (1999) also reported that there was no evidence of a general language delay in their subjects. Also, Nippold (1990) in

her review of the literature, failed to find sufficient support for the contention that children who stutter are more likely to have language delays.

Weiss and Zebrowski (1994) looked at the narrative ability of eight children who stuttered matched for age and gender with a fluent control group. The young CWS did not perform significantly differently from the children who did not stutter on most of the narrative measures used. In both re-telling a story and creating original stories, the non-fluent children were as grammatically competent as their fluent peers and conveyed the same amount of information. They reported however that there were some subtle differences which could be related to stuttering. In re-telling a story to 'naïve' listeners, for example, the stuttering group produced shorter and less elaborated accounts. The authors suggested that an awareness of their stuttering and a desire to avoid it, rather than a lack of competence, could account for this difference. The stories they created tended to be shorter, with fewer completed episodes. The study by Klein and Rustin (1994) suggested that language difficulties may persist into adolescence.

Differences in receptive vocabulary between younger (ie, preschool age) CWS and CWNS have often been reported (Andrews, et al 1983; Bloodstein, 1995; Bernstein & Ratner, 1997). In specific, young CWS when compared to young CWNS have been found to score lower on the *Peabody Picture Vocabulary Test- III* (PPVT- III; Dunn & Dunn, 1997), a measure of receptive vocabulary (Westby, 1974; Reed, 1977; Meyers & Freeman, 1985; Murray & Ryan, 1992). Bloodstein (1995) suggests that this early "linguistic disadvantage" of young CWS may become less apparent as children advance

in age, a suggestion that may account for equivocal findings relative to differences in receptive vocabulary between older CWS and CWNS (Williams, Melrose & Woods, 1969). Similar findings were also observed by Geetha (1996), in her study of 26 young CWS, where more than 30% of them were found to have various degrees of delay in language abilities and phonological skills. Older children however did not show such delay. It is also evident in adults who do not generally exhibit any language deficits. Therefore it is speculated that language deficits, especially the phonological abilities may in some way contribute to breakdown in fluency in a subgroup of children.

Anderson and Conture (2000) examined differences between children who do (CWS) and do not stutter (CWNS) on standardized tests of receptive/expressive language and receptive vocabulary. Subjects were sixteen boys and four girls who stutter and sixteen boys and four girls who do not stutter. Each child was administered three standardized tests of syntactic, semantic, and phonological abilities and development: (a) *Test of Early Language Development- 2* (TELD- 2; Hresko, Reid & Hamill, 1991), a measure of receptive/expressive language ability, (b) *Peabody Picture Vocabulary Test-III* (PPVT- III; Dunn & Dunn, 1997), a measure of receptive vocabulary and (c) the "Sounds in Words" subtest of the *Goldman- Fristoe Test of Articulation* (GFTA; Goldman & Fristoe, 1986), a measure of speech sound development. Results indicated that difference between measures of receptive/expressive language and receptive vocabulary is significantly greater for CWS than CWNS. Findings suggest that the semantic development of CWS may lag behind their syntactic development, a possible

imbalance among the components of the speech-language system of CWS that may contribute to the difficulties they have establishing normal speech fluency.

Arndt and Healey (2001), based on a survey of speech-language pathologists, found 72 (fifteen percent) of 467 children had both language and fluency problems. Children with persistent stuttering scored lower than those who have recovered on measures of receptive and expressive language (Yairi, Ambrose, Paden & Throneburg, 1996). But, some children with persistent stuttering exhibit above average expressive language abilities (Yairi, 2004).

According to Anderson and Conture (2004), CWS exhibit a slower speech reaction time when generating sentences in the absence of priming sentences and they benefit more from syntactic priming than their non-stuttering peers.

c. Lexical retrieval in stuttering - One hypothesis that emerges from time to time is that stuttering may be associated with a difficulty in accessing a word (Wingate, 1988; Gregory & Hill, 1999; Packman, Onslow, Coombes & Goodwin, 2001), that is, difficulties in lexical retrieval and there have been few well-controlled trials to evaluate this possibility. One of the problems in testing this notion lies in distinguishing differences in response latencies as being due to word fear, rather than difficulties with lexical access (Conture, 1990). The arguments both for and against this possibility have recently been reviewed in a study which found people who stutter to be disfluent on nonwords as well as real words, thus indicating that the meaning of the word itself was

not implicated in any failure in its production (Packman et al., 2001). These findings were subsequently questioned by Au-Yeung and Howell (2002) who pointed out some methodological weaknesses in the study's design. However, a subsequent study (Batik, Yaruss & Bennett, 2003) also found that there was no difference in word-finding ability between a group of twenty children who stuttered (mean age nine years, ten months) and a matched control group of children with no stuttering. Batik et al. (2003) concede, however, that their test only required a single word response and that as the demands of other linguistic factors (such as grammatical complexity, length of utterance) increase in running speech, this could lead to differences in word retrieval between children who stutter and those who do not.

d. Change in stuttering with word class **-** Another area of enduring interest has been the study of stuttering from a word class perspective. Particularly, this relates to the difference noted between stuttering on content words (also known as open class words) comprising nouns, lexical verbs, adjectives and adverbs and function words (or closed class words) which include pronouns, prepositions, articles, conjunctions and auxiliary verbs. A consistent research finding is that stuttering occurs more commonly on content words amongst the adult population (Johnson & Brown, 1935; Brown, 1938, 1945; Hejna, 1955; Geetha, 1979; Howell, Au-Yeung & Pilgrim, 1999), while stuttering in younger children occurs mostly on function words (Bloodstein & Gantwerk, 1967; Wall, 1977; Bernstein, 1981; Bloodstein & Grossman, 1981; Howell et al., 1999). This change has been said to reflect the growing ability for a child to appropriately use function words within grammatical constituents, which usually occurs by around eight years of age.

Jayaram (1979) found that stuttering occurs more on lexical words. His results indicated the order of difficulty on grammatical parts of speech in Kannada to be verbs, nouns, adjectives, prepositions and pronouns, and in English as nouns, adjectives, verbs, pronouns and prepositions. In a recent study, a group of 26 adult native German speakers, rather than indicating a change in stuttering loci from function words to content words, were found to have significantly increased stuttering rates on both word classes when compared to a group of six to eleven year olds (Dworzynski & Howell, 2004). Thus, the increased stuttering seen in the adult group seemed to be related to an increased difficulty with content words, rather than a decrease in difficulty with function words.

Phonology and Stuttering

There is evidence too that children who stutter may have reduced abilities to plan, or retrieve sentence level units of speech (Cuadrado & Weber-Fox, 2003; Anderson & Conture, 2004) and that there may be a link between early stuttering and phonological deficit (Louko et al., 1990; Postma & Kolk, 1993; Kolk & Postma, 1997; Louko, Conture & Edwards, 1999). Louko et al. (1999) claim that around 30 to 40 percent of children who stutter also demonstrate articulation difficulties, as opposed to the figure of two to four percent expected in the general population, although some research has put this figure as just under thirteen percent (Blood et al., 2003). Such findings have in part been responsible for the development of the Covert Repair Hypothesis (Postma & Kolk, 1993), which argues that stuttering is related to an unstable phonological system.

a. The Covert Repair Hypothesis **-** This is essentially a psycholinguistic theory of error production in non-stuttering speakers, which can also explain the speech errors seen in stuttering from a phonological perspective. Postma and Kolk (1993) and Kolk and Postma (1997) base their covert repair hypothesis theory first and foremost on the assumption that all language production is subject to various self-monitoring procedures, which occur at different stages along the language production process. Early monitoring occurs for the phonetic plan of the utterance while the final monitoring stage, occurring fractionally after the speech end product, is auditory (in fact auditory feedback). The theory contends that the speech flow of those who stutter is interrupted by an internal feedback loop during pre-vocalization, just before speech is produced (Levelt, 1998). When an error in the phonetic plan is detected, speech/language production is halted and "repairs" are made before the process can continue.

The assumption is that the error type that people who stutter are trying to repair is phonological and that the phonological encoding which is responsible for developing the articulatory plan is faulty. The theory is based in part on findings that speakers who stutter are slower at phonological encoding than their non-stuttering peers. The timing of the activation of upcoming phonological units is central to the theory. Conture (2001) argues that there may be two strands to the way in which time affects the likelihood of an increase in stuttering:

1) At a normal speech rate the speaker demonstrates a slow activation rate of both the target unit and competing targets. This increases the likelihood of

selection error and consequently the likelihood of stuttering, because all the units are equally activated.

2) On the other hand, when speaking rate is increased, the rate of activation of the speech units remains normal, but the speaker speeds up the phoneme selection time. This too increases the likelihood that the speaker may mis-select because both the target and competing units now have similar levels of activation.

This leads to the conclusion that both increased speaking rate and slower rate of target activation may contribute to increase in stuttering. Conture (2001) explains: "Thus for people who stutter according to Postma and Kolk, activation of intended sounds or 'target' (sound) units is delayed, or is slow to activate. This is thought to result in a longer period of time during which their intended sounds are in competition with other sounds". However, the problem is compounded when the speaker tries to increase rate. The implication of this is that the neural processes underlying phonological processing operate more slowly in those who stutter.

b. Phonological abilities in individuals who stutter - During the past decade there has been an emerging interest in children who stutter and have a concomitant phonological disorder. The profiles of CWS appear to be highly similar to those of phonologically disordered children. Both disorders occurs more frequently in males than in females, they run in families, they are characterized by oral-motor coordination components and periodically, stuttering emerges after phonological intervention. The similarity in profiles

along with the high rate of coincidence, requires one to question the relationship between the two disorders.

Reports indicating that children who stutter also have a phonological disorder (eg. Conture, Louko & Edwards, 1993; Bernstein & Ratner, 1995; Louko, 1995; Melnick & Conture, 2000; Wolk, Blomgren & Smith, 2000; Conture, 2001), have prompted researchers to examine the possibility that the two disorders may impact one another. However, recent research has not provided convincing evidence to demonstrate an interaction between stuttering and phonology (Nippold, 2002). Nevertheless, it is widely believed that a phonological disorder in a young child who stutters can exacerbate the child's disfluencies and further, that attempts to treat the phonological disorder directly can worsen the stuttering (eg. Bernstein & Ratner, 1995; Louko, Conture & Edwards, 1999; Arndt & Healy, 2001; Conture, 2001).

Some beliefs related to stuttering and phonological disorders are: (a) stuttering and phonological disorders have a high rate of co-occurrence, (b) 'trading relationships' exist between stuttering and phonology.

c. Co-occurrence of stuttering and phonology – The evidence of occurrence of a phonological disorder in 30%- 40% of children who stutter do suggest a link between the two disorders, especially when contrasted with reports that two to six percent of CWNS have a phonological disorder (Conture et al., 1993; Bernstein Ratner, 1995; Louko, 1995; Melnick & Conture, 2000). Clearly, some children who stutter also have a phonological

disorder (Wolk, Edwards, & Conture, 1993; Throneburg, Yairi & Paden, 1994; Paden & Yairi, 1996).

Since the 1920s at least fiffteen published studies have addressed the issue of co-occurrence of stuttering and phonological disorders (Berry, 1938; Darley, 1955; Morley, 1957; Andrews & Harris, 1964; Williams & Silverman, 1968; Blood & Seider, 1981; Seider, Gladstein & Kidd, 1982a; Louko et al., 1990; St. Louis, Murray & Ashworth, 1991; Ryan, 1992; Bernstein Ratner, 1998; Yaruss, LaSalle & Conture, 1998; Arndt & Healy, 2001;). Collectively reports of co- occurrence have varied widely from one study to another, with some investigators reporting no differences between CWS and CWNS in the frequency of phonological disorders (eg. Seider et al., 1982a; Ryan, 1992; Bernstein Ratner, 1998) and others reporting a substantially higher frequency of phonological disorders in children who stutter (eg. Darley, 1955; Andrews & Harris, 1964; Williams & Silverman, 1968; Louko et al., 1990).

However, many of the studies contained methodological weaknesses that limited the degree to which their findings could be generalized. Examples of these problems include the absence of matched control groups of non-stuttering children (Blood & Seider, 1981; St. Louis et al., 1991; Yaruss et al., 1998; Arndt & Healey, 2001), the use of medical records or parental questionnaires to document phonological disorders instead of direct testing of children's speech (Berry, 1938; Darley, 1955; Andrews & Harris, 1964; Seider et al., 1982), brief examination of children's phonological skills such as the use of screening tools rather than detailed analyses of conversational speech (Morley,

1957; St. Louis et al., 1991; Ryan, 1992; Bernstein Ratner, 1998), unclear diagnoses of stuttering (Yaruss et al., 1998) or of phonological disorders (Louko et al., 1990) and the use of subjective scoring systems to document a phonological disorder (Williams & Silverman, 1968; St. Louis et al., 1991). In addition, some of the studies examined clinical samples rather than randomly selected groups of children (eg. Blood & Seider, 1981; Arndt & Healey, 2001).

A study done by Sneha (1994) looked into the phonological processes among three to seven year old CWS and observed that the young CWS exhibited more varieties and number of processes than their fluent peers. The phonological processes stopping, frication, multiple process, lateralization, depalatalization, substitution of glide, epinthesis and change in place of articulation were specific to CWS and not seen in normal children. Among these, stopping, frication and lateralization were deviant processes.

d. Trading relationships **-** The term 'trading relationships' implies that as the frequency of one behavior increases (eg. stuttering), the other declines (eg. phonological errors) and that positive changes in one domain (eg greater phonological accuracy) come at the expense of the other (eg. more stuttering).

With regard to stuttering, the concept of trading relationships has its roots in the Demands-Capacities model. According to this model, the disfluencies occur when communicative demands exceed a child's capacities in one or more areas of

development, including linguistic, motoric, emotional, and/or cognitive areas (Adams, 1990; Starkweather & Gottwald, 1990). This implies, for example, that weakness in phonological (linguistic) and/or articulatory (motoric) development could exacerbate stuttering if communicative demands on the child, either self- imposed or environmental demands are excessive.

However, research has not supported the existence of trading relationships between stuttering and phonology. One approach to study this has been to calculate correlation coefficients between the number of disfluencies children produce in conversation and the number of phonological errors that occur in their speech (Louko et al., 1990; Ryan, 1992, 2001; Yaruss & Conture, 1996; Anderson & Conture, 2000; Wolk et al., 2000). If trading relationships exist between stuttering and phonology, one might expect to find children with more severe stuttering to have fewer phonological errors and vice-versa (ie. negative correlation coefficients). Alternatively, if phonological errors negatively impact fluency, one might expect to find children with more severe stuttering to have a greater number of phonological errors (i.e., positive correlation coefficients). Out of the six studies that employed this design, none yielded statistically significant correlation coefficients, failing to demonstrate trading relationships.

Another approach to examining possible interaction between stuttering and phonology has been to compare groups of children who stutter in relation to the presence or absence of a phonological disorder (Wolk et al., 1993; Yaruss & Conture, 1996; Yaruss, LaSalle & Conture, 1998). If trading relationship exists between stuttering and

phonology, one might expect to find that children, who stutter and have disordered phonology, would differ from those who stutter but have normal phonology. However, no statistically significant differences have been found between these two groups in the nature or severity of their stuttering.

Investigators also have examined children's stuttering severity in relation to their ability to articulate phonologically complex words such as those containing multiple sounds or syllables, or later developing consonants or clusters (Howell & Au- Yeung, 1995; Throneburg et al., 1994; Logan & Conture, 1997; Melnick & Conture, 2000; Wolk et al., 2000). However, the results of these studies failed to demonstrate statistically significant relationships between stuttering and the production of phonologically complex words, regardless of the severity of children's stuttering or the presence or absence of a phonological disorder.

Hence, despite the persistent and varied efforts of researchers to document the presence of trading relationships between stuttering and phonology, none have been successful. Thus, there is no convincing evidence that phonology influences stuttering or vice-versa.

Yairi (1993) cited a study by Louko et al. (1990) in which children who stuttered had more phonological problems than their non-stuttering peers. St. Louis et al. (1991) found that nearly 60% of school-aged children with stuttering manifested coexisting communication disorders, notably in the realms of articulation and voice, along with

various degrees of delay in language, as against the older group, when two groups of 25 children were compared. In the first fifteen months of a multi-factorial longitudinal study, Rommel et al. (1999) also reported that almost 60% of 41 pre-school children examined presented with articulatory problems in addition to stuttering. In the majority of cases, these problems were not very severe.

The association of concomitant language and articulation problems in children who stutter was also observed by Geetha (1996). She compared disfluency and language characteristics of normally disfluent children and children who stutter, below the age of six years and found poor language receptive, expressive abilities and articulatory skills in nearly 30% of stuttering children.

e. Some possible explanations for co- existence of phonological problems in CWS - While many children who stutter present with normal linguistic development at the phonological, semantic and syntactical levels, recent research does seem to show that a significant number have phonological problems in particular. One possible hypothesis is that there is a delayed neurological maturation which makes the child vulnerable to both fluency and articulation problems (includes both articulatory and phonological disorders). This would tend to suggest some form of motor deficit, though many children who stutter also have periods when they are fluent. It may be that the presence of disfluencies occurs only when there are additional stress factors present which overload the system; for example, an 'at risk' child who is exposed to an environment where his/her speech models have a rapid rate of utterance.

