Chapter I
Introduction

Stuttering is a disorder of fluency where communication difficulties are the central component. Different researchers have defined stuttering differently. Some of these definitions have focused primarily on the observable behaviors associated with stuttering (e.g., the repetitions and prolongations that often characterize stuttered speech), while other definitions have focused more on the experience of the disorder from the perspective of the speaker (or occasionally, the clinician). For example the World Health Organization has defined stuttering/stammering as “disorders in the rhythm of speech, in which the individual knows precisely what he wishes to say, but at the time is unable to say it because of an involuntary, repetitive prolongation or cessation of a sound” (WHO, 1992). This definition focuses on the observable behaviors while attempting to explain at least some of the underlying experience of dysfluencies. Other definitions have focused more specifically on presumed underlying causes. Johnson (1955) said, “…stuttering consists of the reactions made by the stutterer in an effort not to stutter”. Later, in 1970 he said, more simply, “Stuttering is a disorder of the social presentation of the self. Basically, stuttering is not a speech disorder but a conflict revolving around self and role, an identity problem”.

Wingate (1976) gave the “standard” definition, which included seven separate and related elements in three primary categories, as follows: I. (a) Disruption in the fluency of verbal expression, which is (b) characterized by involuntary, audible or silent, repetitions or prolongations in the utterance of
short speech elements, namely: sounds, syllables, and words of one syllable. These disruptions (c) occur frequently or are marked in character and (d) are not readily controllable. II. Sometimes, the disruptions are (e) accompanied by accessory activities involving speech apparatus, related or unrelated body structures, or stereotyped speech utterances. These activities give the appearance of being speech-related struggle. III. Also, there are infrequently (f) indications or report of the presence of an emotional state, ranging from a general condition of ‘excitement’ or ‘tension’ to more emotion of a negative nature such as fear, embarrassment, irritation, or the like. (g) The immediate source of stuttering is some incoordination expressed in the peripheral speech mechanism; the ultimate cause is presently unknown and may be complex or compound”.

Van Riper (1982) spent an entire chapter attempting to define stuttering, before finally summarizing with “stuttering occurs when the forward flow of speech is interrupted by a motorically disrupted sound, syllable, or word, or by the speaker’s reactions thereto”. A somewhat different approach was taken by Perkins (1990), who included the “feeling of loss of control” as a critical element in his definition of stuttering. Indeed, through his research (e.g., Moore & Perkins, 1990), Perkins demonstrated that the speaker’s feelings were a critical factor in determining whether a particular speech disruption would be considered by the speaker to be “stuttered”.

Stuttering has been shown to begin in early childhood and is usually considered a childhood disorder (American Psychiatric Association, 1987). Although stuttering is found at all ages, most persons begin to stutter before
adolescence, most commonly between 2 and 5 years of age, with the highest peak at around 4 years (Bloodstein, 1987). Prevalence (the actual number of children stuttering at any one time) of stuttering is high and is approximately 1% in school children. Following the preschool years, the prevalence of stuttering remains stable till the puberty, as new cases are balanced by spontaneous remissions. However, at puberty, the prevalence falls to approximately 0.8% (Bloodstein, 1987). The incidence of stuttering is around 5% (Andrews, Craig, Feyer, Hoddinott, Howie & Neilson, 1983).

The long-term effects of stuttering on adults have been demonstrated to be undesirable. It can be disabling emotionally, socially and vocationally (Craig, 1990). Furthermore, persons with stuttering presenting for treatment have been shown to have high levels of anxiety similar to those with anxiety disorders or depression (Craig, 1990). Research has also shown that persons with stuttering experience more difficulties with social adjustment and are more prone to social avoidance than fluent persons, which is not because of some predisposing personality (Andrews, Craig, & Feyer, 1983). There is also evidence that stuttering reduces person’s vocational potential and promotion opportunities and, thus warrants speech therapy.

