STUTTERING TREATED BY GRADED DELAYED AUDITORY FEEDBACK AND CONTINGENCY CONTRACTING

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by

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Abstract

A less intensive version of the Ingham and Andrews (1973b) programme which combined delayed auditory feedback and contingent reinforcement was tested for its effectiveness in treating stutterers. The value of inclusion of intensive group conversation without graded delayed auditory feedback (GDAF) was also tested.

Two groups (n=4) of chronic male stutterers participated in a two-stage programme. During State I, subjects learned prolonged speech with the aid of delayed auditory feedback. Subjects in both groups were reinforced monetarily for progressing through the steps of Stage I and penalized for disfluencies by loss of a portion of a $10.00 deposit. One group also had intensive practice in group conversation without the aid of GDAF. Stage II assigned the subjects to speak in a series of speech situations outside the clinic.

Seven subjects showed significant improvement in their fluency and speech rate measures after treatment. No difference between groups was found, thus there is no evidence that increased practice in group conversation was useful. The improvement of the group as a whole was not as great as that attained by subjects in the Ingham and Andrews study. The implications of this finding for the use of GDAF and reinforcement procedures in a counselling setting are discussed.

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TREATMENT OF STUTTERING

The last decade has seen a major transition in the treatment of stuttering. In the first half of the century therapists were primarily concerned with the emotional well-being of the stutterer. Wendell Johnson was one of the foremost advocates of this approach (Johnson, 1955). Johnson's "diagnosogenic" theory of stuttering holds that stuttering develops only after adults in the child's environment have misinterpreted the normal disfluencies of childhood as stuttering and labelled the child a stutterer. Thereafter the child is likely to become excessively concerned about his speech in a way which is likely to result in increased rather than reduced speech disruption (Johnson, 1955). Johnson's theory has been extremely influential in the treatment of stuttering. The therapies which derived from this theoretical approach involved the promotion of attitude change and efforts to diminish the stutterer's fear and avoidance. As these traditional therapies were experimentally tested, increased dissatisfaction with their lack of systematization arose (Gregory, 1969; Prins, 1970). Gregory (1969) in his evaluation of his own therapeutic procedure made the following statement:

> Findings, especially those for less severe stutterers, imply that the therapy program described and evaluated in this investigation, may not be the most appropriate. The present results suggest that along with work on attitudes and the diminishing of fear and avoidance behavior, a greater emphasis on building up new psychomotor speech patterns using delayed auditory feedback and other approaches to motor speech planning should be studied .... therapy can be made more effective by programming activities more precisely ... (frontispiece).

Skepticism about the effectiveness of the traditional therapies has stimulated increased work in the application of behaviour therapy to the modification of stuttering behaviour.

The study of behaviour therapies and their effectiveness has not resulted in the formulation of a satisfactory theory of stuttering. Theories of stuttering are characterized by "an emphasis upon one or several of the available facts, rather than attempts to encompass and relate all information but, on the other hand, it is also the case that most theories have, quite properly, concentrated attention upon prediction and control of the stuttering problem, rather than upon simply "understanding"." (Beech and Fransella, 1968, p. 55-56)

The theories of stuttering have primarily evolved from procedures found effective in reducing its occurrence. Because these theories are inadequately developed, little consideration will be given to them in the following review. Instead evidence relating to treatment procedures will be examined.

As Ingham and Andrews (1973a) point out in their review, at least seven classes of procedures have been introduced by proponents of behaviour therapy. These included rhythmic speech, shadowing, masking, negative practice, anxiety reduction, delayed auditory feedback/prolonged speech, and operant conditioning. The more significant procedures will now be considered.

Anxiety Reduction

Traditional therapists have regarded anxiety reduction as a primary function of stuttering therapies; however, few controlled studies have been conducted to analyse the effects of anxiety reduction on stuttering. Unfortunately, as Gray and England (1969) point out, many of those studies on anxiety reduction which have been carried out have failed to employ independent measures of anxiety. The state of anxiety was often inferred from the dependent variable (stuttering) which it was hypothesized to affect (Gray and England, 1969).

Gregory (1969) conducted a study in which a mixture of the traditional stuttering therapies was tested. Independent measures of anxiety were also employed. The results indicated a reduction in the severity of stuttering but neither the measure of "state anxiety" (palmar sweat print) nor "trait anxiety" (Taylor Manifest Anxiety Scale) showed any change. Aron (1965) administered anxiety-reducing drugs to a sample of 46 stutterers. Over a series of placebo/drug trials, subjects showed a reduction in the rated severity but not frequency of stuttering.

Several studies have been conducted using systematic desensitization of stuttering. Yet these studies are characterized by failure to report specific speech performance data. Rosenthal (1968) reported a case study in which a severe stutterer was treated successfully by systematic desensitization but no speech data is reported. Studies by Walton and Mather (1963); Damste, Zwaan, and Shoenaker (1968); Kraft (1970); and

Kuchner (1970) reported promising results but similarly, no conclusions can be drawn. Earlier studies by Wolpe (1961) and Lazarus (1963) included stutterers among patients treated by systematic desensitization but the stutterers failed to respond to treatment.