Van Riper (1972) suggested that when a person stuttered on a word, there is a 'temporal disruption of the simultaneous and successive programming of muscular movements required to produce speech'. He went on to conclude that temporal disruption is the core behavior of stuttering. As Van Riper said, speech requires precisely timed motor sequences and the normal distribution of motor ability would produce some individuals who have difficulty in accomplishing that timing. He put forward the idea that the one percent of population who stutters 'represent the extreme end of the normal distribution in coordinative ability or stress vulnerability'. Perkins (1986) concludes that stuttering is a dis-coordination of muscular and/or aerodynamic coordinations among the phonatory, articulatory, and possibly respiratory system.

Recent research has utilized a priming technique to assess the speech reaction time (SRT) of children who stutter (Melnick, Conture & Ohde, 2003; Anderson & Conture, 2004). Melnick et al. studied the ability of preschool children to name pictures rapidly during three conditions: no prime, related prime, and unrelated prime. Results indicated that for all children, both stuttering and non-stuttering, SRTs were shorter when provided with a related prime. However, CWS with delayed articulatory mastery demonstrated longer SRTs. The authors interpreted these findings to infer a 'somewhat' less developed articulatory/phonological system for CWS compared to their non-stuttering peers. However, Anderson and Conture (2004) failed to find significant differences in SRTs between these two groups of children.

Wolk, Edwards and Conture (1993) discussed three views regarding the co-existence of stuttering and phonology. First was Bloodstein's psychosocial perspective, which suggested that children with communication disorders develop a sense of failure around speech and begin to struggle with speech. Second is the common predisposition underlying both disorders. Lastly, stuttering and phonological disorders are related to the same phenomenon - a central neurological processing deficit. This last hypothesis has gained support in the literature on stuttering and phonological disorders (Byrd & Cooper, 1989; St. Louis, 1991; Webster, 1993; Wijnen & Boers, 1994). Many researchers have investigated the characteristic patterns of stuttering and phonological disorders when they co-occur:

- Of the children who stuttered, 24%-45% also exhibit disordered phonology (Louko et al., 1990; Arndt & Healey, 2001; Conture, 2001).
- Children, at the onset of stuttering, appear to be delayed in phonological skills (Yairi, 2004).
- CWS exhibit more atypical processes and greater frequency of cluster reduction than fluent peers (Louko et al., 1990; Wolk, Blomgren & Smith, 2000).
- CWS and disordered phonology exhibit longer sound prolongations as compared to those with stuttering and normal phonology (Wolk et al., 1993). This has particular relevance when considering the sound prolongation feature which may be important in the differential diagnosis of young CWS (Schwartz & Conture, 1998).

- Poor phonological skills in the early stages of stuttering may differentiate between persistent and recovered individuals who stutter (Paden & Yairi, 1996; Paden, Ambrose & Yairi, 2002).
- Stuttering does not necessarily occur on phonologically difficult sounds, syllable shapes, or multiple syllables (Throneburg et al., 1994; Howell & Au-Yeung, 1995).
- There are inconsistent findings on whether words with phonological errors are more likely to be stuttered than on those spoken error free (Melnick & Conture, 2000; Caruso, Ritt & Sommers, 2002).
- More severe stuttering does not necessarily mean a greater number of phonological processes will be present in the child's speech (Louko et al., 1990; Ryan, 1992; Wolk et al., 1993; Yaruss, LaSalle & Conture, 1998; Anderson & Conture, 2000).
- Phonological patterns are not significantly different between children who stutter and their fluent peers (Wolk et al., 1993).
- Children who stutter and have disordered phonology may take longer to recover from stuttering (Paden, Ambrose & Yairi, 1999; Conture, 2001; Nippold, 2002; Paden, Ambrose & Yairi, 2002).
- Frequency, duration and types of stuttering are not significantly different for children who stutter and for those also have concomitant phonological disorders (Yaruss & Conture, 1996; Wolk, Blomgren & Smith, 2000).

f. Relation between phonological skills and recovery of stuttering - The influence of interaction between phonological disorders and stuttering is becoming clearer through longitudinal studies. Research by Paden and Yairi (1996) indicated that poor phonological skills in the earlier stages of stuttering differentiate persistent from recovered individuals who stutter. Paden, Ambrose & Yairi (2002) further delineated the interaction between stuttering and phonological disorders. Investigating the development of phonological skills in children who do and do not stutter over a two-year period, they observed some group trends:

1. The mean percentage of phonological error for children who were persistent with stuttering was higher than those who recovered from stuttering.
2. One year later, the number of phonological errors no longer differentiated between the two groups of subjects.
3. Mastery of the ten error patterns investigated occurs by year three.
4. By age 5;5 years, 20.3% of recovered children no longer meet criteria as phonologically impaired as compared to only 13.6% of the persistent children.
5. A larger percentage of girls in the recovered group (35.5%) no longer met the phonological criteria as compared to 18.2% in the persistent group.
6. Children with persistent stuttering demonstrated slower phonological progress.

These authors speculated that stuttering interferes with phonological development, slowing down its rate for a subgroup of children who stutter.

A New Approach for Measurement

Not all studies that compared stuttering and fluent populations find differences in their language or phonological abilities (Nippold, 1990, 2002). Watkins, Yairi and Ambrose believe that children who stutter do not, as a group, exhibit gross language disorders. However, as others have suggested (Schwartz & Conture, 1988; Nippold, 1990; Starkweather, 1991; Bernstein Ratner, 1997b; Anderson & Conture, 2000; Conture, 2001), a subgroup of children may exist who exhibit subtle language deficits co-occurring with stuttering. A potential reason for the differences in findings may be the typical methodology of studies that contrast groups of stuttering and non-stuttering children (Watkins & Johnson, 2004). For example, most studies tend to employ standardized language tests or spontaneous speech sampling. However, some authors are of the opinion that the use of standardized measures of language is not sufficient to detect the subtle language differences suspected in children who stutter (Bernstein Ratner, 1997, 2004; Watkins, Yairi & Ambrose, 1999; Weber- Fox, 2001).

Thus, researchers and clinicians have continued to search for more measures that are capable of distinguishing between these groups of children, particularly on the basis of language ability. A promising measure that has gained strength in the research literature over the past decade is "**nonword repetition**".

Nonword Repetition Tasks have been widely used to estimate phonological working memory skills in children (e.g., Dollaghan, Biber & Campbell, 1993, 1995;

Gathercole & Baddeley, 1996; Dollaghan & Campbell, 1998) and adults (Gupta, 2003). Phonological working memory in children with typically developing language (e.g, Gathercole, Hitch, Service & Martin, 1997) and language impairments (e.g., Bishop, North & Donlan, 1996) have been studied using this task.

Children with language impairments have notable deficits in nonword repetition that cannot be attributed to differences in their language knowledge. Successful performance of the nonword repetition task requires several processing operations that are assumed to be involved in language learning, including transforming the acoustic-phonetic sequence into its constituent phonemes, maintaining the ordered and phonologically coded string in working memory and organizing the articulatory output. Deficits in any or all of these operations could have negative consequences for nonword repetition and language learning tasks (eg. creating new lexical entries and formulating sentences).

Nonword repetition task is thought to reflect some of the underlying cognitive difficulties of Specific Language Impairment (SLI), perhaps those concerned with working memory, phonological memory or long-term word knowledge (Gathercole, 1995). Some research is beginning to suggest that nonword repetition may be useful as a genetic marker for language impairment (Bishop et al., 1996, 1999).

Findings of Botting & Conti-Ramsden (2001) clearly indicate a relationship between performance on a nonword repetition task and actual language ability. On

examination of different psycholinguistic markers for SLI, they found that tasks involving short-term-memory (nonword repetition and sentence recall) were superior to those assessing syntactic skills in identifying groups of children with a history of SLI at a younger age, even when language skills had improved. Botting & Conti-Ramsden (2001) also show that the progress made by SLI children with high nonword repetition scores is significantly greater than for those with poor repetition scores.

Dollaghan and Campbell (1998) observed that a nonword repetition task distinguished children enrolled in language intervention from language-normal children with a higher degree of accuracy than a norm-referenced language test.

Gray (2003) conducted a study to assess the diagnostic accuracy and test-retest reliability of nonword repetition and digit span tasks administered to preschool children with specific language impairment. Two forms of nonword repetition tasks were administered to 22 preschool children (aged 4;0 to 5;11years) with SLI and to 22 age and gender matched controls with normal language. Results were compared with performance on a digit span task and norm-referenced test scores. Nonword repetition scores provided excellent sensitivity and specificity for discriminating between groups. The SLI group appeared to benefit from repetition than the normal language group.

There are studies reported which establish a relationship between vocabulary knowledge and nonword repetition skills (e.g., Gathercole & Baddeley, 1990; Gathercole, Willis, Emslie & Baddeley, 1991; Gathercole, Service, Hitch, Adams & Martin, 1999).

Some investigators have suggested that phonological working memory (as measured by nonword repetition) drives vocabulary development (Gathercole & Baddeley, 1990; Gathercole et al., 1991; Gathercole et al., 1999), whereas others have argued that increasing vocabulary knowledge enables a child to perform better on nonword repetition tasks (e.g., Snowling, Chiat & Hulme, 1991; Dollaghan et al., 1995).

Hakim and Ratner (2004) examined phonological working memory skills in eight CWS between the ages of 4;1 and 8;4 and compared it with eight age and gender matched CWNS. They evaluated participant's performance on the Children's Test of Nonword Repetition (CNRep; Gathercole, Willis, Baddeley & Emslie, 1994). On the CNRep, children were presented with 40 nonwords, ten words each of length two, three, four and five syllables, via tape recorder and then asked to repeat each nonword. They found that, while CWS performed more poorly at all syllable lengths, significant differences were found only for three-syllable stimuli. At the three-syllable length, CWS repeated significantly fewer items correctly and exhibited more phoneme errors than normally fluent children. However, the fluency of nonword productions did not change as a function of increased word length, that is, CWS were just as fluent on longer nonwords as on shorter ones. Thus, fluency rates were not found to be related to nonword repetition performance.

A similar study was done by Anderson, Wagovich and Hall (2006) in younger CWS of 3;0-5;0 years of age. They concluded that CWS were less successful in repeating two-syllable and three-syllable nonwords than CWNS. Also, the CWS produced almost

twice as many phoneme errors in their three-syllable nonword repetition attempts than CWNS. These authors had also examined the relationship between language skills and nonword repetition. They found a significant relationship between a test of phonology i.e., Goldman-Fristoe Test of Articulation-2 (GFTA-2; Goldman & Fristoe, 2000) and nonword repetition scores in CWS. The role of phonological working memory in explaining language differences between the groups was highlighted by them.

Nonword repetition performance in fourteen school-aged children (8;0-12;0 years) who stutter and eleven who do not was studied by Seery, Watkins, Ambrose & Throneburg (2006). They found that both groups produced fewer correct responses with increased syllable length. At the five- syllable level, CWNS had a significantly greater number of words correct. Also, both groups demonstrated an increase in the frequency of phoneme errors with increased syllable length.

Bakhtiar, Abad Ali and Sadegh (2007) examined phonological encoding in young Persian native children (aged 5;1 to 7;10 years) who stutter (CWS) and do not stutter (CWNS), during a nonword repetition task. Results indicated that the CWS had a slightly poor performance in nonword repetition score than CWNS, though not significant. Also, differences between the bisyllabic and trisyllabic nonwords were significant for phonological errors but not for reaction times. It was concluded that CWS might not have a gross problem in phonological retrieval of the novel phonological context even with increase in syllable length. These authors also wanted to examine the Covert Repair Hypothesis (CRH; Kolk & Postma, 1997) which implicates that the phonological

processing skills is a cause for disfluencies in individuals who stutter. But the predictions of CRH were not supported by them.

There is no literature till date, reporting any Indian studies conducted related to nonword repetition skills in CWS. The present research aims to study the nonword repetition skills in Kannada speaking CWS. Kannada is a syllabic language of Dravidian origin and is quite different in structure compared to English, which is phonemic in nature. Hence, it would be interesting to know the difference if any in nonword repetition abilities in Kannada compared to English.

CHAPTER III

METHOD

The present study was undertaken to investigate the nonword repetition abilities of children diagnosed as having stuttering compared to those who do not, in Kannada and to see in what ways it differs from those studies in English. Although it was aimed to take the audiovisual samples for data collection initially, due to some technical problems it could not be done and only audio recordings of all samples were obtained. The detailed procedure used for the study is as follows:

Subjects

25 subjects in the age range of 5;0-6;0 years were taken for the study, of which ten were children with stuttering (CWS) and the remaining fifteen were age matched children without stuttering (CWNS).

a. Criteria for selection of CWS: In this group, only those subjects were selected who:

- Were native speakers of Kannada.
- Were diagnosed by a speech- language pathologist as having developmental stuttering of mild to severe degree.
- Should have been stuttering for at least six months.
- Had normal hearing sensitivity in both ears.

- Had no other associated problems like apraxia, oro-motor deficits, misarticulations, attention deficits, academic problems and cognitive deficits.

b. Criteria for selection of CWNS: In this group, only those subjects were selected who:

- Were native speakers of Kannada.
- Were diagnosed as having normal speech and language by a speech-language pathologist.
- Had normal hearing sensitivity in both ears.
- Had no other associated problems like apraxia, oro-motor deficits, misarticulations, attention deficits, academic problems and cognitive deficits.

Ethical standards used in the study

- The parents or guardians of each of the subjects selected to participate in the study were briefed about the study, its aims, method and duration of testing.
- An informed verbal and written consent was taken from the parents or guardians of the subjects before carrying out the testing.

Materials

The test materials used in the study included:

- Stuttering Severity Instrument- 3 (SSI-3; Riley, 1994)
- Screening Articulation Test in Kannada (Babu, Ratna & Bettagiri, 1972)

- Speech Language Assessment Checklist (Unpublished AIISH Research Fund Project, 2007)
- List of bi-syllabic and tri-syllabic words (comprising of all the base phonemes in the initial position of words taken from Kannada Articulation Test, KAT; Babu et al., 1972)
- List of bi-syllabic and tri-syllabic nonwords (based on words from KAT)

Preparing list of words and nonwords **-** A list of bi- and tri-syllabic words and nonwords, comprising of all the basic phonemes (of Kannada language) in the initial position of the words and nonwords was prepared from words in the KAT. One word was selected each, from KAT, starting with the basic phonemes for preparation of the word list. Bi-syllabic and tri-syllabic words were selected. The following rules were used in the preparation of the nonwords:

- *Rules used for preparation of bi-syllabic nonwords starting with vowels:*
    - The vowel positions were maintained.
    - The consonant in the second syllable of the word was substituted with another consonant such that it forms a nonword in Kannada.

  For example, a:ne (word) to a:be (nonword).

- *Rules used for preparation of bi-syllabic nonwords starting with consonants:*
    - The consonants of the original word were maintained.

- The vowels of the original word were transposed such that it forms a nonword in Kannada.

For example, to:pi (word) to ti:po (nonword).

- *Rules used for preparation of tri-syllabic nonwords:*
  - The first syllable of the original word was maintained.
  - The second syllable of the original word was transposed with the third syllable such that it forms a nonword in Kannada.

For example, kitaki (word) to kikita (nonword).

The prepared lists of words and nonwords were then audio-recorded by a female native speaker of Kannada, using the "WaveSurfer 1.5.7" software (downloadable software for speech recording and analysis). An interval of five seconds was given between each word/nonword recorded. A pilot study was carried out to ensure that the words and nonwords can be repeated by a 5;0-6;0 year old group of normal children with ease.

Procedure

Each of the subjects was tested individually. The subject was made to sit comfortably in a distraction free environment and the tester had a general conversation with the subject for building a rapport, before commencing the actual testing. Stuttering Severity Instrument-3 (SSI-3; Riley, 1994) was administered to CWS to get the stuttering

severity score and to the CWNS to screen out any stuttering-like disfluencies. The Screening Articulation Test in Kannada (Babu et al, 1972) was administered to all the subjects to check for their articulatory ability and presence of any abnormal phonological processes. Language assessment was done using the Speech Language Assessment Checklist (Unpublished AIISH Research Fund Project, 2007).

Prior to presentation of the list of words and nonwords, practice items were given to the subjects to familiarize them with the task. The practice items had five words and nonwords each in the bi-syllabic and tri-syllabic list. The recorded list of words and nonwords were then presented to the subjects, via headphones connected to the laptop in which the stimuli were recorded. The subjects were given instructions to repeat each of the items (word/ nonword) heard. Each of the words and nonwords were presented only once and sufficient time was given for responding. The responses of the children for all the tasks were audio- recorded using the "WaveSurfer 1.5.7" software. The duration of testing lasted for about one hour and rest periods of around five minutes were given to the subjects in between the tasks. Suitable reinforcement was also given to the subjects participating in the study.