An examination of the stuttering literature reveals many different approaches to stuttering treatment that have been offered by clinicians and researchers over centuries (Van Riper, 1982; Bloodstein, 1995 among others). Available treatment approaches differ not only in terms of the goals they seek to achieve, but also in the specific strategies used to achieve them. These treatments
for stuttering can be divided into two broad categories of procedures. The first category contains treatment procedures that do not intentionally alter a stutterer’s entire speech pattern. Typical of these treatments are those that are only response contingent arrangements to modify stuttering frequency (Martin, Kuhl & Haroldson, 1972; Reed & Godden, 1977; Costello, 1980; James, 1981). The second category contains treatments that deliberately alter the stutterer’s overall speech pattern in order to reduce stuttering. This category includes a wide variety of treatments that induce persons with stuttering to use an unusual manner of speaking, which may then be systematically shaped (by some means) into relatively normal sounding speech. Examples of procedures in this category include rhythmic speech and prolonged speech and its variants.

**Prolonged speech** and its many variants have been the most prominent treatment procedures for advanced stuttering (Ingham, 1984). These treatment procedures incorporate the use of a novel speech pattern to replace stuttered speech. The notion of prolonged speech was first experimentally reported by Goldiamond (1965). Since then many variants of the speech pattern have emerged. Consequently “prolonged speech” became a generic term applying equally to procedures with labels such as “precision fluency shaping”, “smooth motion speech”, “breath stream management”, “regulated breathing” and the like. The prolonged speech treatment programs, in general, involve the instatement, shaping, generalization, and maintenance of fluent prolonged speech. There are two hallmarks of the prolonged speech therapies, the unique speech skill and the specific training procedure. Despite the similarities in some of the aspects, most of the treatment programs now incorporate procedures that
assist clients to generalize and maintain the fluency. However, stuttering treatments should include the quantification of treatment targets and the systematic evaluation of relevant behaviors across clinically important settings and over clinically meaningful periods of time or in other words, efficacy of the treatment should be established.

**Efficacy** is the extent to which a specific intervention, procedure, regimen or service produces a beneficial result under ideally controlled conditions when administered or monitored by experts (Last, 1983). The evaluation of stuttering therapies can have two goals namely (1) assessing the results of a therapy for a given subject after a certain amount of time, (2) identification of the weakness in the therapy program.

Recent concern has been expressed about absence of rigorous documentation regarding the efficacy of stuttering treatments (Ansel, 1993; Conture & Guitar, 1993; Starkweather, 1993; Conture, 1996; Cordes & Ingham, 1998). It has been asserted that the state of stuttering treatment research, at least up to early 1996, was abysmal and that some leaders in the field appear to have abandoned basic scientific principals that are at the heart of any attempt to establish treatment efficacy (Cordes, 1998).

Although rigorous documentation on the efficacy of stuttering treatment is absent, some authors have examined the effects of stuttering therapy outcome. Van Riper (1973), Perkins (1981), Prins (1983), Ingham (1984), Bloodstein (1987), Conture (1996) and others have reviewed such studies. Blood (1993), in
his review of the efficacy of stuttering treatment in adults, cites Bloodstein’s (1987) review of over 100 studies with adults, in which Bloodstein concluded that ‘substantial improvement, as defined in these studies, typically occurs as a result of almost any kind of therapy in about 60 to 80% of the cases’. Andrews, Guitar and Howie (1980) performed a meta analysis of effects of stuttering treatment on the data of 756 persons who stuttered. They reviewed 42 studies that assessed symptom reduction treatments in adults who stuttered. Results revealed that prolonged speech, gentle onset, rhythm, airflow, attitude change, and desensitization were the six most common principal treatment formats. Both prolonged speech and gentle onset yielded the greatest effectiveness and appeared to be the strongest treatments in both the long- and short-term evaluations. Ingham (1993) reviewed the behavior modification approaches to stuttering and suggested that treatments involving ‘prolonged speech’ result in short- as well as long-term reductions in stuttering frequency. Although, currently prolonged speech is the most prominent among treatment procedures several important concerns have been raised about its efficacy.