Browning (1967) treated a nine-year-old schizophrenic boy using a procedure which combined token reinforcement, social reinforcement and systematic desensitization procedures. The dependent measure used was independent ratings of the percentage of words stuttered in oral reading and conversation. During the first treatment phase which combined token reinforcement with relaxation, only oral reading improved. Only when social approval for fluency was instituted did the percentage of disfluencies during conversation decrease below baseline level. Aten and Burgraff (1969) employed anxiety reduction procedures with single subjects. Large reductions in percentage of words stuttered were achieved with all subjects, with one subject showing almost complete fluency after 14 months of treatment. However no data on speech rate were reported.

Adams (1971) conducted a study in which 12 subjects were treated by reciprocal inhibition of feared speech situations. The subjects were selected from a sample of stutterers who showed a relationship between palmar sweat measures of emotionality and frequency of stuttering. After 28 weeks in therapy, subjects and their families reported that about half of the original feared speech situations were no longer associated with stuttering. No information was provided on baseline disfluency rates in

conversation or rates after treatment and reliability of the observer assessments were not specified.

The studies reported suggest evidence of reduced stuttering for some cases after treatment by therapies using anxiety reduction techniques. However, absence of relevant speech data and failure to utilize independent measures of anxiety precludes clarification of the role of anxiety reduction in the reported fluency changes.

Rhythmic Speech

Rhythmic stimulation as a treatment technique for stuttering is usually credited to Von Dantzig who conducted "syllable-tapping" therapy in 1940. Within the last decade, rhythmic stimulation techniques have again come into prominence. The mechanism of control of these techniques has also been investigated since it has not been clear if rhythm is prerequisite for a reduction in stuttering. Beech and Fransella (1966) attempted to test whether the "rhythm effect" could be attributed to making predictable the specific time when an utterance should occur. Twenty subjects were used as their own controls. Words were exposed on a screen for varying lengths of time. For one half the words, the time at which they were to be pronounced was clearly shown. The results confirmed the hypothesis but the authors claim, that while the results were significant, they were not sufficiently powerful to account for the rhythm effect. For this reason, the term "rhythm effect" will be used in the following review even though the reason for its effect is still not clear.

Meyer and Mair (1963) devised a hearing aid type of electronic metronome on which they presented some preliminary data. Meyer and Comley (1969) employed a similar device which provided unilateral or bilateral signals. They compared groups using these devices with another treatment group trained in rhythmic speech without the aid of an ear metronome and with an untreated control group. The authors reported that six patients "equally represented in the experimental groups and the control group - achieved complete fluency" (p.156). No conclusion may be derived from this study since the authors reported stuttering frequency differences among the groups and did not provide any speech behaviour data; however, the authors did suggest that the treatment effect is not dependent upon the electronic metronome and might be achieved by having the subjects practise syllabized speech without the aid of a stimulus.

Brady (1971) conducted an extensive study using a treatment called "metronome conditioned speech retraining". The procedure includes five steps. The subject first learns to speak fluently to the accompaniment of a desk metronome. The rate of speech is gradually increased. The third step involves the replacement of the desk metronome with a miniature earpiece metronome and the subject works through an individualized hierarchy of speech situations using the earpiece metronome. In the fourth step, he works through the hierarchy without the aid of the metronome. The fifth stage allows for additional treatment in the event of a relapse.

Brady (1971) applied the above treatment to 26 severe stutterers. Of the 23 clients who completed the treatment, 21 showed a marked increase in fluency. The mean percentage decrease in words stuttered during a six-minute speech sample was 67.3%.

No client in Brady's study is reported to have reached a level of complete fluency. Ingham and Andrews (1973a) suggest that this result may be attributed to the fact that the subjects were not required to achieve complete fluency before moving from the desk to the miniature metronome.

Andrews and his associates (Andrews and Harris, 1964; Holgate and Andrews, 1966; Andrews, Holgate, Hopper and Ingham, 1967) have done considerable work on unaided rhythmic speech. The treatment procedure is known as "syllable-timed speech". Andrews and Harris (1964) conducted an intensive 10-day programme of group treatment involving a combination of syllable-timed speech practice and non-directive group therapy. This was followed by weekly sessions for the next nine months. Results indicate that among the 35 subjects aged 11 to 44 years, there was a 74% reduction in frequency of stuttering. It is interesting that this was associated with a relatively small increase in rate of speech - from a mean of 62 to a mean of 88 words per minute.

Ingham and Andrews (1971) have investigated the quality of fluency after syllable-timed speech therapy and compared it with that achieved through delayed auditory feedback therapy. Speech samples from subjects

matched as to severity, who had undergone one of the treatment techniques were compared: The authors concluded that subjects receiving syllable-timed speech showed more evidence of residual secondary debilitating stutters (blocks and prolongations) and were limited as to their optimal rate of speech and tended to stutter when this rate was exceeded.

Subjects receiving delayed auditory feedback (DAF) showed more acceptable primary stutters (simple repetitions) and experienced no limitation in speech rate.

This study suggests that the similarity between the type of fluent speech resulting from rhythm therapies and normal speech remains ambiguous. Yet there is some suggestion that DAF therapy may be more beneficial in teaching the individual new motor speech patterns than the rhythm procedures.

Shadowing

The shadowing treatment procedure involves two speakers. The therapist reads orally from one text while the stutterer imitates, ie: shadows, the therapist's speech, speaking a few words behind.