Scoring

All the tests administered were scored according to the norms provided by each of the tests. For the repetition task, the responses of each of the subjects were first transcribed and then scored as either correct or incorrect. All phonemes within a

word/nonword (except for any misarticulations or phonological process pertaining to this age group) had to be produced correctly for the response to be scored as correct, i.e., presence of one or more phoneme errors was considered as an incorrect response. The number of words/nonwords correctly repeated was calculated for each subject at each syllable length and across all stimulus items.

Secondly, the number of phonemes produced incorrectly (other than misarticulations or any phonological processes) within each response was noted. The total number of correct phonemes was then calculated for each subject at each syllable length and across all stimulus items.

Finally, each of the responses was also judged as fluent or non- fluent. The total number of stuttering-like disfluencies, normal disfluencies and other speech errors (articulatory, metathetical etc.) was noted for each subject in both word and non word repetition tasks. Then, the total number of fluent responses was calculated for each subject at each syllable length of words and nonwords.

Reliability

Inter-judge and intra-judge reliability was checked. Part of the recorded samples of randomly selected subjects were transcribed and analyzed again to see for the intra-judge reliability. Also, randomly selected subjects' responses for the word and non word repetition task were analyzed by another speech-language pathologist proficient in

analyzing stuttering-like disfluencies and phoneme errors. This was done to establish the inter-judge reliability.

Analysis

For analysis, the scores obtained were tabulated under different headings, as follows:

- KAT- score obtained from the Kannada Articulation Test
- RLS – receptive language score obtained from the Speech Language Assessment Checklist.
- ELS – expressive language score obtained from the Speech Language Assessment Checklist.
- CLS – combined language score obtained by adding the receptive and expressive language scores from the Speech Language Assessment Checklist (CLS = RLS + ELS).
- CRBIW – number of correct responses obtained from the bi-syllabic word list
- CRTRIW - number of correct responses obtained from the tri-syllabic word list
- CRTW – total number of correct responses obtained from the bi- and tri-syllabic word lists (CRTW = CRBIW + CRTRIW)
- CRBINW - number of correct responses obtained from the bi-syllabic nonword list

- CRTRINW - number of correct responses obtained from the tri-syllabic nonword list
- CRTNW – total number of correct responses obtained from the bi- and tri-syllabic nonword lists (CRTNW = CRBINW + CRTRINW)
- FBIW - number of fluent responses obtained from the bi-syllabic word list
- FTRIW - number of fluent responses obtained from the tri-syllabic word list
- FTW – total number of fluent responses obtained from the bi- and tri-syllabic word lists (FTW = FBIW + FTRIW)
- FBINW - number of fluent responses obtained from the bi-syllabic nonword list
- FTRINW - number of fluent responses obtained from the tri-syllabic nonword list
- FTNW – total number of fluent responses obtained from the bi- and tri-syllabic word lists (FTNW = FBINW + FTRINW)
- PCBIW - number of phonemes correctly produced on repetition of the bi-syllabic word list
- PCTRIW - number of phonemes correctly produced on repetition of the tri-syllabic word list
- PCTW – total number of phonemes correctly produced on repetition of the bi- and tri- syllabic word lists (PCTW = PCBIW + PCTRIW)
- PCBINW - number of phonemes correctly produced on repetition of the bi-syllabic nonword list
- PCTRINW - number of phonemes correctly produced on repetition of the tri-syllabic nonword list

- PCTNW – total number of phonemes correctly produced on repetition of the bi- and tri-syllabic nonword lists (PTNW = PCBINW + PCTRINW)

The obtained raw scores were also converted into their percentages for convenience of analysis because the total scores for all the parameters to be compared were not the same. The data was subjected to statistical analysis using the "SPSS 10.0" software. Statistical tests such as independent samples t-test, paired samples t-test, Kruskal-Wallis test and Mann-Whitney test were carried out to answer the research questions. Karl Pearson's correlation coefficient was also done to establish the reliability of the data.

CHAPTER IV

RESULTS AND DISCUSSION

The present study was aimed at answering various research questions related to nonword repetition skills in Kannada speaking children who stutter. This study also looked into the existence of any possible correlation between nonword repetition scores with articulation test scores and with language test scores. Two groups of children were considered for this- the CWS (the stuttering group) and the CWNS (the normal group). Both groups were tested for their articulation, language, word and nonword repetition skills.

1. Articulation and language tests

a. *Comparison with respect to age-group and gender:*

The CWS and CWNS were compared for their performance in the articulation and language tests. The mean and standard deviations of the articulation (KAT) and language (RLS, ELS, and CLS) test scores in normals and children with stuttering are given with respect to gender (male and female) and age groups (5;0-5;6 years and 5;6-6;0 years) in Table 1 and Table 2, respectively.

As per the mean and standard deviations given in Table 1, there are not many differences seen across males and females in both CWS and CWNS for the articulation

and language test scores. However, the results cannot be generalized as the sample size is not matched in both the groups.

Table 1: Mean and standard deviations (SD) of the articulation (KAT) and language (RLS, ELS and CLS) test scores in CWNS and CWS, with respect to gender.

Tests	**CWNS**						**CWS**					
	M			**F**			**M**			**F**		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
KAT	4	97.71	.91	11	98.66	1.58	8	94.19	4.11	2	95.32	3.96
RLS	4	99.07	1.18	11	99.20	.68	8	98.95	.97	2	98.37	2.29
ELS	4	99.05	.63	11	99.59	.71	8	98.30	2.33	2	99.35	.91
CLS	4	99.06	.79	11	99.40	.624	8	98.62	1.54	2	98.86	1.61

[CWNS = normal group; CWS = stuttering group; M = male; F = female; N = number of subjects; SD = standard deviation; KAT = Kannada Articulation test score; RLS = receptive language score; ELS = expressive language score; CLS = combined language score]

According to literature, just like stuttering, phonological disorders tend to occur more frequently in males than in females. This finding had questioned the co-existence of the two disorders, and recent research has also concluded that the two co-exist in most CWS (eg., Louko et al., 1990; St. Louis et al., 1991; Ryan, 1992; Bernstein Ratner, 1998; Yaruss et al., 1998; Arndt & Healy, 2001), though the co-existence ratio of the two disorders in males and females have not been reported.

Table 2: Mean and standard deviations (SD) of the articulation (KAT) and language test scores in CWNS and CWS, with respect to age groups.

Tests	CWNS						CWS					
	5-5.6			5.6-6			5-5.6			5.6-6		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
KAT	3	96.87	1.44	12	98.79	1.25	5	93.26	2.91	5	95.58	4.71
RLS	3	99.15	.73	12	99.17	.84	5	98.18	1.25	5	99.50	.67
ELS	3	98.91	.99	12	99.58	.61	5	97.27	2.44	5	99.75	.55
CLS	3	99.03	.57	12	99.38	.68	5	97.72	1.50	5	99.62	.55

[CWNS = normal group; CWS = stuttering group; N = number of subjects; SD = standard deviation; KAT = Kannada Articulation test score; RLS = receptive language score; ELS = expressive language score; CLS = combined language score]

It is evident from table 2 that not many differences were obtained in both CWS and CWNS on the articulation and language tests, with respect to the age groups. However, it can be noted that the children in the age group of 5;6-6;0 years have done slightly better than those in the 5;0-5;6 age group, as expected, in both CWNS and CWS.

Bloodstein (1995) also had suggested that the differences in the linguistic abilities of young CWS become less apparent as children advance in age. Other researchers (eg., Louko et al., 1990, St. Louis et al., 1991; Geetha, 1996) have reported coexisting communication disorders in most school-aged children with stuttering. Results of the present study however cannot be generalized easily, as there is variation in the sample size between the age groups in CWNS, and the sample size and age range considered for grouping is not sufficient.

Since the sample size across gender and the age groups was not uniform, further statistical analysis could not be carried out with respect to age and gender grouping.

b. ***Between-group comparison:***

The mean and standard deviations for the two groups of children, ie., CWNS and CWS, were also computed, for comparing the performance of the two groups, with respect to the scores obtained for the articulation (KAT) and language (RLS, ELS and CLS) tests. These values are as given in Table 3.

Table 3: Mean and standard deviations of the articulation (KAT) and language (RLS, ELS and CLS) test scores between CWNS and CWS.

Tests	**CWNS**			**CWS**		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**
KAT	15	98.40	1.46	10	94.42	3.88
RLS	15	99.17	.80	10	98.84	1.17
ELS	15	99.45	.71	10	98.51	2.12
CLS	15	99.31	.66	10	98.67	1.46

[CWNS = normal group; CWS = stuttering group; N = number of subjects; SD = standard deviation; KAT = Kannada Articulation test score; RLS = receptive language score; ELS = expressive language score; CLS = combined language score]

There are differences observed in the articulation and language test scores between the CWNS and CWS, with CWNS performing slightly better than the CWS. However, greater differences are seen for the articulation test scores between the two groups and also the SD.

The mean and standard deviations given in Table 4 show how the test scores for the articulation (KAT) and language (RLS, ELS and CLS) tests, vary in CWNS and CWS with different severities of stuttering.

Table 4: Mean and standard deviations of the articulation (KAT) and language (RLS, ELS and CLS) test scores in CWNS and CWS with different severities of stuttering.

Tests	**CWNS**			**CWS - Mild**			**CWS - Moderate**			**CWS - Severe**		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
KAT	15	98.40	1.46	4	97.50	3.84	3	93.49	2.87	3	91.24	1.47
RLS	15	99.17	.80	4	99.38	.71	3	98.48	1.35	3	98.48	1.63
ELS	15	99.45	.71	4	99.69	.62	3	96.96	3.27	3	98.48	1.63
CLS	15	99.31	.66	4	99.53	.59	3	97.72	2.13	3	98.48	1.31

[CWNS = normal group; CWS = stuttering group; N = number of subjects; SD = standard deviation; KAT = Kannada Articulation test score; RLS = receptive language score; ELS = expressive language score; CLS = combined language score]

A clear pattern can be observed for the articulation test (KAT) across the severity groups, with CWNS having better articulatory skills. The articulatory skills tend to show a decrease as the severity increased. However, this pattern is not seen on the language test scores across the varying level of severity.

An independent samples t-test was done between CWNS and CWS to see how their performance varied across the language (RLS, ELS and CLS) and articulation (KAT) test scores. The values of the t- test are provided in Table 5.

Table 5: Independent samples t-test values for articulation (KAT) and language (RLS, ELS and CLS) test scores between CWNS and CWS.

Tests	t (23)
KAT	3.63*
RLS	.83
ELS	1.60
CLS	1.47

[* = significant difference ($p < 0.05$); KAT = Kannada Articulation test score; RLS = receptive language score; ELS = expressive language score; CLS = combined language score]

The mean for the CWNS on the articulation test (KAT) is 98.4 (SD = 1.46) and that for CWS is 94.42 (SD = 3.88). On analysis with the t-test there was a significant difference ($p<0.05$) observed in the articulation test scores between CWNS and CWS, indicating the presence of poor articulatory skills in CWS, compared to CWNS.

This is in consonance with the findings that there may be a link between early stuttering and phonological or articulatory deficit (eg., Louko et al., 1990; Postma & Kolk, 1993; Wolk et al., 1993; Sneha, 1994; Throneburg et al., 1994; Paden & Yairi, 1996; Kolk & Postma, 1997; Louko et al., 1999; Arndt & Healey, 2001; Conture, 2001). The co-existence of articulation difficulties in children who stutter was established by various studies (eg., Geetha, 1996; Louko et al., 1999; Rommel et al., 1999). Melnick, Conture & Ohde (2003) opine that CWS have a rather less developed articulatory/phonological system compared to their non-stuttering peers.

The findings of the previous and the present studies with respect to articulatory deficits also support the Covert Repair Hypothesis (Postma & Kolk, 1993), which argues

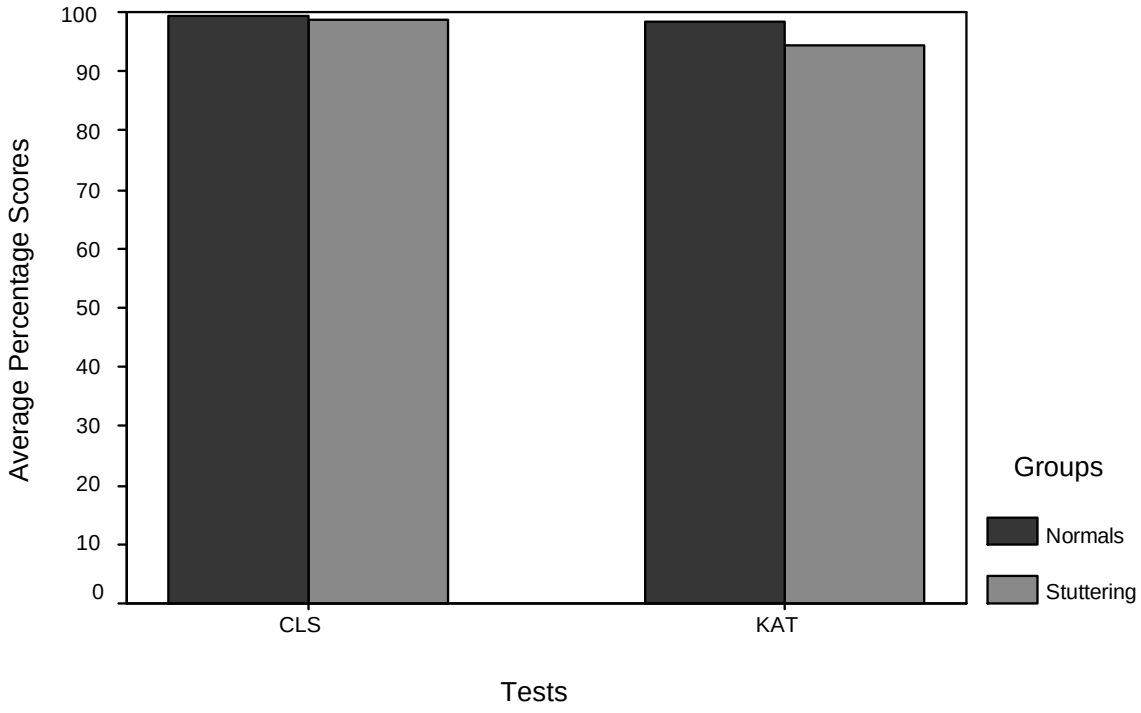
that stuttering is related to an unstable phonological system, and in individuals who stutter the phonological encoding which is responsible for developing the articulatory plan is faulty. According to Paden and Yairi (1996) and Paden, Ambrose and Yairi (2002), poor phonological skills in the early stages of stuttering may be used to differentiate between persistent CWS and recovered CWS.

The language test scores in the present study however did not show any significant difference in language abilities between the two groups of CWS and CWNS. This was unlike previous studies which documented that children who stutter differ in their speech and language skills, therefore requiring sub-grouping (eg. Louko et al., 1990; Bloodstein, 1995; Ramig & Bennett, 1995, 1997a; Geetha, 1996; Bernstein Ratner, 1997b; Guitar, 1998; Melnick & Conture, 2000; Conture, 2001; Yairi, 2004). CWS have been shown by many studies to have lower scores for receptive and expressive language (Murray and Reed, 1977; St. Louis & Hinzman, 1988; Byrd & Cooper, 1989; Anderson & Conture, 2000;).

The results of the current study, rather goes alongside with the results of the longitudinal study by Watkins et al. (1999), who found that CWS and CWNS were similar in skill on all the measures of expressive language. However, these findings on articulatory and language abilities of CWS cannot be generalized easily, because this study did not include a detailed analysis of the conversational speech of CWS and CWNS. Articulatory skills were only analyzed at word level, and the language abilities of

each child was not tested across the various language parameters like morphology, semantics and syntax, in particular.