First, a puzzling aspect about the current popularity of prolonged speech is that it seems to override ‘clinical commonsense’ (Onslow & Ingham, 1989). Onslow and Ingham (1989) stated that ‘the willingness, with which some clinicians assign their clients to prolonged speech programs, seems to be based on almost religious faith. It is possibly difficult therefore to persuade many of these clinicians that they have misplaced their faith.
There is no treatment that has been proven to be effective for all people. Therefore, this question actually applies to all of the treatment approaches (including prolonged speech) that have been developed over time. When this procedure is applied uniformly to all stuttering clients, there is an unstated assumption that the speech problems of all these clients are dealt optimally by the same speech pattern. This is not true. Different people stutter in different ways and people who stutter have different reactions to their stuttering. Based on these factors alone, it is reasonable for us to assume that treatment should be tailored to individual client needs. So it is necessary to identify those persons who benefit from prolonged speech and those who don’t.

Second, although the review of the stuttering treatment literature by Van Riper (1973), Andrews and Colleagues (1980), Perkins (1981), Prins, (1983), Ingham (1984), Bloodstein (1987) and Conture (1996) show strong effectiveness for the prolonged speech approaches, concern has also been expressed for type of outcome measures used in all these studies. Most of the reports of the effects of prolonged speech treatments are based on percentages of words or syllables stuttered and words or syllables spoken per minute. This means, evaluations of these treatments have provided only crude description of the client’s real speech performance.

Third, the primary issue in establishing true fluency that has been easily tested and frequently reported, is the unnaturalness of the speech output after stuttering therapy. Researchers have noted that after the prolonged speech therapy there is a significant reduction in stuttering frequency while a significant
increase in the unnaturalness has been observed (Ingham, Gow & Costello, 1985; Metz, Schiavetti & Sacco, 1990; Onslow, Hayes, Hutchins & Newman, 1992; Kalinowski, Noble, Aromson, & Stuart, 1994). In most of these studies, naturalness has been measured in post-treatment speech of persons with stuttering. But it is not used as an outcome procedure. Mostly they have used it to compare the treated persons with stuttering with normals, or to give feedback about the progress in the treatment. Onslow, Costa, Andrews, Harrison, and Packman (1996) used extensive outcome measures across a variety of situations in evaluating the outcome of an intensive non-programmed prolonged speech treatment. Their results showed that in majority of subjects, there was no regression in speech naturalness during the post-treatment period either, within and beyond the clinic. Subramanian (1997) and Kanchan (1997) investigated speech naturalness rating of 40 adults with stuttering who underwent non-programmed prolonged speech therapy. In their study they used binary scale instead of the traditional 9-point scale used by the previous researchers. Their results showed significant increase in mean naturalness score from pre-therapy to post-therapy. So, findings on the change in naturalness scores after therapy have emerged as an effective tool in investigating efficacy of therapy. Thus percent dysfluency, rate of reading and naturalness have been used as perceptual measures of efficacy. However, it has also been questioned whether perceptual judgments alone can be used to investigate the efficacy of therapy.

Alternatively, acoustic analysis has been found to be informative because it affords quantitative analysis that carry potential for subsystem description and for determining the correlates of perceptual judgment. Therefore, acoustic
analysis can be a valuable complement to perceptual evaluation and are particularly valuable as source of quantitative data for clinical assessments and for tracking the effects of intervention.

Many functional benefits might accrue from acoustic investigations of treatments based on prolonged speech. One of the serious shortcomings of such treatments is that the speech patterns used cannot be operationalized at present (Ingham, 1984). Discovery of the functional acoustic components of those speech patterns could lead to the development of more cost and time effective treatments for advanced stuttering. Furthermore, it is not clear at present which of the acoustic features of speech patterns in these treatments have a functional relationship to stuttering frequency. Additionally, it is of enormous clinical interest to discover whether the controlling acoustic features of these speech patterns are similar or different across subjects (Onslow & Ingham, 1989).