Cherry and Sayers (1956) used shadowing with 10 male and female subjects aged from four to 59 years. They report that seven of the ten subjects responded favourably to shadowing practice conducted both with the therapist and at home. Unfortunately insufficient data was provided to enable assessment of the results of therapy; however, the authors

suggest that it was less successful with older subjects. This finding was confirmed by McLaren (1960). Walton and Black (1958) employed shadowing with an adult male stutterer. They report that the total number of stammers and hesitations per 10-minute telephone conversation declined from 80 to 15 over 20 sessions. No follow-up was provided; however, the subject reported improvement.

Walton and Mather (1963) reported on treatment of another subject using shadowing and systematic desensitization. No details on the results were given.

Kelham and McHale (1966) reported using a shadowing technique on 38 subjects, aged four to 43 years. The subjects were treated in groups over approximately three years. Clinicians' ratings of improvement were made and the authors report an overall success rate of 74%. No data on speech measures were reported.

Kondas (1967) used a procedure combining relaxed breathing and shadowing with 19 children and one adult stutterer. When progress using the shadowing technique was achieved, "desensitization treatment" was added. The speech measure used was frequency of stuttering and the results indicated that this measure showed a reduction over the treatment period. Adequate evaluation of the report is not possible because of methodological omissions since no data was provided on the pretreatment severity of the successfully treated subjects.

These studies have failed to demonstrate that shadowing is an effective treatment procedure. Failure to report sufficient information on method and results precludes formulation of conclusions.

Masking

The masking technique consists of having noise presented to the stutterer at a level of intensity which prevents him from hearing part or all of his speech.

Derazne (1966) has reported work using a masking unit which has been employed in the USSR since 1939. The masking is used in conjunction with breathing exercises and increased sleep. Details of the results were not reported; however, the author states that stuttering was eliminated from the majority of the children treated. Derazne also attributes some of the effectiveness of the treatment to the development of rhythmic breathing. Therefore, there is an implication that there may have been changes in speech other than reduced stuttering.

Parker and Christopher (1963) employed a portable masking unit in the treatment of three stutterers. No data was presented but the authors claimed that one subject recovered completely and the other two were greatly improved after a few months of treatment.

Perkins and Curlee (1970) reported clinical impressions of the short term use of portable masking units with three stutterers. While using

the unit, subjects reported being completely fluent; however, fluency deteriorated when they attempted to conduct a telephone call without using the unit. Very brief carryover of three to five days was reported by two subjects. The other subjects stuttered more severely at termination of treatment.

Gruber (1971) used a portable masking unit with eight high-school-age and three adult stutterers. Masking was only used during or after a speech block. The author reported that the only change in the disfluency levels of the subjects was reduction in severity of blocking.

MacCulloch, Eaton and Long (1970) conducted a study whereby eight subjects experienced 23 weekly half-hour sessions of oral reading and conversation under masking conditions. After 12 sessions they made fewer oral reading errors but there was no further improvement in subsequent weeks. Oral reading rate remained unchanged during treatment in spite of a decrease in errors. No evidence is presented on reliability, follow-up or assessment on tasks other than reading the same passage.

No accurate estimation can be made of the therapeutic value of masking from these studies because of lack of stringent controls and presence of confounding variables.

Negative Practice

Dunlap was the first individual to develop and utilize the procedure called negative practice. Negative practice refers to having the subject repeatedly practice the undesirable behaviour. Stuttering was the first behaviour on which Dunlap tested his procedure. He stressed that the subject must practice precisely the behavioural features of the involuntary response.

Dunlap (1928, 1930) reported that negative practice benefited some stutterers.

Fishman (1937) reported the first detailed study of use of the therapeutic procedure. His subjects were five adolescent and adult stutterers. Subjects were assessed on the number of words read or spoken in a 10-minute speech sample. Stuttered words from this sample were recorded and inserted into ten sentences. The subject was then required to stutter on the inserted words. When the voluntary stutter resembled the involuntary stutter, the subject was instructed to stutter each sentence three times; then to say the sentence correctly with the instructor, and to say the sentence correctly once alone. Praise was made contingent upon stuttering correctly and speaking correctly alone.

Case (1960) adopted some of Fishman's procedures in his treatment of 30 stutterers. One aim of the study was to compare the effects of negative practice on blockers and non-blockers. Case also included faradic punishment whenever a word was not stuttered correctly. Treatment varied

greatly from patient to patient. The results indicated that speech blockers worsened under negative practice. Ten patients were reported cured and 15 improved on the basis of subjective reports and the reports of relatives and friends.

Fahmy (1950) also reported that blockers worsened under negative practice. Since the subjects were interrupted by the command "again" when they stuttered it may be suggested that a response-contingent punishment procedure was in effect rather than negative practice alone.

It is clear then that little testing of the therapeutic efficacy of negative practice has been conducted and no indication of its therapeutic value has been given.

Delayed Auditory Feedback/Prolonged Speech

A prominent theory of stuttering regards the speech disorder as evidence for a disturbed speech-auditory feedback loop or auditory perceptual defect (Butker and Stanley, 1966; Chase, 1958; Cherry and Sayers, 1956; Stromstra, 1956; Mysak, 1960; Yates, 1963). Research using delayed auditory feedback (DAF) with normal subjects supports this theory.

Lee (1950a, 1950b, 1951) and Black (1951) reported that DAF affected nonstutterers' speech by retarding their rate of oral reading, disturbing fluency and increasing speech intensity. Other researchers later reported that DAF results in higher vocal pitch (Fairbanks and Guttman, 1958) and faster rate of repetition of speech sounds (Chase, 1958).