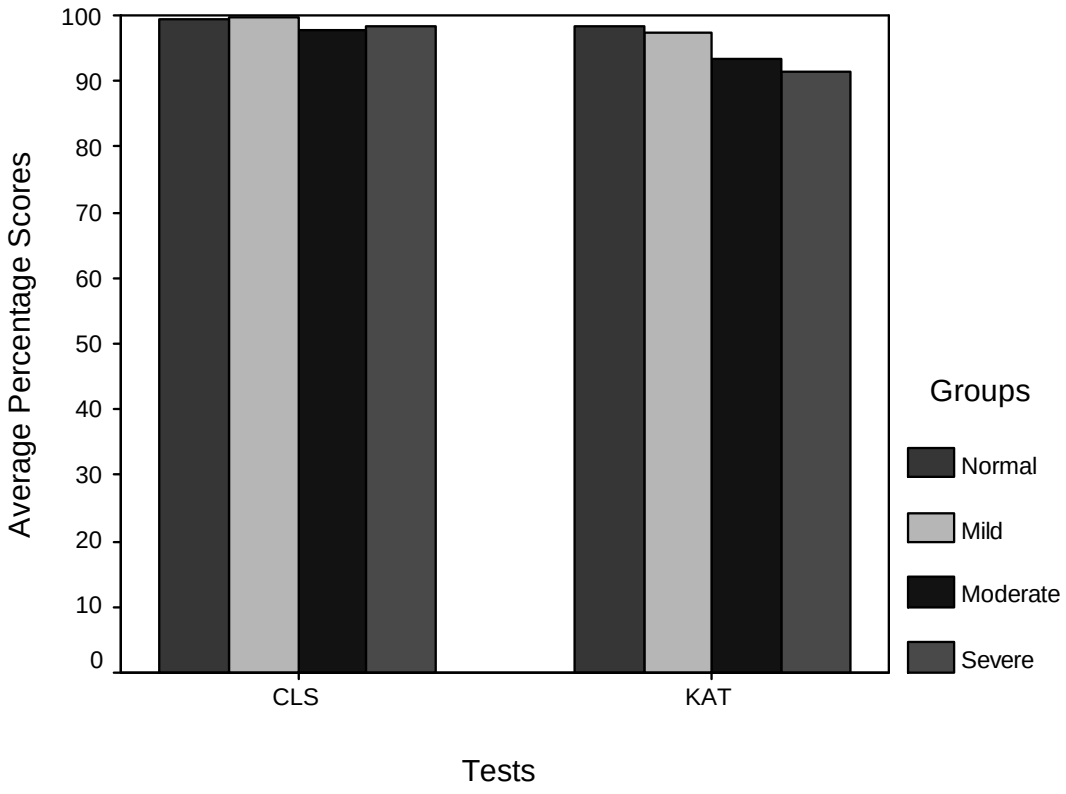
Graph 1 below gives the average percentage scores of articulation (KAT) and language (CLS) tests in CWNS and CWS.



Graph 1: Average percentage scores of articulation (KAT) and language (CLS) tests in CWNS and CWS.

It can be seen from the graph that CWS score slightly lower than CWNS on these tests of articulation and language, and this is more evident in the KAT scores.

Graph 2 shows how the performance in the articulation (KAT) and language (CLS) tests vary with respect to CWNS and CWS with varied severities of stuttering.



Graph 2: Average percentage scores of articulation (KAT) and language (CLS) tests across the varying levels of severity.

Just as observed from the means and standard deviations from the graph it can be clearly interpreted that the KAT scores show a decreasing pattern from the normal to the severe group, while this pattern is not seen in the language scores.

2. Word/Nonword Repetition task

The performance of the subjects in word/nonword repetition task can be discussed with respect to three major aspects, as follows:

1) Number of correct responses (CR)
2) Number of fluent responses (F)
3) Number of phonemes correct (PC)

a. Comparison with respect to age-group, gender and severity:

The mean and standard deviations of the various parameters in the word and nonword repetition task scores, in CWNS and CWS, are given with respect to gender and age groups (5;0-5;6 years and 5;6-6;0 years) in Table 6 and Table 7, respectively.

It can be observed from table 6 that in both males and females the CWNS performed better on all the parameters related to word/nonword repetition than CWS. In the number of correct responses obtained there was no gender difference in general. However, if the total number of correct responses is considered for the word and nonword repetition tasks, in both CWNS and CWS groups males have performed better than the females, especially on the nonword repetition task. But, if the responses across the syllable word/nonword lengths are considered, variations in responses between males and females can be recognized, where males have scored better in some parameters and females in other parameters.

Table 6: Mean and standard deviations of various parameters in word and nonword repetition task in CWNS and CWS, with respect to gender.

Test scores	CWNS						CWS					
	M			F			M			F		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
CRBIW	4	95.00	2.00	11	95.64	6.05	8	88.00	8.55	2	92.00	.00
CRTRIW	4	90.00	10.58	11	94.18	5.47	8	85.00	9.97	2	80.00	16.97
CRTW	4	92.50	6.19	11	91.18	16.85	8	86.50	8.26	2	86.00	8.49
CRBINW	4	78.00	14.79	11	71.64	10.95	8	77.50	11.10	2	62.00	2.83
CRTRINW	4	91.00	3.83	11	83.64	7.47	8	75.00	15.23	2	80.00	16.97
CRTNW	4	84.50	8.70	11	77.64	7.15	8	76.75	13.56	2	71.00	9.90
FBIW	4	97.00	3.83	11	98.91	1.87	8	88.00	13.18	2	86.00	19.80
FTRIW	4	96.00	8.00	11	97.82	2.75	8	77.00	27.77	2	46.00	65.05
FTW	4	96.50	5.74	11	98.36	1.96	8	82.50	19.35	2	66.00	42.43
FBINW	4	95.00	10.00	11	98.91	1.87	8	78.00	33.67	2	70.00	31.11
FTRINW	4	93.00	8.25	11	93.82	6.03	8	69.00	29.91	2	52.00	62.23
FTNW	4	94.00	8.49	11	96.36	3.20	8	72.50	32.54	2	61.00	46.67
PCBIW	4	98.52	.57	11	98.75	1.82	8	96.93	2.37	2	96.07	2.77
PCTRIW	4	97.33	1.96	11	98.97	.91	8	96.75	2.40	2	96.33	3.30
PCTW	4	97.81	1.35	11	98.88	1.13	8	96.82	2.21	2	96.23	3.09
PCBINW	4	92.89	2.93	11	91.88	3.54	8	93.25	4.49	2	89.21	1.39
PCTRINW	4	97.66	.66	11	96.42	1.56	8	94.00	4.59	2	94.00	6.60
PCTNW	4	95.73	1.19	11	90.98	11.76	8	93.70	4.21	2	92.06	4.49

[M = male; F = female; N = number of subjects; SD = standard deviation; CRBIW = number of correct responses on bi-syllabic word repetition task; CRTRIW = number of correct responses on tri-syllabic word repetition task; CRTW = total number of correct responses on word repetition task; CRBINW = number of correct responses on bi-syllabic nonword repetition task; CRTRINW= number of correct responses on tri-syllabic nonword repetition task; CRTNW = total number of correct responses on nonword repetition task; FBIW = number of fluent responses on bi-syllabic word repetition task; FTRIW = number of fluent responses on tri-syllabic word repetition task; FTW = total number of fluent responses on word repetition task; FBINW = number of fluent responses on bi-syllabic nonword repetition task; FTRINW = number of fluent responses on tri-syllabic nonword repetition task; FTNW = total number of fluent responses on nonword repetition task; PCBIW = number of phonemes correct on bi-syllabic word repetition task; PCTRIW = number of phonemes correct on tri-syllabic word repetition task; PCTW = total number of phonemes correct on word repetition task; PCBINW = number of phonemes correct on bi-syllabic nonword repetition task; PCTRINW = number of phonemes correct on tri-syllabic nonword repetition task; PCTNW = total number of phonemes correct on nonword repetition task]

Taking into account the number of fluent responses in all the parameters related to fluency, in CWS females had better fluency during the word/nonword repetition task compared to males. On the other hand, in the CWNS group, males could maintain better fluency than females on all the fluency related parameters, during the repetition task. For the parameters related to the number of phonemes correct, the males and females received almost similar scores in both CWNS and CWS groups.

When comparing the age-groups, it can be seen that in CWNS, the children in the 5;6-6;0 years age group performed better in the word repetition task than those in the 5;0-5;6 years age group. But for the nonword repetition task, both the age groups performed nearly similar, indicating that children in both the groups had similar difficulty in nonword repetition. But, in the stuttering group, children in the 5;6-6;0 years age group scored better than those in the 5;0-5;6 years age group, on all the parameters related to the number of correct responses.

The children in the 5;6-6;0 years age- group, in general, seem to be able to maintain better fluency during the word/nonword repetition task, compared to those in the 5;0-5;6 years age- group. This is more evident in the CWNS group than in the CWS group. Children in the stuttering group show some variability in the pattern of responses between the age groups, in the nonword repetition task.

Table 7: Mean and standard deviations of scores of various parameters in word and nonword repetition task in CWNS and CWS, with respect to age groups (5;0-5;6 and 5;6-6;0 years).

Test scores	CWNS						CWS					
	5-5.6			5.6-6			5-5.6			5.6-6		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
CRBIW	3	89.33	8.33	12	97.00	3.02	5	85.60	9.21	5	92.00	4.90
CRTRIW	3	92.00	8.00	12	93.33	7.10	5	78.40	11.87	5	89.60	6.07
CRTW	3	77.00	31.32	12	95.17	4.30	5	82.00	9.17	5	90.80	2.28
CRBINW	3	73.33	20.53	12	73.33	10.14	5	66.40	8.29	5	82.40	9.21
CRTRINW	3	86.67	10.07	12	85.33	7.10	5	68.80	17.53	5	83.20	7.16
CRTNW	3	80.00	15.10	12	79.33	6.17	5	67.60	10.81	5	83.60	9.10
FBIW	3	96.00	4.00	12	99.00	1.81	5	87.20	17.75	5	88.00	9.38
FTRIW	3	90.67	6.11	12	99.00	1.81	5	62.40	45.40	5	79.20	23.56
FTW	3	93.33	4.62	12	99.00	1.60	5	74.80	31.10	5	83.60	14.10
FBINW	3	92.00	10.58	12	99.33	1.56	5	78.40	26.17	5	74.40	39.46
FTRINW	3	93.33	8.33	12	93.67	6.26	5	62.40	46.10	5	68.80	22.34
FTNW	3	92.67	9.24	12	96.50	3.42	5	70.40	36.07	5	70.00	33.91
PCBIW	3	96.72	2.26	12	99.18	.92	5	95.48	2.56	5	98.03	1.20
PCTRIW	3	97.77	.77	12	98.72	1.49	5	95.20	2.42	5	98.13	1.28
PCTW	3	97.35	1.21	12	98.90	1.09	5	95.31	2.44	5	98.09	.59
PCBINW	3	91.50	2.99	12	92.31	3.49	5	89.60	3.57	5	95.29	3.05
PCTRINW	3	96.66	1.77	12	96.77	1.47	5	92.00	5.73	5	96.00	2.21
PCTNW	3	81.35	22.08	12	94.97	1.74	5	91.03	4.20	5	95.71	2.40

[N = number of subjects; SD = standard deviation; CRBIW = number of correct responses on bi-syllabic word repetition task; CRTRIW = number of correct responses on tri-syllabic word repetition task; CRTW = total number of correct responses on word repetition task; CRBINW = number of correct responses on bi-syllabic nonword repetition task; CRTRINW= number of correct responses on tri-syllabic nonword repetition task; CRTNW = total number of correct responses on nonword repetition task; FBIW = number of fluent responses on bi-syllabic word repetition task; FTRIW = number of fluent responses on tri-syllabic word repetition task; FTW = total number of fluent responses on word repetition task; FBINW = number of fluent responses on bi-syllabic nonword repetition task; FTRINW = number of fluent responses on tri-syllabic nonword repetition task; FTNW = total number of fluent responses on nonword repetition task; PCBIW = number of phonemes correct on bi-syllabic word repetition task; PCTRIW = number of phonemes correct on tri-syllabic word repetition task; PCTW = total number of phonemes correct on word repetition task; PCBINW = number of phonemes correct on bi-syllabic nonword repetition task; PCTRINW = number of phonemes correct on tri-syllabic nonword repetition task; PCTNW = total number of phonemes correct on nonword repetition task]

In both CWNS and CWS groups, children in the 5;6-6;0 years age group obtained more number of phonemes correct on all the parameters related to it, in the word/nonword repetition task when compared to the children in the 5;0-5;6 years age-group.

Further statistical analysis could not be carried out with respect to age and gender grouping since there is irregularity in the sample size between the groups and the sample size is inadequate in some groups for statistical analyses.

b. Between- group comparison:

The mean and standard deviations across the CWNS and CWS groups were obtained for various parameters in word and nonword repetition task, the results of which are shown as in Table 8. It can be noted that CWNS were better on most of the parameters on the word/nonword repetition task compared to those in the CWS group.

The mean and standard deviations given in Table 9 show how the test scores for the various parameters in word and nonword repetition task varied in CWNS and CWS groups with different severities of stuttering. Though a clear decrease in performance is not seen from the normal to the severe group, the normal and the mild groups definitely are better on all the parameters related to the word/nonword repetition task, when compared to those in the moderate and severe groups.

Table 8: Mean and standard deviations of the scores of various parameters in word and nonword repetition task between CWNS and CWS groups.

Test scores	CWNS			CWS		
	N	Mean	SD	N	Mean	SD
CRBIW	15	95.47	5.21	10	88.80	7.73
CRTRIW	15	93.07	7.00	10	84.00	10.67
CRTW	15	91.53	14.54	10	86.40	7.82
CRBINW	15	73.33	11.87	10	74.40	11.81
CRTRINW	15	85.60	7.38	10	76.00	14.73
CRTNW	15	79.47	7.91	10	75.60	12.64
FBIW	15	98.40	2.53	10	87.60	13.39
FTRIW	15	97.33	4.45	10	70.80	35.23
FTW	15	97.87	3.25	10	79.20	23.23
FBINW	15	97.87	5.21	10	76.40	31.63
FTRINW	15	93.60	6.38	10	65.60	34.32
FTNW	15	95.73	4.89	10	70.20	33.00
PCBIW	15	98.69	1.56	10	96.76	2.31
PCTRIW	15	98.53	1.41	10	96.66	2.39
PCTW	15	98.59	1.24	10	96.70	2.22
PCBINW	15	92.15	3.31	10	92.44	4.33
PCTRINW	15	96.75	1.47	10	94.00	4.61
PCTNW	15	92.24	10.19	10	93.37	4.06

[N = number of subjects; SD = standard deviation; CRBIW = number of correct responses on bi-syllabic word repetition task; CRTRIW = number of correct responses on tri-syllabic word repetition task; CRTW = total number of correct responses on word repetition task; CRBINW = number of correct responses on bi-syllabic nonword repetition task; CRTRINW= number of correct responses on tri-syllabic nonword repetition task; CRTNW = total number of correct responses on nonword repetition task; FBIW = number of fluent responses on bi-syllabic word repetition task; FTRIW = number of fluent responses on tri-syllabic word repetition task; FTW = total number of fluent responses on word repetition task; FBINW = number of fluent responses on bi-syllabic nonword repetition task; FTRINW = number of fluent responses on tri-syllabic nonword repetition task; FTNW = total number of fluent responses on nonword repetition task; PCBIW = number of phonemes correct on bi-syllabic word repetition task; PCTRIW = number of phonemes correct on tri-syllabic word repetition task; PCTW = total number of phonemes correct on word repetition task; PCBINW = number of phonemes correct on bi-syllabic nonword repetition task; PCTRINW = number of phonemes correct on tri-syllabic nonword repetition task; PCTNW = total number of phonemes correct on nonword repetition task]

Table 9: Mean and standard deviations of the scores of the various parameters in word and nonword repetition task in CWNS and CWS groups with different severities of stuttering.

Test scores	CWNS			CWS-Mild			CWS-Moderate			CWS-Severe		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
CRBIW	15	95.47	5.21	4	91.00	5.03	3	88.00	6.93	3	86.67	12.86
CRTRIW	15	93.07	7.00	4	92.00	3.27	3	86.67	4.62	3	70.67	8.33
CRTW	15	91.53	14.54	4	91.50	1.91	3	87.33	5.03	3	78.67	10.07
CRBINW	15	73.33	11.87	4	82.00	12.44	3	69.33	10.07	3	69.33	10.07
CRTRINW	15	85.60	7.38	4	89.00	2.00	3	61.33	16.17	3	73.33	6.11
CRTNW	15	79.47	7.91	4	86.50	6.61	3	65.33	12.86	3	71.33	8.08
FBIW	15	98.40	2.53	4	90.00	12.44	3	85.33	18.90	3	86.67	14.05
FTRIW	15	97.33	4.45	4	90.00	10.07	3	72.00	38.57	3	44.00	46.13
FTW	15	97.87	3.25	4	90.00	10.95	3	78.67	28.73	3	65.33	30.02
FBINW	15	97.87	5.21	4	91.00	2.00	3	82.67	26.63	3	50.67	48.06
FTRINW	15	93.60	6.38	4	80.00	13.06	3	66.67	44.06	3	45.33	45.49
FTNW	15	95.73	4.89	4	85.50	6.61	3	74.67	35.35	3	45.33	46.49
PCBIW	15	98.69	1.56	4	97.79	1.23	3	97.05	1.70	3	95.09	3.53
PCTRIW	15	98.53	1.41	4	98.66	.54	3	96.44	2.34	3	94.22	1.68
PCTW	15	98.59	1.24	4	98.31	.38	3	96.69	2.04	3	94.57	2.42
PCBINW	15	92.15	3.31	4	95.34	3.52	3	89.86	4.93	3	91.17	3.53
PCTRINW	15	96.75	1.47	4	97.17	2.13	3	90.89	6.40	3	92.89	3.36
PCTNW	15	92.24	10.19	4	96.42	1.62	3	90.47	5.07	3	92.19	3.38

[N = number of subjects; SD = standard deviation; CRBIW = number of correct responses on bi-syllabic word repetition task; CRTRIW = number of correct responses on tri-syllabic word repetition task; CRTW = total number of correct responses on word repetition task; CRBINW = number of correct responses on bi-syllabic nonword repetition task; CRTRINW= number of correct responses on tri-syllabic nonword repetition task; CRTNW = total number of correct responses on nonword repetition task; FBIW = number of fluent responses on bi-syllabic word repetition task; FTRIW = number of fluent responses on tri-syllabic word repetition task; FTW = total number of fluent responses on word repetition task; FBINW = number of fluent responses on bi-syllabic nonword repetition task; FTRINW = number of fluent responses on tri-syllabic nonword repetition task; FTNW = total number of fluent responses on nonword repetition task; PCBIW = number of phonemes correct on bi-syllabic word repetition task; PCTRIW = number of phonemes correct on tri-syllabic word repetition task; PCTW = total number of phonemes correct on word repetition task; PCBINW = number of phonemes correct on bi-syllabic nonword repetition task; PCTRINW = number of phonemes correct on tri-syllabic nonword repetition task; PCTNW = total number of phonemes correct on nonword repetition task]

The children with severe stuttering were observed to have more difficulty in maintaining fluency when the syllable length was more and when they had to repeat nonwords. Thus, it may be concluded that as the complexity of the stimulus increases children having severe stuttering find it more difficult to repeat the stimulus fluently.