A recurring and compelling research finding in this area is that increase in the durations of certain acoustic events is a prominent part of the effects of such procedures (Metz, Onufrak, & Ogburn, 1979; Metz, Samar, & Sacco, 1983; Robb, Lybolt, & Price 1985; Mallard & Westbrook, 1985; Webster, Morgan, & Cannon, 1987; Metz, Schiavetti, & Sacco, 1990). However, Packman, Onslow, and Van Doorn (1994) investigated the duration changes when prolonged speech is used without programmed instruction. Their results indicated that there is no increase in duration of any of the acoustic parameters after therapy.
The finding that prolonged speech treatment appear to function by increasing the durations of acoustic segments may have considerable theoretical significance in light of a concurrent set of findings pertaining to the stutter-free speech of people who stutter. Those findings have provided compelling evidence that the duration of certain acoustic segments in the speech of people who stutter is longer than the same segments in the speech of people who do not stutter (Disimoni, 1974; Hillman & Gilbert, 1977; Metz, Conture, & Caruso, 1979; Starkweather & Meyers, 1979; Adams, & Runyan, 1981; Healey & Gutkin, 1984; Shenker & Finn, 1985; Winkler & Ramig, 1986; Borden, Kim, & Spiegler, 1987; Healey & Ramig, 1989). In addition to theoretical significance, the acoustic effects of prolonged speech should attract considerable interest from a practical viewpoint. Currently, the operational features of speech patterns in the therapeutic use are poorly defined and unreplicable (Ingham, 1984), and this situation represents a serious threat to the efficiency of such speech patterns as therapeutic agents (Onslow & Ingham, 1989). It is likely, for example, that many of the acoustic speech modifications in prolonged speech programs are redundant to the purpose of eliminating stuttered speech. Furthermore, the unspecified nature of the speech pattern in such programs raises questions about whether clinicians can reliably instruct clients in the use of those speech modifications. Accordingly, information that can contribute to knowledge about the operational features of prolonged-speech treatments is of immense interest. Further, it has been shown that low ratings of perceived naturalness are associated with acoustic measures of slow rate, increased voice onset time (Metz, Schiavetti, & Sacco, 1990), and increased pause time (Prosek & Runyan, 1983).
Fourth, any treatment should be adequately tested and show reduction in stuttering in the long-term. This should be replicated by independent researchers and demonstrated on large numbers of subjects. Onslow and Ingham (1989) believe that prolonged speech treatment, while reducing stuttering abnormally alters the naturalness of the speech of the clients, and it is also not clear whether this unnatural sounding speech is the feature which contributes to unsuccessful long-term maintenance of fluency.

Last, replicability is an essential ingredient of any therapy procedure. Put simply, a client’s treatment should be formulated so that any suitable trained clinician can carry it out; the procedures in that treatment should be specified so that they can be conducted reliably and their effects (or non effects) clearly recognized. Yet, this is where prolonged speech procedures, have their greatest shortcomings (Ingham, 1984); they are usually replicable in only the very loosest sense of the term. There is desperate need for the quantitative procedure, which accounts for the validity of the treatment outcome.