Critics of the perceptual theory of stuttering point to the evidence that the repetition of sounds by nonstutterers under DAF is different from sound repetition of stutterers (Neeley, 1961; Sutton and Chase, 1961). However Yates (1963) has criticized Neeley's conclusion and design. Neeley used only one delay interval and intensity level. Yates states that since there is an interaction between intensity and delay (Butler and Galloway, 1957), this interaction is obscured if only one level of each is used. Also the delay level (0.14 sec.) used by Neeley is not optimal for producing a breakdown in fluency among normal subjects. Yates also states that because an invalid comparison is made between normal subjects who were given no chance to adapt to DAF and stutterers who, theoretically, have spent many years adapting to their perceptual defects, a difference could be expected.

Many practitioners of stuttering therapy regard delayed auditory feedback as one of the most promising developments in stuttering treatment (Webster and Lubker, 1968; Yates, 1970; Van Riper, 1970). The first report of the use of DAF in the treatment of stuttering was provided by Adamczyk (1959). Adamczyk had 15 stutterers (children and adults) speak under continuous 250 msec. DAF for specified time periods. He reported that 13 of the 15 subjects showed great improvement which had not deteriorated at a two-month follow-up. Unfortunately, as in many studies of stuttering behaviour, neither measurement of speech performance nor discussion of the relation of the subject's speech to normal speech was provided.

Goldiamond reported his early work with stutterers using DAF in 1965 and his subsequent studies on DAF have stimulated increased use of the procedure. Goldiamond (1965) laid considerable emphasis on the necessity for the stutterer to learn a new prolonged speech pattern. Prolonged speech refers to a slow speech pattern characterized by prolongation of vowel sounds within words and smooth transitions between words. The importance of this variable arose from a series of experiments which employed DAF as a response contingency.

Goldiamond's (1965) procedure modifies oral reading and stuttering rates using removal of delayed auditory feedback contingent upon incidents of stuttering. Prolonged speech was established at a rate of 25 words per minute with a 250 msec. delay interval. DAF is removed for 10 seconds after each occurrence of stuttering so identified by the subject. When a criterion of fluency is achieved, the delay is reduced and reading rate increased in systematic steps. The subject, at completion of the delay sequence, is given instructions in self-control procedures to aid him in the maintenance of fluency outside the treatment setting. Goldiamond claims that the speech of his subjects "is well articulated and is considered pleasant by listeners, that is, there are no sing-song, delayed, or otherwise unpleasant patterns (1965, p.14)".

Goldiamond has reported to have successfully treated 48 subjects aged 8 to 56 years but no long-term follow-up has been described (Goldiamond, 1967). Further developments in his laboratory include the development

of a miniature DAF apparatus which can be worn in the ear to promote generalization to outside settings (Goldiamond, 1967).

Goldiamond (1967b) has also reported that he has been successful in teaching the prolonged speech pattern without use of DAF apparatus which suggests that his use of DAF as a response contingency may not be a critical feature of his procedure.

Other investigators have employed modified forms of the Goldiamond method but few have utilized stringent experimental controls; therefore, for many studies, it is difficult to assess the extent of the therapeutic effect since some investigators did not make pretreatment measurements of stuttering severity or carry out a follow-up procedure at the termination of treatment.

Webster and Lubker (1968) conducted a treatment programme with 14 subjects using continuous DAF. They reported that the subjects showed "marked improvement" in the laboratory but no supporting data were provided. In a subsequent study, Webster (1970) treated eight subjects in the laboratory and his data indicated that all subjects showed a reduced stuttering frequency at treatment termination compared with their pretreatment measurement. In the Webster procedure, the experimenter did not control the increase in the rate of oral reading of the subjects as Goldiamond had. Instead subjects were merely instructed to speak slowly (30 to 35 words per minute). Subjects were also instructed to make smooth transitions between speech sounds as well as to make

consonent sounds with decreased speed and amplitude. At the end of treatment, speech rate had increased to between 80 and 100 words per minute.

In a later paper, Webster (1971) claims that once the target behaviour of his programme has been acquired, then slight reinforcement is sufficient to ensure generalization. He provides data which shows that 16 subjects showed reduced stuttering while reading six to 18 months after treatment compared to pretreatment measures; however, no subject was completely free of stuttering behaviour. No data is provided on speech rate after treatment. He also reports, without supporting data, that 70 of 100 stutterers treated by his method, have maintained fluency for long periods after treatment.

Curlee and Perkins (1969) report the use of a systematized DAF procedure in which conversation was modified instead of reading. The authors support their choice of conversation as the behaviour to be modified with the following reasons: (a) they found that many clients found reading to be a drudgery; (b) the treatment was otherwise limited to subjects with good reading skills; (c) the equipment used to establish control over reading rate was clumsy and expensive and (d) the difficult transition from reading to conversation remains a problem for many clients. The Curlee and Perkins procedure, which they refer to as "Conversational Rate Control Therapy", requires the subjects to prolong their conversational speech and to speak at a rate of 30 to 35 words per minute under an initial delay level of 250 msec. When the client has reached a no-stuttering

criterion as determined by both the client and clinician for two successive 15-minute periods, the delay is reduced by 50 msec. but subjects are instructed to maintain the speech rate developed at 250 msec. This procedure is continued in steps of 50 msec. until 0 msec. delay is reached. The subject is then returned to the 200 msec. level and a new faster speech rate is established and the graded delay reduction is again accomplished maintaining the same rate. This sequence is continued until the subject is speaking at normal speech rate at 0 msec. delay. If a subject emits two stutters, he is returned to the previous delay level in the hierarchy.