The decrease in fluency in these children could be explained using the Covert Repair Hypothesis, according to which speakers who stutter are slower at phonological encoding. When the stimulus is complex, the timing for the activation of upcoming phonological units is slow. This increases the likelihood of selection error and consequently the likelihood of stuttering, because all the units are equally activated.

An independent samples t-test was done between CWNS and CWS groups to see how their performance varied across various parameters in word and nonword repetition task. The values of the t- test are given in Table 10.

Among the measures obtained from the word and nonword repetition task, a significant difference ($p < 0.05$) was noted across most of the parameters between CWNS and CWS groups. The parameters in which CWNS and CWS varied significantly ($p < 0.05$) are CRBIW, CRTRIW, CRTRINW, FBIW, FTRIW, FTW, FBINW, FTRINW, FTNW, PCBIW, PCTRIW, PCTW, PCTRINW.

Table 10: Values obtained on independent samples t-test
for scores of various parameters
in word and nonword repetition task.

Test scores	t (23)
CRBIW	2.58*
CRTRIW	2.57*
CRTW	1.02
CRBINW	.22
CRTRINW	2.16*
CRTNW	.94
FBIW	3.07*
FTRIW	2.91*
FTW	3.09*
FBINW	2.60*
FTRINW	3.11*
FTNW	2.97*
PCBIW	2.50*
PCTRIW	2.46*
PCTW	2.73*
PCBINW	.19
PCTRINW	2.17*
PCTNW	.33

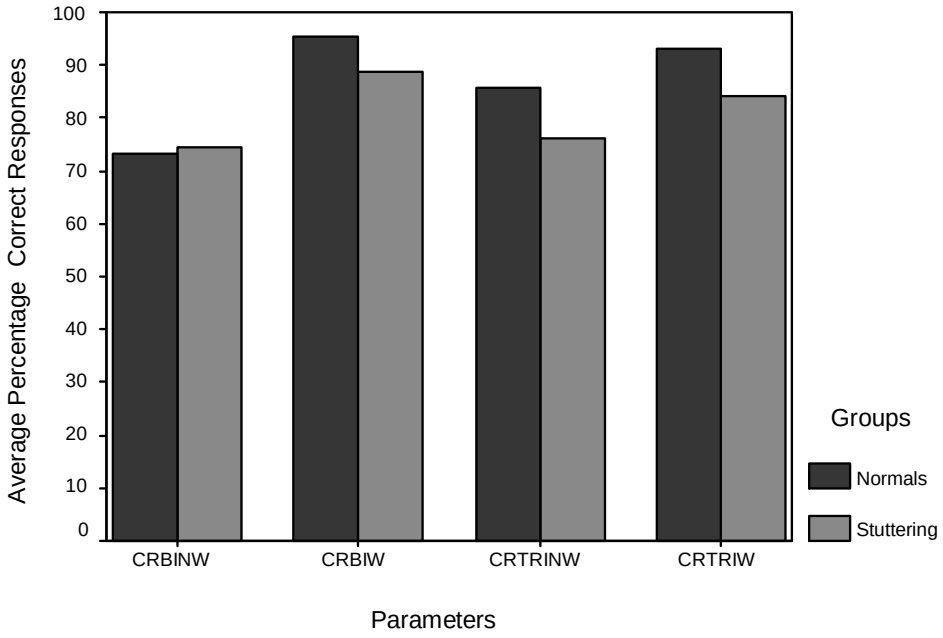
[* = significant difference ($p < 0.05$); CRBIW = number of correct responses on bi-syllabic word repetition task; CRTRIW = number of correct responses on tri-syllabic word repetition task; CRTW = total number of correct responses on word repetition task; CRBINW = number of correct responses on bi-syllabic nonword repetition task; CRTRINW= number of correct responses on tri-syllabic nonword repetition task; CRTNW = total number of correct responses on nonword repetition task; FBIW = number of fluent responses on bi-syllabic word repetition task; FTRIW = number of fluent responses on tri-syllabic word repetition task; FTW = total number of fluent responses on word repetition task; FBINW = number of fluent responses on bi-syllabic nonword repetition task; FTRINW = number of fluent responses on tri-syllabic nonword repetition task; FTNW = total number of fluent responses on nonword repetition task; PCBIW = number of phonemes correct on bi-syllabic word repetition task; PCTRIW = number of phonemes correct on tri-syllabic word repetition task; PCTW = total number of phonemes correct on word repetition task; PCBINW = number of phonemes correct on bi-syllabic nonword repetition task; PCTRINW = number of phonemes correct on tri-syllabic nonword repetition task; PCTNW = total number of phonemes correct on nonword repetition task]

(i) Number of correct responses:

The average score for the children in the CWNS group, for the total number of correct responses in the word repetition task (CRTW) was 91.53 (SD= 14.53) while that for those in the stuttering group was 86.4 (SD= 7.82) (Table 8). As determined by the t-test, this difference is not significant [t (23) = 1.02, p> 0.05].

On the nonword repetition task, the average score for the normal children for the total number of correct responses (CRTNW) was 79.46 (SD= 7.90), while that for those in the stuttering group was 75.6 (SD= 12.64) (Table 8). There was no significant difference obtained between the two groups on CRTNW [t (23) = 0.94, p> 0.05] (Table 10).

From the mean and standard deviations obtained (Table8), it is clear that the children in the stuttering group performed more poorly in the nonword repetition task for the bi- syllabic nonwords (CRBINW) and were nearly equal in their scores for the tri-syllabic nonwords (CRTRINW); the children with stuttering performed slightly better than their normal peers. Thus, on the independent samples t-test significant differences (p< 0.05) were found between the two groups only for the tri-syllabic nonword repetition (CRTRINW) (Table 10).



Graph 3: Average percentage correct responses across bi- and tri- syllable word/nonword lengths, between CWNS and CWS groups.

However, when the performances of the two groups were compared across the syllable lengths of the words (CRBIW, CRTRIW), children with stuttering were found to perform significantly poorer than their normal peers ($p < 0.05$). This is also evident from the graph 3.

The results of the present study partly replicate the results of the earlier studies on nonword repetition in CWS (Hakim & Ratner, 2004; Anderson et al., 2006; Seery et al., 2006; Bakhtiar et al., 2007). These authors had not attempted to find differences in word repetition between CWS and CWNS. On the nonword repetition task, they found that CWS had a slightly poor performance in nonword repetition score than CWNS, though not significant. The same was concluded from the present study.

Overall, both the groups produced fewer correct responses with increased syllable length, as per the present and the previous studies. But, Hakim and Ratner, (2004) found significant differences in performance between the groups at the tri-syllabic nonword length. The present study also found significant differences in performance only for CRTRIW. Marton and Schwartz (2003) also found three-syllable nonwords to be the 'breakpoint' at which SLI and typically developing children were best differentiated. Similarly, tri-syllabic nonwords may serve as an indicator to differentiate CWS from CWNS.

Thus the results on the number of correct responses in nonword repetition task seem to follow the same pattern in English and Kannada, in CWS and CWNS.

(ii) Number of fluent responses:

When CWS and CWNS were compared for their performance across various parameters related to the number of fluent responses obtained in the word repetition task (FBIW, FTRIW, FTW, FBINW, FTRINW, FTNW), a significant difference ($p < 0.05$) was seen for all these parameters.

The average score for the CWNS for the total number of fluent responses in the word repetition task (FTW) was 97.26 (SD= 3.24), while that for CWS was 79.2 (SD= 23.23) (Table 8). The values of t- test (Table 10) clearly reveals that there is a significant difference between the performance of the two groups on FTW

[t (23) = 3.099, p< 0.05], indicating that there were significantly more stuttering-like disfluencies among the CWS compared to CWNS, during the word repetition task.

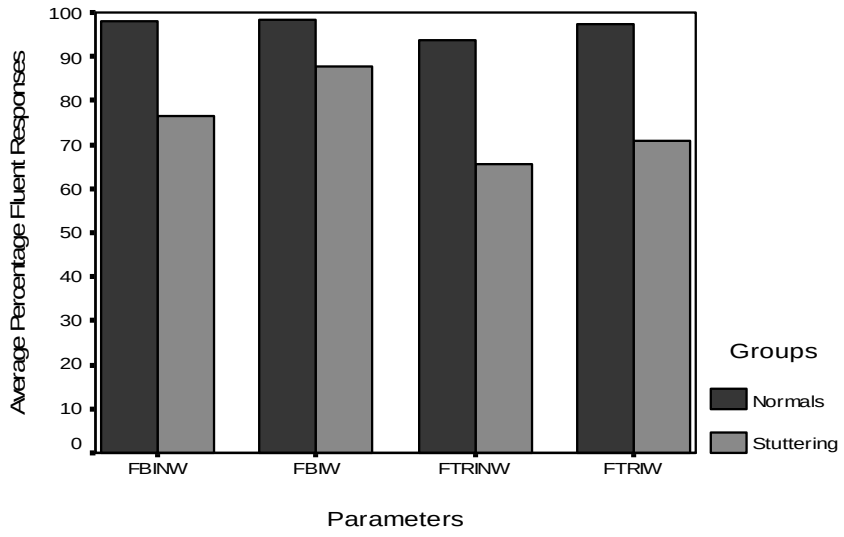
When the performances of the two groups were compared across the different syllable lengths of the words (FBIW, FTRIW), children with stuttering were found to have significantly poorer number of fluent responses than their normal peers (p< 0.05). Also, greater differences were seen between the groups for the tri-syllabic word repetition, implying that as the word length increased during the repetition task, the CWS had greater difficulty maintaining their fluency.

On the nonword repetition task the average score for the normal children for the total number of fluent responses (FTNW) was 95.73 (SD= 4.89), while that for those in the CWNS group was 70.20 (SD= 33.0) (Table 8). The t-test revealed a significant difference between the two groups on FTNW [t (23) = 2.97, p< 0.05) (Table 10).

From the results obtained on the mean and standard deviations (Table 8) and independent samples t-test (Table 10), it is clear that the CWS were significantly poorer in maintaining their fluency in the nonword repetition task for the bi- and tri-syllabic nonwords (FBINW, FTRINW), compared to the group of CWNS (p< 0.05).

Similar to findings were also noted in the word repetition task where CWS had greater difficulty in maintaining fluency during nonword repetition at the tri-syllabic length compared to bi-syllabic. But, this finding was not the same as in the earlier studies

(Hakim & Ratner, 2004; Anderson et al., 2006). Unlike the present study, the earlier studies had found that the fluency of nonword productions did not change as a function of increased nonword length.



Graph 4: Average percentage fluent responses across bi- and tri- syllable word/nonword lengths, between CWNS and CWS groups.

Graph 4 also shows that CWNS has better fluency than CWS on all the parameters related to fluency in the word/nonword repetition tasks.

(iii) Number of phonemes correct:

The average score for the children in the CWNS group for the total number of phonemes correct in the word repetition task (PCTW) was 98.59 (SD= 1.24), while that for those in the stuttering group was 96.70 (SD= 2.22) (Table 8). As indicated by the t-test, the difference in the total number of phonemes correct between the two groups is significant [$t(23) = 2.73$, $p < 0.05$].

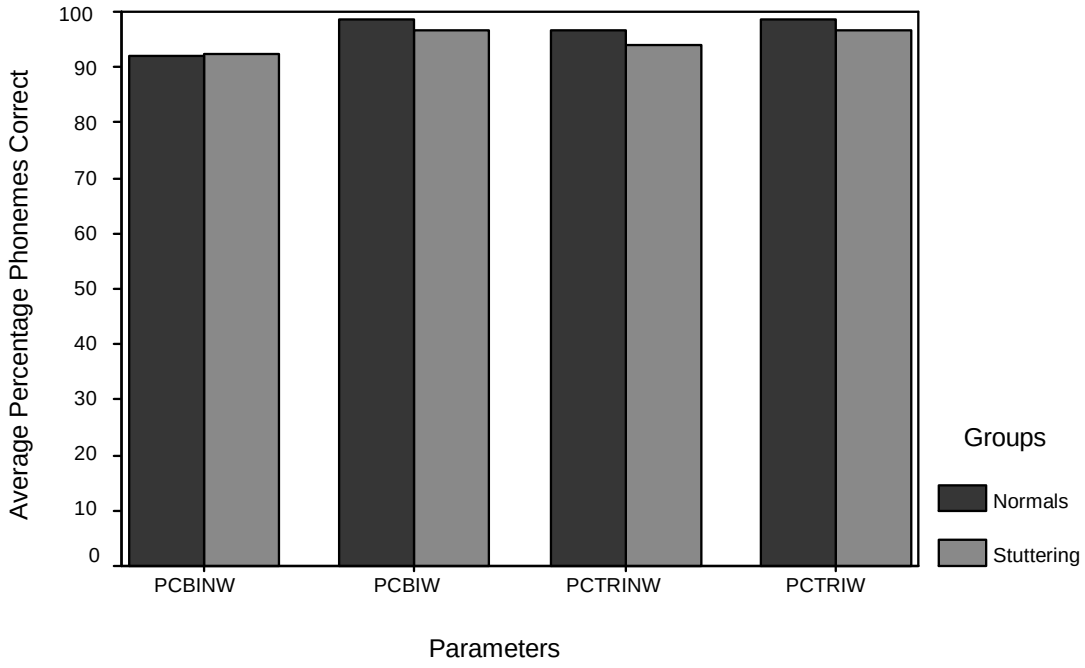
The number of phonemes correct was also calculated across the syllable lengths of the words for both the groups analyzed. The statistical analyses reveal that the number of phonemes correct in the bi- and tri-syllabic word repetitions (PCBIW, PCTRIW) between the two groups is significantly different ($p < 0.05$). Generally it can be noted from the statistical data that children with stuttering produce more phoneme errors on the word repetition task than their normal peers.

On the nonword repetition task, the average score for CWNS for the total number of correct responses (PCTNW) was 92.24 (SD= 10.19) while that for CWS group was 93.36 (SD= 4.06) (Table 8). There was no significant difference obtained between the two groups on PCTNW [$t(23) = 0.33$, $p > 0.05$) (Table 10).

From the mean and standard deviations obtained (Table 8), results can also be inferred across the nonword syllable lengths. While the CWS are nearly equal in their number of phonemes correct, with the CWNS, for the bi- syllabic nonword repetition task (PCBINW), in the tri-syllabic nonword repetition task (PCTRINW) the CWS show significantly more phoneme errors than CWNS ($p < 0.05$). Thus, on the independent samples t-test significant differences were found for the number of phonemes correct between the two groups only in tri-syllabic nonword repetition task (PCTRINW) (Table 10).

This may be due to the fact that as the complexity of the nonwords increases with respect to the number of syllables it has, the CWS has more difficulty processing the word and retrieving it for repeating.

The graph 5 below also shows that generally there are more phoneme errors for CWS on a word/nonword repetition task. In the present study, only equal number of phoneme errors was obtained for both groups in the bi-syllabic nonword repetition task.



Graph 5: Average percentage phonemes correct across bi- and tri- syllable word/nonword lengths, between CWNS and CWS groups.