To summarize, the fact that some treatments are frequently recommended, seemingly in the absence of unequivocal demonstration that they are effective in helping individuals who stutter, poses serious problems at times. It does not seem appropriate for scientific practitioners to promote a treatment program without making some attempt to verify its efficacy. In the scientific evaluation of treatment efficacy, one of the most important goals is to demonstrate that a treatment results in a specific, measurable change that would not have occurred (or would not have occurred to the same extent) if the
treatment had not been introduced and these changes are long lasting. However, with respect to prolongation therapy, efficacy measures in most cases have been reported with only perceptual measures. Most of these studies have reported their efficacy with frequency and rate measures. Naturalness measures have been widely used with prolongation therapy to compare the treated persons with stuttering and normals, or to give feedback about the changes in the persons with stuttering with respect to their treatment. The reports, which have used naturalness score to indicate the outcome, are very few and they have indicated that there is no change in the post-treatment naturalness score compared to pre-therapy condition. But the perceptual measures have been criticized for their superficiality, and inability to describe the changes that occur simultaneously in two or more components of the speech production. Objective measures such as acoustic analysis has been widely used and the results have shown that, there is increase in the duration of the acoustic segments after prolonged speech treatment. But a thorough and comprehensive acoustic analysis has not been done so far. The results of the acoustic studies have also questioned the validity of the perceptual results (Savithri, 2002), and have indicated that speech subsystems - respiratory, laryngeal, and articulatory - are not similarly affected in persons with stuttering and not all types of errors (respiratory, laryngeal, and articulatory) are eliminated after therapy. However, in most of these studies the number of subjects used is very less and the results cannot be generalized. So there is a need for comprehensive study of efficacy of prolongation therapy in adults with stuttering using both perceptual and acoustical measures. Also, the effect of factors such as age at time of treatment needs to be examined. In this
context, the present study was planned. The objectives of the present study were multifold and were as follows:

(a) To find out the efficacy of non-programmed prolonged speech technique in persons with stuttering (PWS),
(b) to find out the effect of age at the time of treatment on the efficacy of non-programmed prolonged speech technique in persons with stuttering (PWS),
(c) to find out the long-term effects of non-programmed prolonged speech technique in persons with stuttering (PWS), and
(d) to find out the correlation between the perceptual and acoustical parameters.

Specifically, speech and reading samples of 30 Kannada speaking adults with stuttering were recorded before, after and 6-month after non-programmed prolonged speech technique. These 30 stutterers were divided into two age groups. Group I consisted of 20 persons with stuttering in the age range of 15-24. Group II consisted of 10 persons with stuttering in the age range of 25-38 years. Perceptual and acoustical measures were extracted from these samples and were compared across three conditions (before, after, and 6-month after prolonged speech therapy).

In the non-programmed prolonged speech, there is no strict criterion that persons with stuttering should follow a particular rate of speech. Perceptual measures included were percent dysfluency counts, rate of reading and
naturalness scores. Acoustic measures included were temporal and spectral measures. Temporal measures were voice onset time, vowel duration, closure duration, total duration, transition duration, burst duration, and voicing duration. Spectral measures were extent of F₂ transition, Speed of F₂ transition, F₂ terminal frequency, first and second formant frequency, type of F₂ transition and acoustic vowel space. Apart from these subsystem errors observed on wideband spectrograms were described. Non-programmed prolonged speech technique was the independent variable and perceptual and acoustic measures were dependent variables.

Two alternative hypotheses were posed. The null hypotheses (H₀) predicted no significant difference between conditions on perceptual and acoustical measures of persons with stuttering, and no effect of age at time of treatment on the efficacy of therapy. Alternate one-tailed hypotheses (H₁) predicted a significant difference between conditions and a positive effect of age at time of treatment on the efficacy of therapy. H₁ predicted (a) an improvement in post-therapy condition compared to pre-therapy condition, and (b) better improvement in younger stutterers compared to older stutterers.

The results of the study will have several implications. First of all, acoustic measures contribute to modern speech motor perspective of stuttering. Discovery of the functional acoustic components of speech patterns in persons with stuttering could lead to the development of more cost- and time effective treatments for stuttering. Many others problems and issues could be resolved with the discovery of the functional acoustic components of treatment based on
prolonged speech. It is unclear at present how effectively these treatment procedures can be replicated in clinical or experimental settings. Further, it is unclear at present which of the acoustic features of speech patterns in these treatments have a functional relationship to stuttering frequency. Additionally it is of enormous clinical interest to discover whether the control of acoustic features of these speech patterns is similar or different across persons with stuttering. The results of the present study will throw light in the area of stuttering that could be used in stuttering therapy.