At this point, subjects are assigned to time-out procedures to ensure voluntary rate control (Haroldson, Martin and Starr, 1968). Therefore, whenever the clinician judges that the subject exceeds a defined rate, stutters or hesitates, the lights in the therapeutic setting are turned off and the two sit in silence for 30 seconds after which the lights are turned on and speaking is resumed. This procedure is continued until the client reaches a no-stuttering criterion and then the time-out interval is reduced by 5 seconds. The procedure continues with reduction of the time-out interval contingent upon a fluency criterion.

When a subject completes the DAF procedure, he is required to enter a series of speech situations arranged in a hierarchical order of difficulty, after each of which he reports his ability to maintain fluency.

The authors report their results with 15 stutterers and claim that the fluency rate of this sample had improved "75% to 95%" in outside situations. However no additional description is provided.

In a subsequent study, Curlee and Perkins (1973) modified the details of their conversational rate control therapy and employed it with 27 adolescent and adult stutterers. In this study the subjects proceeded through graded delay intervals as in the original procedure; however, they were permitted to increase their speech rate with each reduction in delay until the 50 msec. delay interval was reached. At this step, the client is required to maintain his 100 msec. delay speech rate. His speech rate is not permitted to increase when he progresses to the 0 msec. delay. Then the delay is returned to 50 msec. and the subject's speech rate is allowed to increase and he maintains this rate until he reaches 0 msec. delay. Finally his speech is permitted to increase to a normal rate. The authors report that the mean percentage of words stuttered by their sample was reduced from 17.0 to 0.2 in the clinic and from 16.0 to 1.3 percent in outside situations. No data is provided on changes in speech rate and, additionally, the authors observe that some of their subjects "sacrificed prosody for fluency by using slow rates with monotonous inflection" (Curlee and Perkins, 1973, p.400). They note that severe stutterers were more willing to make this trade-off than less severe stutterers. The authors conclude that more variables will have to be investigated before "normal" speech can be established by their procedure.

Van Riper (1970) has included DAF exposure in his treatment programme. He presents no data and merely states that he finds DAF useful in having the stutterer recognize that other people can be made to stutter too. It was also used to illustrate to the stutterer that his behaviour was modifiable. He described three situations in which he employs DAF:

(a) by inserting brief moments of delay when the subject is fluent and gradually increasing the duration of the delay as the subject learns to cope with it; (b) having the subject speak under a delay level which promotes maximal fluency and gradually altering the delay until it reaches a level which formerly produced maximal disruption; (c) having the stutterer speak with the delay set at a level producing maximal disruption but with a barely detectible volume and gradually increasing the volume. Van Riper seems to assume that these techniques teach the subject to rely on proprioceptive and tactile feedback for monitoring speech rather than auditory signals; however, lack of data make it impossible to assess the results of his treatment.

Watts (1971) conducted a short, intensive programme of treatment making only brief use of DAF and conducting subsequent practice of prolonged speech without DAF. His programme consisted of 10 two-hour group conversation sessions. Stuttering was rated on a four-point scale devised by Andrews and Harris (1964) and it appears from these ratings that there was an improvement during treatment; however, this change did not generalize effectively beyond the clinic and was not stable over time.

Ryan (1969, 1970, 1971a,b) has reported a series of studies with children which combined both DAF and operant techniques. The procedure used incorporated parts of the Goldiamond (1965) technique and part of the Curlee and Perkins (1969) technique. Ryan placed particular emphasis on the introduction of various stimulus situations into the therapeutic situation to promote transfer and maintenance of the treatment effect.

Individuals in the subjects' environment were trained to act as reinforcers for fluent speech and as the subject improved, degree of therapeutic contact was reduced. Unfortunately, only one detailed report of the treatment of a single subject is provided (Ryan, 1971a) and this subject had not yet completed treatment; however, since the disfluency measure used was stuttered words per minute, which is an unreliable measure (Ingham and Andrews, 1973a), it is difficult to assess the degree of improvement which the subject attained.

As can be seen from the studies reviewed, DAF practice appears to facilitate fluency in stutterers, at least within the laboratory. There is also evidence that DAF is not essential to the establishment of a prolonged speech pattern which in itself aids fluency. Generalization to situations outside the clinic appears to remain a problem in all studies reviewed.

It seems reasonable, then, to promote the learning of a prolonged speech pattern through use of operant procedures. The evidence from the studies utilizing operant techniques will now be reviewed.

Operant Conditioning

The central principle involved in operant conditioning is that the consequences of the emission of a particular class of responses affect the probability of the future emission of the behaviour.

Considerable evidence now exists to show that verbal behaviour can be modified by operant conditioning (see Salzinger & Salzinger, 1967).

Flanagan, Goldiamond and Azrin (1958) conducted a study in which reduction of the frequency of stuttering resulted from the application of response contingent punishment in the form of loud noise; however, the study included insufficient controls to permit the conclusion that the actual mechanism of control was an operant one.