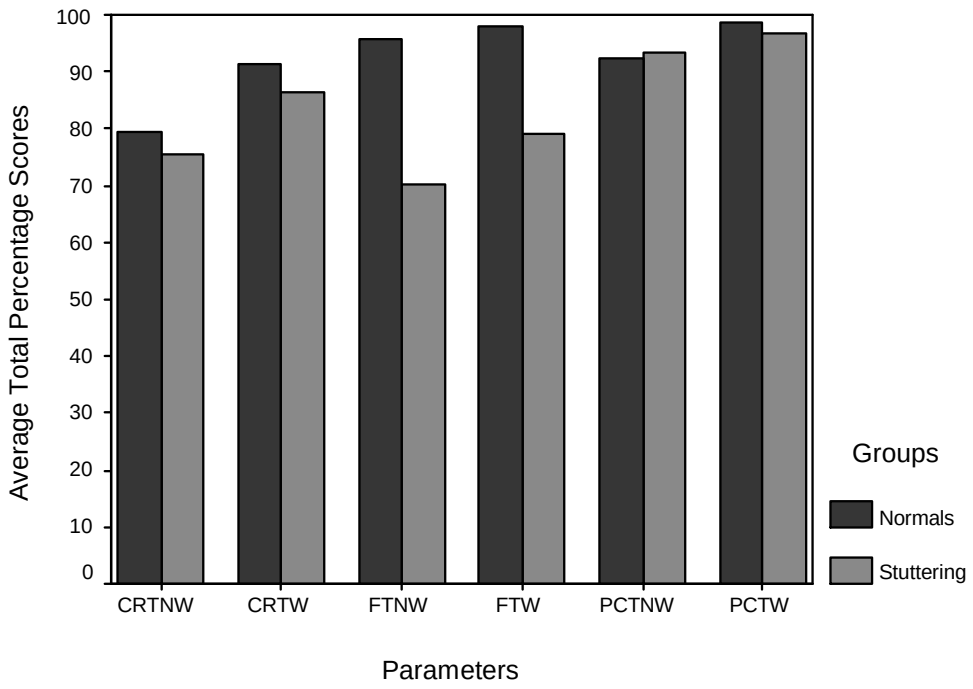
Previous studies in the literature regarding the number of phonemes correct in a nonword repetition task in CWS have given varied conclusions. Few studies have found that, although the CWNS produced more phonemes correct than the CWS group at all nonword lengths, the differences were significant only at the three-syllable stimuli length (eg., Hakim & Ratner, 2004; Anderson et al., 2006; Bakhtiar et al., 2007). A study by

Seery et al. (2006) demonstrated an increase in the fluency of phoneme errors with increased syllable length.

Since a significant difference was noted only for PCTRINW in the present study the result is not in consonance with the study by Seery et al. (2006). It supports the other studies done in English and Persian languages (Hakim & Ratner, 2004; Anderson et al., 2006; Bakhtiar et al., 2007). Hence, it can be concluded that a tri-syllabic nonword repetition task can be a better indicator to differentiate CWS from CWNS, irrespective of the native language of the child.

(iv) Average total percentage scores:

The graph 6 reveals that when comparing the CWS and CWNS on the total scores obtained on the parameters related to the word/nonword repetition scores, CWS generally show a poorer performance for most of the parameters. The CWS show a lower CRTW and CRTNW score, compared to CWNS, though the difference is not significant. There is a marked reduction in fluency observed on word and nonword repetition tasks in CWS, when compared to CWNS. Only on the nonword repetition task, the CWS have more number of phonemes correct when compared to the CWNS group.



Graph 6: Average total percentage scores across various parameters of word and nonword repetition tasks, between the CWNS and CWS groups.

From these results it can be concluded that CWS have poor word/nonword repetition skills. Literature on nonword repetition have stated that for successful performance on the nonword repetition task, several processing operations may be required like transforming the acoustic-phonetic sequence into its constituent phonemes, maintaining the ordered and phonologically coded string in working memory and organizing the articulatory output. These skills are also involved in language learning and deficits in any or all of these operations could have negative consequences for nonword repetition and language learning tasks, such as creating new lexical entries and formulating sentences. Thus, from the present study the CWS can be said to have deficits in these areas.

(v) Word/nonword repetition task scores across severity:

Kruskal-Wallis Test was done to test the differences in performance on the word/nonword repetition task, across the different severities of stuttering. A significant difference was seen only in CRTRIW and CRTRINW at 5% level of significance. Hence, further comparisons were done only for these two parameters across varying levels of severity.

Significant differences obtained only for CRTRIW and CRTRINW across the varying severities again supports the importance of tri-syllabic word and nonword repetition tasks in distinguishing not only between CWS and CWNS in general, but also in differentiating across the severities.

Since the sample size in each of the severity groups was small a non-parametric test, Mann-Whitney Test, was used for further analysis. The results obtained are as follows:

- When the individuals in the normal and mild stuttering group were compared for CRTRIW and CRTRINW scores, no significant differences ($p > 0.05$) were revealed in their performance.
- A significant difference ($p < 0.05$) was observed for CRTRINW scores between the CWNS and children with moderate stuttering.

- Between CWNS and children with severe stuttering a significant difference ($p < 0.05$) was found across both the CRTRIW and CRTRINW scores.
- Analysis done between mild and moderate stuttering groups revealed a significant difference ($p < 0.05$) only in the CRTRINW scores.
- A significant difference ($p < 0.05$) was observed in both CRTRIW and CRTRINW scores when the mild stuttering group was compared with the severe stuttering group.
- Lastly, the moderate and the severe stuttering groups were compared for the CRTRIW and CRTRINW scores and a significant difference ($p < 0.05$) was observed only for the CRTRIW scores.

From the above data obtained with respect to severity, a pattern can be drawn to distinguish between the different severities of stuttering, as follows:

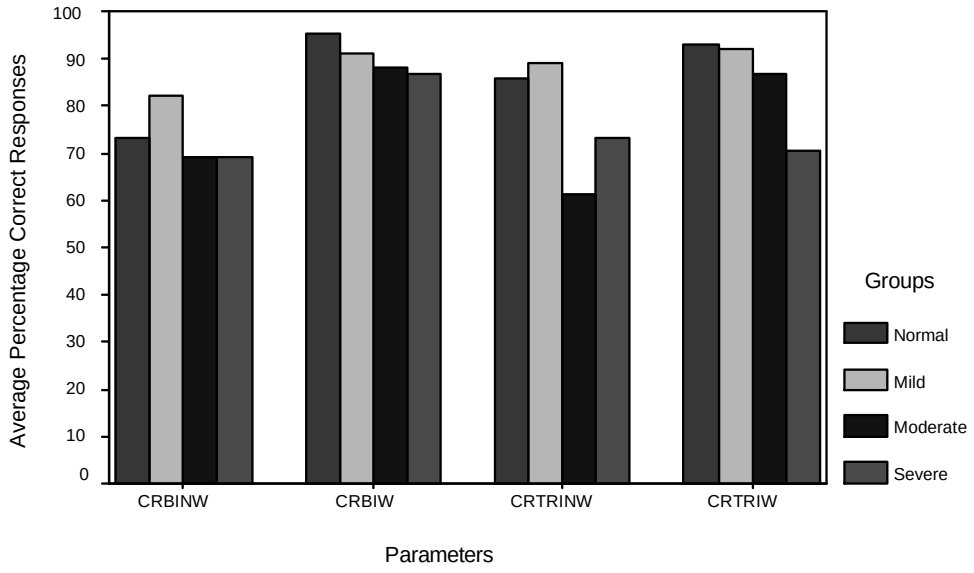
Table 11: Pattern of variation in performances on CRTRIW and CRTRINW between different levels of severity.

Severity	**CRTRIW**	**CRTRINW**
Normal and mild	NSD	NSD
Normal and moderate	NSD	S
Normal and severe	S	S
Mild and moderate	NSD	S
Mild and severe	S	S
Moderate and severe	S	NSD

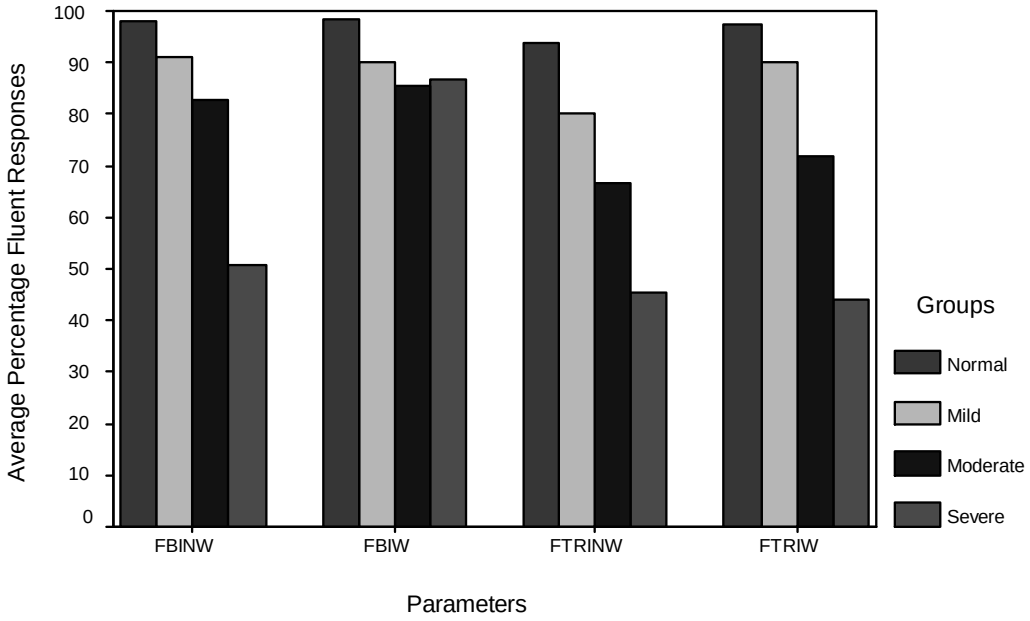
[CRTRIW = number of correct responses on tri-syllabic word repetition task; CRTRINW = number of correct responses on tri-syllabic nonword repetition task; NSD= no significant difference, S= significant difference]

This data may help in developing a testing protocol to differentiate between the severities based on a tri-syllabic word and nonword repetition task.

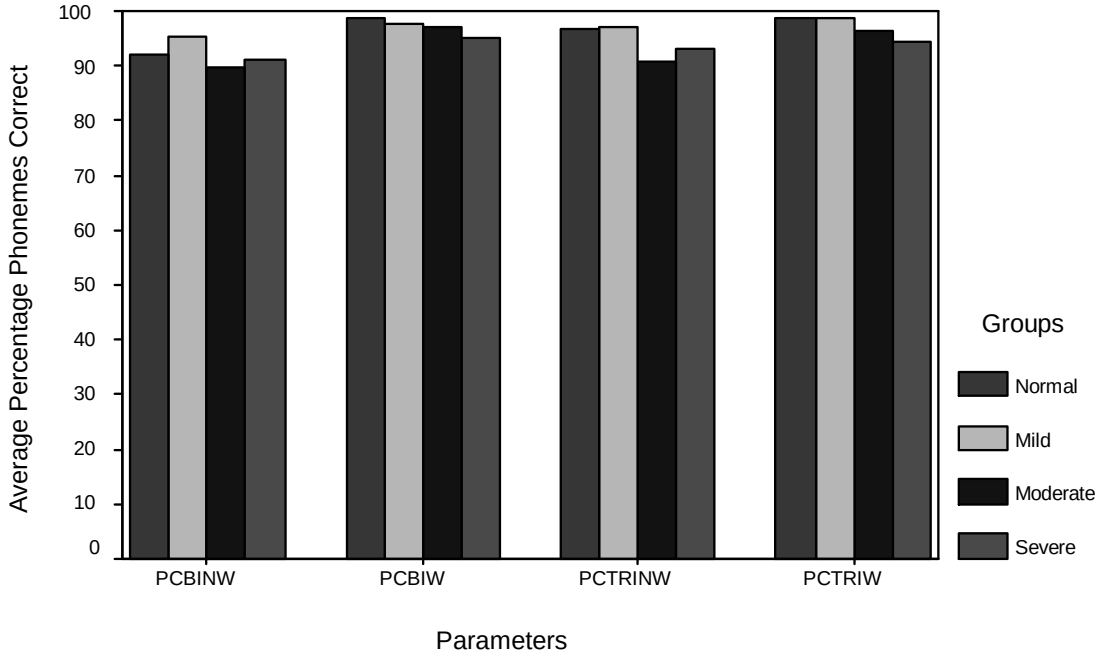
Graphs 7, 8, 9 and 10 depict word/nonword repetition task scores in average percentage, across severity. In graph 7, it can be viewed that, irrespective of the severity, there is a decrease in the number of correct responses seen from the word to the nonword repetition task. Graph 8 clearly shows that the severe CWS have poorer fluency with increase in the complexity of the task. They show difficulty in maintaining fluency across nonwords and across tri-syllabic stimuli. Graph 9 depicts that lesser number of phonemes are produced correctly during nonword repetition task compared to a word repetition task. This pattern is observed across all the types of severity. The difficulty of the severe group in maintaining fluency for the word/nonword repetition task is very evident from the Graph 10 also.



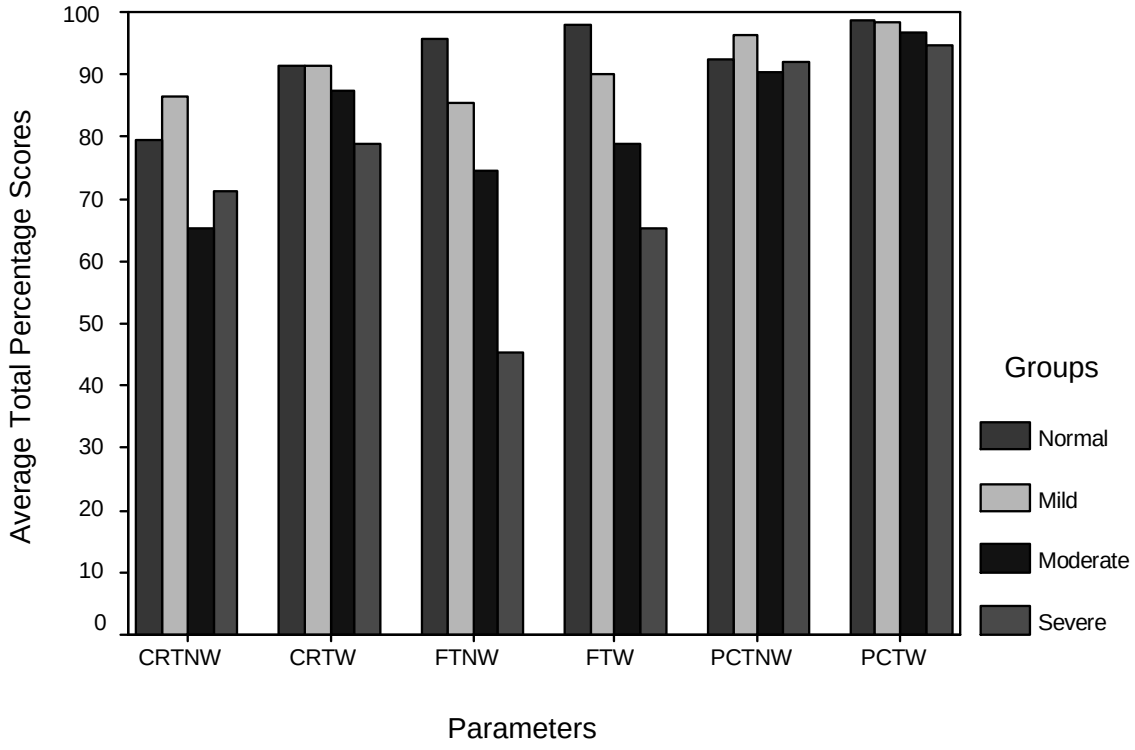
Graph 7: Average percentage correct responses across bi- and tri- syllable word/nonword lengths, across groups of varying severity



Graph 8: Average percentage fluent responses across bi- and tri- syllable word/nonword lengths, across groups of varying severity



Graph 9: Average percentage phonemes correct across bi- and tri- syllable word/nonword lengths, across groups of varying severity



Graph 10: Average total percentage scores across bi- and tri- syllable word/nonword lengths, across groups of varying severity

c. Within group comparisons:

Within group differences across various parameters of word and nonword repetition have not been studied in any of the earlier reported studies. In the present study, paired samples t- test was done in CWNS and CWS to see for any such within group differences. For this analysis, the percentage scores were considered since the totals for the scores varied. The results obtained were as follows:

A. <u>In normals (CWNS)</u>

(i) Parameters related to number of correct responses:

The Table 12 gives the results obtained after Paired Samples t- test analysis in CWNS for the following pairs:

- CRBIW and CRTRIW
- CRBINW and CRTRINW
- CRBIW and CRBINW
- CRTRIW and CRTRINW
- CRTW and CRTNW

Table 12: Results of the paired samples t- test for the parameters related to the number of correct responses in CWNS.

Between parameters	t (14)
CRBIW and CRTRIW	1.41
CRBINW and CRTRINW	4.00*
CRBIW and CRBINW	7.72*
CRTRIW and CRTRINW	2.99*
CRTW and CRTNW	3.58*

[* = significant difference ($p < 0.05$); CRBIW = number of correct responses on bi-syllabic word repetition task; CRTRIW = number of correct responses on tri-syllabic word repetition task; CRTW = total number of correct responses on word repetition task; CRBINW = number of correct responses on bi-syllabic nonword repetition task; CRTRINW= number of correct responses on tri-syllabic nonword repetition task; CRTNW = total number of correct responses on nonword repetition task]

A significant difference ($p < 0.05$) was observed within the normal group of children between scores of CRBINW and CRTRINW, CRBIW and CRBINW, CRTRIW and CRTRINW, and CRTW and CRTNW.

Within group comparison for CRBINW and CRTRINW scores were obtained to know how the normals performed in a nonword repetition task across different nonword syllable lengths. The mean score for CRBINW is 73.33 (SD = 11.87) and for CRTRINW is 85.60 (SD = 7.37). As per the t-test, a significant difference was seen between these scores [$t(14) = 4.00$, $p<0.05$], indicating the number of correct responses were more for the tri-syllabic nonword repetition task in the normals. This did not follow the expected pattern of poorer performance with increased syllable length. The reason for better scores on CRTRINW could be because knowing that the trisyllabic nonwords are more complex, these children would have paid more attention to these during the repetition task.

The comparisons between CRBIW and CRBINW and between CRTRIW and CRTRINW were done to see how the normals' performances vary when they have to repeat words and nonwords of the same length. Across the bi-syllabic stimuli, the average score obtained for CRBIW is 95.46 (SD = 5.20) and that obtained for CRBINW is 73.33 (SD = 11.87). Across the tri-syllabic stimuli, the average score obtained for CRTRIW is 93.06 (SD = 7.00) and that obtained for CRTRINW is 85.60 (SD = 7.37). From the t-test, it is evident that there are significant differences between the CRBIW and CRBINW [$t(14) = 7.72$, $p< 0.05$] and between CRTRIW and CRTRINW [$t(14) = 2.99$, $p< 0.05$]

scores. This implies that these children had more difficulty in repeating nonwords than words, irrespective of the word/nonword length. Generally, it is easier to repeat meaningful words than non-meaningful nonwords. This could be the reason for the results obtained.

Also, comparison between the total number of correct responses in words and nonwords, ie., between CRTW and CRTNW scores, revealed that the CWNS performed poorly on the nonword repetition task compared to the word repetition task.

(ii) Parameters related to number of fluent responses:

Similarly, paired samples t-test was done to see for differences in various parameters obtained related to fluency (Table 13). The comparisons made were as follows:

- FBIW and FTRIW
- FBINW and FTRINW
- FBIW and FBINW
- FTRIW and FTRINW
- FTW and FTNW

A significant difference in performance was seen only for FBINW and FTRINW, FTRIW and FTRINW, and FTW and FTNW, in normals ($p < 0.05$).

Table 13: Results of the paired samples t- test for the parameters related to the number of fluent responses in CWNS.

Between parameters	t (14)
FBIW and FTRIW	1.29
FBINW and FTRINW	2.61*
FBIW and FBINW	.48
FTRIW and FTRINW	2.35*
FTW and FTNW	2.47*

[* = significant difference ($p < 0.05$); FBIW = number of fluent responses on bi-syllabic word repetition task; FTRIW = number of fluent responses on tri-syllabic word repetition task; FTW = total number of fluent responses on word repetition task; FBINW = number of fluent responses on bi-syllabic nonword repetition task; FTRINW = number of fluent responses on tri-syllabic nonword repetition task; FTNW = total number of fluent responses on nonword repetition task]

Within group comparisons were made between FBIW and FTRIW scores and between FBINW and FTRINW scores, so as to see how the fluency varied in word/ nonword repetition task with increase in the syllable length. The mean values obtained for FBIW is 98.4 (SD = 2.52) and for FTRIW is 97.33 (SD = 4.45). On the other hand, the mean values for FBINW is 97.86 (SD = 5.20) and for FTRINW is 93.6 (SD = 6.37). Among these, the t-test shows a significant difference in performance only between FBINW and FTRINW [$t (14) = 2.61$, $p < 0.05$]. Thus, it can be concluded that the difference observed is not due to the increase in syllable length alone, but also due to the fact that it is more difficult to repeat tri-syllabic nonwords than words. This again supports the view that nonwords, being non-meaningful could be more difficult to repeat.

The comparisons between the FBIW and FBINW and between FTRIW and FTRINW were done to observe differences in fluency on a word compared to a nonword repetition task, irrespective of the syllable word/nonword length. The average scores

obtained for FBIW is 98.4 (SD = 2.52) and for FBINW is 97.86 (SD = 5.20). The mean values for FTRIW is 97.33 (SD = 4.45) and for FTRINW is 93.6 (SD = 6.37). Among these the t-test shows a significant difference in performance only between FTRIW and FTRINW [t (14) = 2.35, p< 0.05]. The results indicate that fluency is difficult to maintain at the tri-syllabic word/nonword length and it is more difficult to maintain fluency when repeating nonwords at this syllable length, compared to words.

Mean values obtained on FTW and FTNW are 97.86 (SD = 3.24) and 95.73 (SD = 4.89), respectively, and they show a significant difference according to the t-test [t (14) = 2.47, p< 0.05]. This result also reveals that fluency on a nonword repetition task is more difficult to maintain compared to a word repetition task. This difficulty could again relate to the semanticity of the stimuli to be repeated. Since, the nonwords have no semanticity, the child takes more time to process the stimuli and retrieve it fluently. In other words, if the Covert Repair Hypothesis (CRH) is used to explain this (though CRH is limited to the individuals who stutter) the timing for the activation of upcoming phonological units could be slow; a reason for this being the poor semanticity of the nonword. This increases the likelihood of selection error and consequently the likelihood of stuttering, because all the units are equally activated.

(iii) Parameters related to number of phonemes correct:

A paired samples t- test was also done for the number of phonemes correct. The results are as given in Table 14 and the comparisons made were for the following:

- PCBIW and PCTRIW
- PCBINW and PCTRINW
- PCBIW and PCBINW
- PCTRIW and PCTRINW
- PCTW and PCTNW

Table 14: Results of the paired samples t- test for the parameters related to the number of phonemes correct in CWNS.

Between parameters	t (14)
PCBIW and PCTRIW	.37
PCBINW and PCTRINW	5.40*
PCBIW and PCBINW	7.75*
PCTRIW and PCTRINW	3.34*
PCTW and PCTNW	2.41*

[* = significant difference ($p < 0.05$); PCBIW = number of phonemes correct on bi-syllabic word repetition task; PCTRIW = number of phonemes correct on tri-syllabic word repetition task; PCTW = total number of phonemes correct on word repetition task; PCBINW = number of phonemes correct on bi-syllabic nonword repetition task; PCTRINW = number of phonemes correct on tri-syllabic nonword repetition task; PCTNW = total number of phonemes correct on nonword repetition task]

A significant difference was observed for all the comparisons for number of phonemes correct except for PCBIW and PCTRIW ($p < 0.05$). Comparisons between the scores for PCBIW and PCTRIW and between PCBINW and PCTRINW can reveal differences if any between the word and nonword repetition task for the correct number of phonemes repeated across different word/nonword syllable lengths.

The mean score for PCBIW is 98.68 (SD = 1.55) and for PCTRIW is 98.53 (SD = 1.40). Also, the mean scores obtained for PCBINW and PCTRINW is 98.15

(SD = 3.31) and 96.75 (SD = 1.46), respectively. As per the t-test a significant difference was seen between PCBINW and PCTRINW [t (14) = 5.40, $p<0.05$] indicating that more number of phonemes were correct in the tri-syllabic nonword repetition task compared to the bi-syllabic nonword repetition task. The reason could be that the children maintained better attention during the tri-syllabic nonword repetition task because they expected to get more errors on it and wanted to avoid the errors.

This could also explain the reason for the poor fluency scores obtained in FTRINW compared to FBINW. Again, the Covert Repair Hypothesis can be used to explain this better. The timing for the activation of upcoming phonological units could be slow, due to more time taken to pay attention to the nonword stimuli. This increases the chances of selection error leading to stuttering. However, the present study has not considered the reaction time taken to respond to each stimulus and repeat it. So the conclusions on the amount of time taken to repeat the word may not be consistent.

Within group comparisons were also done for scores between PCBIW and PCBINW, PCTRIW and PCTRINW and between PCTW and PCTNW, to observe differences in number of phonemes correct on a word compared to a nonword repetition task, irrespective of the syllable word/nonword length.

The average scores obtained for PCBIW is 98.68 (SD = 1.55) and for PCBINW is 98.15 (SD = 3.31). The average scores for PCTRIW is 98.53 (SD = 1.40) and for PCTRINW is 96.75 (SD = 1.46). On analysis with the t-test, significant differences were

noted between PCBIW and PCBINW scores [t (14) = 7.75, p< 0.05] and PCTRIW and PCTRINW scores [t (14) = 3.34, p< 0.05]. Results indicate that more number of phonemes correct is obtained when repeating words than when repeating nonwords irrespective of the syllable length. Hence it can be opined again that the meaning of the stimuli is an important factor to be considered for a repetition task.

B. In children with stuttering (CWS)

As was done for the CWNS paired samples t- test was done to compare the performance within the stuttering group for various parameters related to word and nonword repetition tasks. The following comparisons were made within the stuttering group:

- CRBIW and CRTRIW
- CRBINW and CRTRINW
- CRBIW and CRBINW
- CRTRIW and CRTRINW
- CRTW and CRTNW
- FBIW and FTRIW
- FBINW and FTRINW
- FBIW and FBINW
- FTRIW and FTRINW
- FTW and FTNW
- PCBIW and PCTRIW

- PCBINW and PCTRINW
- PCBIW and PCBINW
- PCTRIW and PCTRINW
- PCTW and PCTNW

The results are tabulated below in Table 15, 16 and 17, respectively for comparisons made related to number of correct responses, number of fluent responses and number of phonemes correctly repeated.

(i) Parameters related to number of correct responses:

As can be seen from the tables significant differences in performance were obtained only between CRBIW & CRBINW and CRTW & CRTNW when number of correct responses was compared within the stuttering group ($p< 0.05$).

Table 15: Results of the paired samples t- test for the parameters related to the number of correct responses in the CWS group.

Between scores	t (9)
CRBIW and CRTRIW	1.50
CRBINW and CRTRINW	.44
CRBIW and CRBINW	3.22*
CRTRIW and CRTRINW	1.71
CRTW and CRTNW	2.76*

[* = significant difference ($p< 0.05$); CRBIW = number of correct responses on bi-syllabic word repetition task; CRTRIW = number of correct responses on tri-syllabic word repetition task; CRTW = total number of correct responses on word repetition task; CRBINW = number of correct responses on bi-syllabic nonword repetition task; CRTRINW= number of correct responses on tri-syllabic nonword repetition task; CRTNW = total number of correct responses on nonword repetition task]

When comparing the means between CRBIW and CRBINW; CRTRIW and CRTRINW; & CRTW and CRTNW, it can be observed that the children who stutter perform poorly on the nonword repetition task than the word repetition task. But among these the t-test reveals a significant difference only for CRBIW and CRBINW [t (9) = 3.22, p< 0.05]. The average scores computed for CRBIW and CRBINW are 88.8 (SD = 7.72) and 74.4 (SD = 11.80) respectively. The reason for these results could be the same as in CWNS. The nonwords being non- meaningful is more difficult to repeat.

b) Parameters related to number of fluent responses

Table 16: Results of the paired samples t- test for the parameters related to the number of fluent responses in the CWS group

Between scores	t (9)
FBIW and FTRIW	2.03
FBINW and FTRINW	1.70
FBIW and FBINW	1.26
FTRIW and FTRINW	1.81
FTW and FTNW	1.68

[* = significant difference (p< 0.05); FBIW = number of fluent responses on bi-syllabic word repetition task; FTRIW = number of fluent responses on tri-syllabic word repetition task; FTW = total number of fluent responses on word repetition task; FBINW = number of fluent responses on bi-syllabic nonword repetition task; FTRINW = number of fluent responses on tri-syllabic nonword repetition task; FTNW = total number of fluent responses on nonword repetition task]

There were no significant differences (p> 0.05) in any of the comparisons related to number of fluent responses. However, from the mean and standard deviations obtained (Table 8) it can be concluded that in general the CWS have more difficulty in maintaining fluency for tri-syllabic words and for nonwords during the repetition task.

The reasons can be explained with respect to the Covert Repair Hypothesis, as mentioned for CWNS.

(iii) Parameters related to number of phonemes correct:

Table 17: Results of the paired samples t- test for the parameters related to the number of phonemes correct in the CWNS group

Between scores	t (9)
PCBIW and PCTRIW	.18
PCBINW and PCTRINW	1.24
PCBIW and PCBINW	2.83*
PCTRIW and PCTRINW	2.37*
PCTW and PCTNW	2.99*

[* = significant difference ($p < 0.05$); PCBIW = number of phonemes correct on bi-syllabic word repetition task; PCTRIW = number of phonemes correct on tri-syllabic word repetition task; PCTW = total number of phonemes correct on word repetition task; PCBINW = number of phonemes correct on bi-syllabic nonword repetition task; PCTRINW = number of phonemes correct on tri-syllabic nonword repetition task; PCTNW = total number of phonemes correct on nonword repetition task]

Significant differences were noted for a few of the parameters in comparisons made related to number of phonemes correct. The average scores for PCBIW and PCBINW are 96.75 (SD = 2.31) and 92.4 (SD = 4.33), respectively while that for PCTRIW and PCTRINW are 96.66 (SD = 2.39) respectively. Average scores for PCTW is 96.7 (SD = 2.22) and PCTNW is 93.36 (SD= 4.06). Significant differences were found for PCBIW and PCBINW [$t(9) = 2.83$, $p < 0.05$], PCTRIW and PCTRINW [$t(9) = 2.37$, $p < 0.05$], and PCTW and PCTNW [$t(9) = 2.99$, $p < 0.05$]. Results again showed that

CWS tend to get more phoneme errors in the nonword repetition task compared to a word repetition task.

3. Relationship between nonword repetition and language and articulation scores

Karl Pearson's correlation coefficient was carried out in the normal and stuttering groups to see for any existing relationship between total nonword repetition scores and the articulation test scores (CRTNW and KAT) and between total nonword repetition scores and the language test scores (CRTNW and CLS).

A. In normals (CWNS)

The correlation results in the normal group indicate that there is no correlation between CRTNW and KAT ($r = 0.183$, $p < 0.05$) and CRTNW and CLS ($r = 0.187$, $p < 0.05$). Hence, no pattern of relationship can be established with in the normal group for the nonword repetition scores with the articulation test scores and with the language test scores. In other words, it cannot be concluded that one score varies with the other.

B. In children with stuttering

The correlation results in the CWS group show a significant correlation between the total nonword repetition scores and the language test scores, ie., CRTNW and CLS ($r = 0.662$, $p < 0.05$). But, no significant correlation was obtained between the total

nonword repetition scores and the articulation test scores, ie., CRTNW and KAT ($r = 0.627$, $p < 0.05$). This indicates that as the total nonword repetition score varies the language score also varies. But articulation test scores do not show such a relationship with the nonword repetition task scores. Hence, the CRTNW scores obtained for a nonword repetition task can give some idea on the language skill of the child. Considering the earlier studies done on establishing a relationship between the nonword repetition and the language skills in CWS only one such study is reported in literature for the same. Anderson et al. (2006) examined the relationship between language skills and nonword repetition and found a significant relationship between a test of phonology and nonword repetition scores in CWS. In the present study also a relationship was seen to be present between nonword repetition and language as a whole though not the phonology aspect of language alone.

In general, however the current study showed more correlation between nonword repetition scores with the articulation test scores and with the language test scores in the CWS group compared to the CWNS group.

4. Reliability

Inter-judge and intra-judge reliability were obtained for the present study. For inter-judge reliability, the scores obtained on the selected samples transcribed by an other speech- language pathologist were compared with that of the first speech language pathologist, carrying out the study. Alpha reliability coefficient was calculated for this.

The alpha reliability coefficient obtained for the scores between the two judges was greater than 0.6, signifying that there is inter- judge reliability.

Alpha reliability coefficient was obtained for intra-judge reliability, also. Here the scores obtained on a second transcription of the selected samples, by the first speech language pathologist were compared with that of the first data. This coefficient was also found to be greater than 0.6, indicating the presence of intra-judge reliability.

CHAPTER V

SUMMARY AND CONCLUSION

The present study was mainly aimed at studying the nonword repetition skills in 5;0-6;0 year old Kannada speaking children with stuttering and to compare it with their normal peers.

The study thus focused on how the young children with stuttering (CWS) differed from children without stuttering (CWNS) in the number of correct responses produced and number of phonemes correct on a nonword repetition task compared to a word repetition task. Another objective of the study was to find differences in the fluency of responses during the word/nonword repetition task as the word/nonword length (in syllables) increased. The language and articulatory skills of the CWS were also studied to look into the existence of any possible relationship between language performance and nonword repetition skills and between the phonological/phonetic development and nonword repetition skills.

Two groups of Kannada speaking children were considered for this. The CWNS (Children with no stuttering -the normal group) and the CWS (Children with stuttering- the stuttering group) in the age range of 5;0-6;0 years. Both groups were tested for their articulation, language, word and nonword repetition skills and their responses were transcribed and scored.

Appropriate statistical analyses were done and the results of the study can be summarized as follows:

1. Articulation and language tests

a. Comparison with respect to age-group, gender, and severity:

- Nearly similar performance was seen between males and females in both CWS and CWNS on the articulation and language tests.