Goldiamond (1965) was instrumental in promoting the operant analysis of stuttering behaviour when he postulated that continuity between normal and stuttered speech exists with frequency as the distinguishing feature. In a study by Goldiamond (1965), two stimulus events were made contingent upon stuttering. In one procedure, 5 seconds of DAF at 250 msec. delay was made contingent upon each subject-defined moment of stuttering. The second procedure made the elimination of 250 msec. DAF for 10 seconds contingent upon stuttering. Both procedures decreased the frequency of stuttering. In his operant formulation of stuttering behaviour, Goldiamond postulated at least two alternate theoretical approaches to the alleviation of stuttering. One of these involves essentially correcting the speech pattern in which stuttering is embedded. Goldiamond contends that this approach requires extensive behaviour analysis. The second approach may be considered as substituting for the characteristic, faulty, speech pattern another pattern which does not contain stuttering. The latter approach is the one Goldiamond has adopted in his treatment programme which includes the establishment of prolonged speech. The prolonged speech pattern contains no stuttering since it has not been differentially reinforced. This pattern may then be modified to approximate normal speech.

Many experimenters have investigated the use of aversive stimuli contingent upon stuttering. Electric shock (Martin and Siegal, 1966), communication interruption (Haroldson, Martin and Starr, 1968) and verbal reprimand (Quist and Martin, 1967) have all been successful in suppressing stuttering.

Response cost has been less frequently applied to stuttering behaviour. Response cost refers to the subtraction of already accumulated reinforcement and has been shown to reduce the frequency of a behaviour (Weiner, 1962, 1964a, 1964b). Halvorson (1971) showed that response cost successfully reduced stuttering frequency. In his study, response cost consisted of subtraction of a point on an add-subtract counter. This procedure successfully decreased stuttering below the baseline frequency as long as the response cost had not been previously paired with a reinforcing stimulus. Halvorson postulates that the pairing of punishment with a reinforcing stimulus results in the punisher acquiring discriminative attributes and reduces its response-reducing ability.

Rickard and Mundy (1965) report that they shaped fluency in a nine-year old boy using social reinforcers and points. There is considerable difficulty in the analysis of their results since their measure of disfluency consisted of repetition errors per task unit (number of incidences of repetition of a single speech unit). Other disfluencies associated with stuttering were ignored. Relapse had occurred after six months.

Russell, Clark and Van Sommers (1968) designed a programme to reinforce fluency during oral reading. They reinforced subjects with a flashing light or buzzer after they had read fluently five words projected onto a screen. No systematic measure of fluency was taken and insufficient controls were utilized since it was possible that punishment for disfluency was included when a 5-second delay in a slide change was made contingent upon stuttering. These inadequacies of experimental procedure made invalid the author's conclusion that positive reinforcement of fluency was a more effective procedure than punishment of stuttering.

Ryan (1971a) used a combined reinforcement and punishment procedure with children aged six to nine years. The children were treated individually and the parents of three of them maintained the programme at home. The results in "stuttered words per minute" showed that fluency had been maintained at follow-up. Ryan (1971b) reported better results with subjects who also received detailed practice in various speaking situations followed by systematically reduced therapist contact.

Bar (1971) claimed to have shaped fluency in 44 of 59 children by ignoring disfluency and rewarding fluency with social approval; however, he provided no data to support his claim.

Gross (1973) investigated the effect of response-contingent punishment of disfluency, reinforcement of fluency and a combined procedure. She concluded that the three procedures were equally effective

in reducing stuttering in the oral reading of stutterers. Moore and Ritterman (1973) obtained similar results in their study of the three procedures.

Many case studies have utilized operant procedures. Leach (1969) reinforced a 12-year old boy with money for speaking fluently but insufficient speech data is provided to assess the results. Browning (1967) reinforced with tokens and praise the nonstuttered speech in a nine-year old schizophrenic boy; however, no data for rate of speech and interobserver reliability were provided although the author reports that reduced stuttering was maintained for four days of the extinction period.

One of the more interesting innovations in operant techniques is the extension of the use of token economies to the treatment of stuttering. Ingham, Andrews and Winkler (1972) combined two behaviour modification treatment variables with the Andrews and Harris (1964) syllable-timed speech, group psychotherapy, negative practice, and a token economy. These were used in various combinations with fifty-eight stutterers. Subjects were treated in groups of ten for two weeks under outpatient conditions in a hospital. The authors suggest from the results that the inclusion of the token system with the syllable-timed speech therapy programme resulted in a more effective programme for reducing stuttering and increasing rate of speech within the therapy period.

In a later study (Ingham and Andrews, 1973b), a further extension of this treatment procedure was investigated. This programme required that

the adult stutterer subjects be hospitalized for a three-week period and treated under token economy conditions.

The treatment itself was divided into three stages. During the first stage, subjects were treated under the token economy only. At the end of each treatment hour subjects were rated. A rating session required each subject to produce a given number of syllables of speech. At the end of the session each subject was either rewarded or penalized with tokens or their loss according to his percentage stuttered syllables relative to his baseline stuttering rate.

In the second stage, the token system and rating sessions were combined with DAF therapy procedures derived from Curlee and Perkins (1969). All subjects spoke in the rating sessions under DAF. Each subject was required to speak a sequence of four stutter-free rating sessions (two under DAF and two without DAF assistance) before his delay level was reduced by 50 msec. Between rating sessions, subjects were penalized tokens for stutters.

In the third stage a hierarchy of five speech situations was arranged for each subject. The subject was required to enter each situation and speak 1000 syllables which was tape-recorded. The tapes were rated and advancement to a higher level was contingent upon making two stutter-free recordings in each situation. The authors noted that only two subjects failed to complete the third stage of treatment within the three week treatment period.

Thirty-nine subjects were treated in groups of four. The results indicate that when subjects were formally assessed nine months after completion of treatment, 65 percent of those treated by DAF in the second stage were found to be free of stutters (Andrews and Ingham, 1972a). At the pretreatment assessment, mean severity and rate were 16.41 percent of syllables stuttered (%SS) and 91.35 syllables per minute (SPM). At the end of treatment, mean %SS was 0.11 and mean rate was 206 SPM; however, covert assessment indicated that 15 months after treatment most subjects had shown some relapse to 7.8 %SS and 152 SPM. The authors note that the speech rate was higher than would be predicted from the fluency measure suggesting that the residual stuttering was not particularly debilitating, mild repetitions being dominant (Andrews and Ingham, 1971b).

Summary of Review of Treatment Procedures

Lack of experimental stringency and use of inadequate dependent measures make comparison of the efficacy of the treatment procedures reviewed above extremely difficult. However, an attempt will be made to summarize the evidence.

Negative practice is now seldom employed in the treatment of stuttering. Procedural similarities between negative practice and operant techniques may account for the diminished clinical interest (Ingham and Andrews , 1973a). However, the differences between the response of blockers and nonblockers to the negative practice remains unexplained and leaves room for further experimental investigation of the procedure which may be of theoretical as well as therapeutic relevance. The evidence which does exist suggests that its value as a therapeutic procedure is limited.

Shadowing, has not been clearly demonstrated to be an effective treatment procedure. Masking appears to be associated with reduction in the severity of stutters rather than overall reduction of the frequency of disfluency. Wingate (1969) has also noted changes in speech behaviour patterns associated with both these procedures which are similar to those achieved through metronome controlled speech and prolonged speech methods. Since the latter two techniques are specifically designed to alter speech patterns, it may be that shadowing and masking are redundant as therapeutic methods.

Speech anxiety has long been assumed to play an important role in stuttering but there is little evidence that reduction of speech anxiety alone will result in increased fluency in stutterers. It may be suggested that since some individuals have been apparently helped by therapies designed to reduce speech anxiety, and that since stutterers may have differing developmental histories, speech anxiety may be characteristic of only some stutterers. Anxiety reduction therapies may then result in speech improvement among this group only. It is possible that the use of anxiety reduction in the form of a speech situation hierarchy which supplements other treatment procedures is a more useful way to deal with speech anxiety.

Brady's use of "metronome conditioned speech retraining" has led to increased interest in what has been traditionally referred to as the "rhythm methods" (Brady, 1971). This method and the prolonged speech method are both designed to teach the stutterer a new pattern of speech

to replace the pattern of speech which contains stuttering. Studies using these procedures suggest that they are successful in reducing stuttering. However, a study by Ingham and Andrews (1971) suggests that the procedures differ in the nature of the residual stutters after treatment. The authors found that the prolonged speech method leaves the patient with less debilitating stutters than a syllable-timed speech method, although the fluency rates for the groups undergoing treatment did not differ. Also the group which received the prolonged speech method were capable of speaking fluently at a faster rate than were the group treated by the syllable-timed speech method. This evidence suggests that the DAF/prolonged speech method may have advantages over the metronome control methods.

Operant procedures have more recently been used to modify stuttering behaviour; however, such procedures have frequently been combined with other procedures in therapy. The evidence suggests that operant procedures alone can reduce stuttering but the durability of the change has not been convincingly demonstrated.

Of the studies reviewed, the Ingham and Andrews procedure which combines prolonged speech training with token reinforcement appears to have produced the most impressive results (Ingham and Andrews, 1973b). In this study, stutterers achieved complete fluency which was durable over a nine-month follow-up. Clearly a procedure which can boast such a success rate is worthy of additional experimental investigation.

Statement of the Problem

The Ingham and Andrews studies indicate that an intensive inpatient programme combining delayed auditory feedback with a token economy is effective in replacing stuttering with fluent speech. However, the practicality of such a programme for all stutterers is doubtful since many are unable or unwilling to devote the necessary time to a full-time treatment programme. Many therapists would also have considerable difficulty in securing a residential facility for a three-week period. Therefore it was decided to conduct an experimental test of a less intensive programme which does not require the subject to be an in-patient in a hospital but which combines DAF and operant procedures.

The present study utilized the following procedures: (a) graded delayed auditory feedback; (b) response cost for disfluency and positive reinforcement for fluency; (c) speech assignments arranged in a hierarchy of difficulty.

Delayed auditory feedback was chosen since it is an effective procedure leaving the subject with less debilitating stutters than a syllable-timed speech procedure (Ingham and Andrews, 1971).

A token economy as instituted by Ingham and Andrews was considered to be impracticable since the experimenter did not have control of effective back-up reinforcers in the present study. Ingham and Andrews (1973b) controlled the whole environment on the hospital ward and thus manipulated all reinforcers to back up their tokens. In the present study, monetary reinforcers were selected and made contingent upon attainment of fluency.

Generalization to situations outside the laboratory situation has always been a problem for stuttering programmes. Therefore controlled exposure to difficult speech situations was included in the programme to maximise generalization.