- Children in the age group of 5;6-6;0 years performed slightly better than those in the 5;0-5;6 age group, in both CWNS and CWS, on the language and articulation tests. This confirmed the previous studies that differences in the linguistic abilities of young CWS become less apparent as children advance in age (eg., Bloodstein, 1995).

- The articulatory scores tend to show a decrease in performance as the severity of stuttering increased from mild to severe. However, this pattern is not seen on the language test scores across the varying levels of severity.

b. Between-group comparison:

- The CWNS performed slightly better than the CWS on the articulation and language tests. However, greater differences were seen for the articulation test scores between the two groups.

- Significant differences in the articulation test scores indicate the presence of poor articulatory skills in CWS compared to CWNS. This is in consonance with earlier findings that there may be a link between early stuttering and phonological or articulatory deficit (eg., Postma & Kolk, 1993; Louko et al., 1990; Wolk et al, 1993; Sneha, 1994; Throneburg et al., 1994; Geetha, 1996; Paden & Yairi, 1996; Kolk & Postma, 1997; Louko et al., 1999; Rommel et al., 1999; Arndt & Healey, 2001; Conture, 2001).

- The findings of the previous and the present study with respect to articulatory deficits support the Covert Repair Hypothesis (Postma & Kolk, 1993) which argues that in individuals who stutter the phonological encoding which is responsible for developing the articulatory plan is faulty.

- No significant difference was found in the language abilities between the groups of CWS and CWNS. This was unlike previous studies which documented that CWS have lower scores for receptive and expressive language compared to CWNS (Murray & Reed, 1977; St. Louis & Hinzman, 1988; Byrd & Cooper, 1989; Anderson & Conture, 2000).

- The results of the current study goes with the results of the longitudinal study by Watkins et al. (1999) who found that CWS and CWNS were similar in skill on all the measures of expressive language.

2. Word/nonword repetition task

a. Comparison with respect to age-group, gender and severity:

- CWNS performed better on all the parameters related to word/nonword repetition than CWS including both genders.

- In general the number of correct responses obtained did not show any particular pattern with respect to gender.

- Males performed better than the females on the total number of correct responses especially in the nonword repetition task.

- Across the syllable word/nonword lengths males scored better in some parameters and females in the other parameters.

- In CWNS females had better fluency during the word/nonword repetition task compared to males. But in the stuttering group males could maintain better fluency than females on all the fluency related parameters during the repetition task.

- For the parameters related to the number of phonemes correct, males and females received almost similar scores in both the normal and the stuttering group.

- In normals, the children in the 5;6-6;0 years age group performed better in the word repetition task than those in the 5;0-5;6 years age group. But for the nonword repetition task both the age groups performed nearly similar, indicating that children in both the groups had similar difficulty in nonword repetition.

- In the stuttering group children in the 5;6-6;0 years age group scored better than those in the 5;0-5;6 years age group on all the parameters related to the number of correct responses.

- The children in the 5;6-6;0 years age group in general, seem to be able to maintain better fluency during the word/nonword repetition task compared to those in the 5;0-5;6 years age group. This is more evident in the normal group than in the stuttering group.

- In both the normal and stuttering groups children in the 5;6-6;0 years age group obtained more number of phonemes correct in the word/nonword repetition task, when compared to the children in the 5;0-5;6 years age group.

- Though a clear decrease in performance is not seen from the normal to the severe group the normal and the mild groups definitely performed better on the word/nonword repetition task when compared to those in the moderate and severe groups.

- The children with severe stuttering had more difficulty in maintaining fluency when the syllable length was more and when they had to repeat nonwords, implying that as the complexity of the stimulus increased children having severe stuttering found it more difficult to repeat the stimulus fluently.

- The decrease in fluency in these children could be explained using the Covert Repair Hypothesis. When the stimulus is complex the timing for the activation of upcoming phonological units is slow which increases the likelihood of selection error and consequently stuttering.

b. Between- group comparison:

(i) Number of correct responses:

- No significant difference was seen between CWS and CWNS on the total number of correct responses in the word repetition task (CRTW) though CWS scored a little lower than CWNS.

- Across the syllable lengths of the words (CRBIW, CRTRIW) CWS performed significantly poorer than their normal peers.

- On the total nonword repetition task score (CRTNW) the CWS showed a poorer performance compared to CWNS. But this difference is not significant. The same was found in the earlier reported studies done on foreign children (Hakim & Ratner, 2004; Anderson et al, 2006; Seery et al, 2006; Bakhtiar et al, 2007).

- CWS performed significantly poorly than CWNS in the nonword repetition task for the tri- syllabic nonwords (CRTRINW) similar to previous studies (Hakim & Ratner, 2004), but they were nearly equal in their scores for the bi-syllabic nonwords (CRBINW). Thus three-syllable nonwords can be considered as the 'breakpoint' at which CWS and CWNS are best differentiated.

- Overall, both the groups produced fewer correct responses with increased syllable length as per the present and the previous studies.

Thus the results on the number of correct responses in nonword repetition task seem to follow the same pattern in English and Kannada in CWS and CWNS.

(ii) Number of fluent responses:

- On the word repetition task there is a significant difference between the performance of the two groups for the total number of fluent responses (FTW) indicating that there were significantly more stuttering-like disfluencies among the CWS compared to CWNS during the word repetition task.

- Across the different syllable lengths of the words (FBIW, FTRIW) CWS were found to have significantly poorer number of fluent responses than CWNS.

- Greater differences were seen between CWS and CWNS for the tri-syllabic word repetition implying that as the word length increased during the repetition task the CWS had greater difficulty in maintaining their fluency.

- On the nonword repetition task there was a significant difference between the two groups for FTNW with CWS having lesser number of fluent responses.

- CWS were significantly poorer in maintaining their fluency in the nonword repetition task for the bi- and tri-syllabic nonwords (FBINW, FTRINW) compared to the group of normals.

- CWS had greater difficulty in maintaining fluency during nonword repetition at the tri-syllabic nonword length compared to bi-syllabic nonword length, a finding not consistent with the earlier studies (Hakim & Ratner, 2004; Anderson et al., 2006).

Thus, CWNS had better fluency than CWS on all the parameters related to fluency in the word/nonword repetition tasks.

(iii) Number of phonemes correct:

- On the word repetition task the difference in the total number of phonemes correct (PCTW) obtained between the CWS and CNS is significant.

- The number of phonemes correct in the bi- and tri-syllabic word repetitions (PCBIW, PCTRIW) between the two groups are significantly different.

- CWS produced more phoneme errors on the word repetition task than their normal peers.

- On the nonword repetition task there was no significant difference obtained between the two groups on PCTNW.

- Across the nonword syllable lengths while the CWS are nearly equal in their number of phonemes correct with the CWNS, for the bi- syllabic nonword repetition task (PCBINW) in the tri-syllabic nonword repetition task (PCTRINW) the CWS show significantly more phoneme errors than CWNS. This may be due to the fact that as the complexity of the nonwords increases the CWS has more difficulty processing the word and retrieving it for repeating.

Thus, generally there are more phoneme errors for CWS on a word/nonword repetition task. Significant difference noted only for PCTRINW supports the previous studies done in English and Persian languages (Hakim & Ratner, 2004; Anderson et al., 2006; Bakhtiar et al., 2007). It can be concluded that a tri-syllabic nonword repetition task can be a better indicator to differentiate CWS from CWNS irrespective of the native language of the child.

(iv) Average total percentage scores:

- CWS generally show a poorer performance for the totals on most of the parameters related to the word/nonword repetition scores.

To conclude CWS have poor word/nonword repetition skills. CWS may have deficits in several processing operations which are also involved in language learning, like transforming the acoustic-phonetic sequence into its constituent phonemes, maintaining the ordered and phonologically coded string in working memory and organizing the articulatory output.

(v) Word/nonword repetition task scores across severity

- A significant difference in the performance for word/nonword repetition task was seen only in CRTRIW and CRTRINW scores, across varying severity, supporting the importance of tri-syllabic word and nonword repetition tasks in

distinguishing not only between CWS and CWNS in general but also in differentiating across the severities.

- CRTRIW and CRTRINW scores showed no significant differences between children in the normal and mild stuttering group.

- A significant difference was observed for CRTRINW scores between the normal and moderate stuttering group.
- Between normals and children with severe stuttering a significant difference was found across both the CRTRIW and CRTRINW scores.

- There was a significant difference only in the CRTRINW scores between the mild and the moderate stuttering groups.

- A significant difference was observed in both CRTRIW and CRTRINW scores when the mild stuttering group was compared with the severe stuttering group.

- Between the moderate and the severe stuttering groups a significant difference was observed only for the CRTRIW scores.

From the data obtained with respect to severity a pattern can be drawn which may help in developing a testing protocol to differentiate between the severities based on a tri-syllabic word and nonword repetition task.

c. Within-Group Comparisons

A. <u>In normals</u>

(i) Parameters related to number of correct responses:

- A significant difference was observed within the normal group of children between scores of CRBINW and CRTRINW, CRBIW and CRBINW, CRTRIW and CRTRINW, and CRTW and CRTNW.

- A significant difference was seen between CRBINW and CRTRINW scores, indicating that the number of correct responses were more for the tri-syllabic nonword repetition task in the normals. A reason for this may be that knowing that the trisyllabic nonwords are more complex these children would have paid more attention to these during the repetition task.

- There are significant differences between the CRBIW and CRBINW scores, and between CRTRIW and CRTRINW scores, implying that these children had more difficulty in repeating nonwords than words, irrespective of the word/nonword length. Reason could be that it is generally easier to repeat meaningful words than non-meaningful nonwords.

- CRTW and CRTNW scores reveal that normals performed poorly on the nonword repetition task compared to the word repetition task.

(ii) Parameters related to number of fluent responses:

- A significant difference in performance was seen only for FBINW and FTRINW, FTRIW and FTRINW and FTW and FTNW in normals.

- A significant difference in performance was obtained between FBINW and FTRINW and not between FBIW and FTRIW, indicating that syllable length (bi-syllabic or tri-syllabic) and type of stimuli (word or nonword) can affect the performance during a repetition task. Nonwords, being non-meaningful could be more difficult to repeat.

- A significant difference in performance was obtained only between FTRIW and FTRINW and not between the FBIW and FBINW, indicating that fluency is difficult to maintain at the tri-syllabic word/nonword length and it is more difficult to maintain fluency when repeating nonwords at this syllable length compared to words.

- Scores on FTW and FTNW show a significant difference between the two, also revealing that fluency on a nonword repetition task is more difficult to maintain compared to a word repetition task. This difficulty could relate to the semanticity

of the stimuli and the fluency can be explained based on Covert Repair Hypothesis (CRH).

(iii) Parameters related to number of phonemes correct:

- A significant difference was observed for all the comparisons for number of phonemes correct except for PCBIW and PCTRIW.

- A significant difference was seen between PCBINW and PCTRINW, indicating that more number of phonemes were correct in the tri-syllabic nonword repetition task compared to the bi-syllabic nonword repetition task. The reason could be that the children maintained better attention during the tri-syllabic nonword repetition task because they expected to get more errors on it and wanted to avoid the errors.

- Significant differences were noted between PCBIW and PCBINW scores and between PCTRIW and PCTRINW scores implying that more number of phonemes correct is obtained when repeating words than when repeating nonwords, irrespective of the syllable length. Hence it can be opined again that the meaning of the stimuli is an important factor to be considered for a repetition task.

B. In children with stuttering

(i) Parameters related to number of correct responses:

- Children who stutter perform poorly on the nonword repetition task than the word repetition task.

- Significant differences in performance were obtained only for CRBIW and CRBINW, and CRTW and CRTNW when number of correct responses was compared within the stuttering group. The nonwords being non-meaningful would be more difficult to repeat.

(ii) Parameters related to number of fluent responses:

- There were no significant differences in any of the comparisons related to number of fluent responses.

- In general, the CWS have more difficulty in maintaining fluency for tri-syllabic words and for nonwords during the repetition task which can be explained with respect to the Covert Repair Hypothesis.

(iii) Parameters related to number of phonemes correct:

- In comparisons made related to number of phonemes correct, significant differences were found for PCBIW and PCBINW, PCTRIW and PCTRINW and PCTW and PCTNW. This again shows that CWS tend to get more phoneme errors in the nonword repetition task compared to a word repetition task.

3. Relationship between nonword repetition and language and articulation scores

A. In normals

- In the normal group there is no correlation between CRTNW and KAT and CRTNW and CLS. Hence no pattern of relationship can be established with in the normal group for the nonword repetition scores with the articulation test scores and with the language test scores.

B. In children with stuttering

- In consonance with the study of Anderson et al. (2006), the present study also showed a significant correlation between the total nonword repetition scores and the language test scores, ie., CRTNW and CLS. This indicates that as the total nonword repetition score varies the language score also varies. Hence the

CRTNW scores obtained for a nonword repetition task can give some idea on the language skill of the child in Kannada speaking CWS.

- No significant correlation was obtained between the total nonword repetition scores and the articulation test scores, ie., CRTNW and KAT.

- In general more correlation was observed between nonword repetition scores with the articulation test scores and with the language test scores, in the stuttering group compared to the normal group.

Conclusion

To conclude, the results of the present study done in Kannada speaking children show similar results in most aspects of the nonword repetition task as was obtained in the earlier studies on nonword repetition skills in English and Persian speaking CWS and CWNS.

With respect to the articulatory and language abilities, greater differences between CWNS and CWS were seen on the articulation test scores though CWNS had poorer scores than CWS on both articulation and language tests.

As a whole, the Kannada speaking CWS have poor word/nonword repetition skills compared to CWNS. The CWS score poorly than CWNS in the number of correct

responses and in the number of phonemes correct and they have more difficulty in maintaining their fluency. It was found that in general both the CWS and CWNS have difficulty on the nonword repetition task than the word repetition task.

The tri-syllabic nonword repetition task was found to be a good indicator to differentiate CWS from CWNS as well as between the severities of stuttering. Also, the total score obtained on a nonword repetition task can give some idea of the language skill in Kannada speaking CWS.

The present study concludes that there are some differences and similarities in the word/nonword repetition skills of Kannada speaking CWS and the children outside India. Ample research is warranted before generalizing the results to other Indian languages also.

Implications of the Study

* This study gives an insight into the relationship between language skills of CWS and nonword repetition skills and hence into phonological and language skills in these children.

* With further research in this area it may help augment assessment and management in young children who stutter.

Limitation of the study

* Due to time constraints age- and gender- matched subjects could not be obtained. This has resulted in inadequate sample size in both the stuttering and the normal groups.
* There is no adequate sample size within each type of severity of stuttering so as to consider for further severity-wise analysis of performance.

Future Directions

Further research can be done in the Indian scenario on:

* Nonword repetition skills in the stuttering population across different age groups.
* Nonword repetition skills across different severities of stuttering.
* Comparing the nonword repetition skills in the stuttering population across different Indian languages.
* Differences in reaction times for nonword repetition and word repetition across different length of syllables in the stuttering versus normal population.

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APPENDIX A

WORD AND NONWORD LIST

Practice Items:

Phoneme	Bisyllabic		Trisyllabic	
	Words	**Nonwords**	**Words**	**Nonwords**
a	a:ru	a:bu	agasa	asaga
b	bɛlu:n	bulɛ:n	buguri	burigu
m	mi:sɛ	mɛ:si	mosalɛ	molɛsa
k	ka:lu	ku:la	kattari	karitta
g	gini	giti	ganɛ:ʃa	gaʃa:nɛ

Test Items:

Phoneme	Bisyllabic		Trisyllabic	
	Words	**Nonwords**	**Words**	**Nonwords**
a	a:nɛ	a:bɛ	alilu	alu:li
i	ili	imi	ippatu	ituppa
u	u:ta	u:ma	uja:lɛ	ulɛ:ja
e	ɛ:ni	ɛ:ti	ɛradu	ɛdura
o	ondu	onku	ombatu	omtuba
ai	aidu	ainu	aivatu	aituva
k	kannu	kunna	kitaki	kikita
g	gantɛ	gɛnta	gulabi	gubila
t	to:pi	ti:po	tikɛtu	titukɛ
d	dumma	dammu	damaru	daruma
p	pɛnnu	punnɛ	pustaka	pukasta
b	bassu	bussa	ba:gilu	ba:lugi
j	jɛʃtu	juʃtɛ	jotʃanɛ	jonɛtʃa
m	mi:nu	mu:ni	mombati	momtiba
n	na:ji	ni:ja	navilu	naluvi
l	la:ri	li:ra	lavanga	langava
s	su:rja	sa:rju	saikalu	sailuka
v	va:stu	vu:sta	vima:na	vina:ma
tʃ	tʃa:ku	tʃu:ka	tʃamatʃa	tʃatʃama
ʤ	ʤinkɛ	ʤɛnki	ʤahaʤu	ʤaʤuha
ʃ	ʃartu	ʃurta	ʃa:vigɛ	ʃa:gɛvi
r	ra:tri	ri:tra	rɛ:dijo	rɛ:jodi
t	tattɛ	tɛtta	tottilu	tolutti
d	do:ni	di:no	dalimbɛ	dabɛlim
h	hasu	husa	haladi	hadila