In the present study, it was arranged that stutterers would undergo a treatment programme which included a selection of elements similar to those found to be effective in the Inghams and Andrews study; however, the programme would be implemented at a lower level of intensity. It was hypothesized that this programme could be used effectively and hence more efficiently by two days of intensive training followed by hour-long daily sessions over the following three to six weeks rather than the intensive 21-day inpatient procedure used by Ingham and Andrews (1973b).

Two treatment variations were also to be tested. One included group conversation without the aid of DAF while the other included no such procedure. It was hypothesized that the inclusion of group conversation would result in greater fluency at the end of treatment, and more stable change as indicated by the follow-up interviews because this procedure provided for practice in a situation more similar to the non laboratory ones.

METHOD

Subjects

Male stutterers over the age of 15 years were solicited through newspaper advertisements or referred by university or highschool counsellors. Males were selected because sex appears to be an important variable in stuttering behaviour. There is substantial evidence of a differential sex ratio of 3:1, males to females, among stutterers. As a control procedure in the present study, it was decided to control for the sex variable by sampling only males because they are most numerous in the population. Ten stutterers, aged from 16 to 30 years, were selected after an initial screening assessment, to undergo treatment.

Seven subjects had previously been treated by speech therapists. Speech therapy, offered to students in conjunction with a school medical health service, had been neither intensive nor of long duration because of a shortage and frequent turnover of therapists. The treatment was described by the subjects as having consisted of speech practice with the therapist, occasionally with the aid of a tape recorder or telephone to vary the speech situation.

Two subjects had been treated by psychologists. Systematic desensitization of difficult speech situations had been the treatment received by one subject and the other had participated in metronome paced practice. Both subjects had terminated treatment at the end of a university year and failed to resume it. All subjects had terminated therapy before entering the present programme.

All subjects who had been treated previously reported that treatment had either had no noticeable effect or that the effect had not been a lasting one (see Table 1 for a summary).

During the initial interview, all subjects reported stuttering since childhood. All reported that stuttering interfered with their life. Pilot subject 1 had left his study of law because he observed that his professors ignored him and discouraged his attempts to join in class discussions. Reluctant to make another career choice, he remained in the university setting taking random undergraduate courses, although he had already obtained two bachelors degrees. Pilot subject 2 reported that his speech became more disfluent in social situations involving close friends. He also stated that speaking before an audience of his colleagues resulted in increased stuttering. His university graduate courses required him to deliver papers to his colleagues more frequently and he was unable to avoid these difficult speech situations. This resulted in great anxiety.

Among the experimental subjects, E1, a severe stutterer who also grimaced, reported that, as a student nurse, his interaction with patients was severely hindered. His instructor also stated that his career was in danger due to the severity of his problem.

E2, a university student, reported avoidance of speech with strangers. This behaviour pattern led him to seek manual work as summer employment rather than work more suited to his educational level which might have involved contact with strangers. E3 stated that he avoided almost all

Table 1

Subject Characteristics

Subject		Characteristics of stuttering behaviour	Age	Level of education and occupation	EPI Scores N	EPI Scores E	Previous treatment
Pilot	P1	repetitions; long speech blocks	22	university student with B.A. degree	not available		speech therapy
	P2	frequent brief hesitations; long speech blocks	24	graduate student	not available		speech therapy
Experimental group having group conversation	E1	severe speech blocks; facial grimacing	20	student nurse	9	18	none
	E2	prolongations of vowel sounds in words	21	3rd year university student	5	11	none
	E3	speech blocks and some prolongations of sounds; occasional repetitions	16	highschool student in final year	19	12	speech therapy
	E4	short blocks at start of words; some repetitions	17	highschool student in final year	6	17	speech therapy
Experimental group having no group conversation	E5	speech blocks; repetitions of syllables and words	27	accountant with bachelor's degree	13	14	systematic desensitization
	E6	speech blocks; prolongations of vowel sounds; less frequent repetitions	30	economist with bachelor's degree	7	8	speech therapy
	E7	speech blocks; prolongations	19	2nd year university student	10	5	metronome pacing; speech therapy
	E8	short blocks accompanied by sharp intake of breath	16	highschool student in final year	7	10	speech therapy

unfamiliar speech situations. As a highschool student, he did not interact with his classmates or respond to questions in the classroom. His mother reported that he was shy and did not speak very frequently at home. E4, a highschool student, reported increased disfluency in conversations with strangers and authority figures such as school teachers and potential employers, although in conversations with familiar figures he was quite fluent. Although his stuttering was not severe, it caused him considerable frustration and he was anxious to reduce its frequency.

E5, an accountant, reported that his stuttering interfered with his job by making communication with clients clumsy and embarrassing to both parties. He stated that his prospects for promotion were endangered by his stuttering. E6 reported similar experience in his employment situation. Interaction with his superiors resulted in increased disfluency and caused him considerable anxiety.

E7 also reported considerable avoidance behaviour. He infrequently entered social situations and spent most of his time alone when not attending university classes. E8 intended to study to become a teacher. He expected that stuttering would interfere with this career by provoking ridicule from his students.

As Table 1 indicates, the subjects' speech behaviour included all types of stuttering but speech blocks of varying durations appeared to be the most common feature.

The subjects were grouped into similarly aged pairs since age matching was presumed to facilitate conversation between participants when assigned to a delayed auditory feedback recorder. One pair participated in the pilot study. Two pairs were assigned to each of the treatment groups in the main experimental study.

Apparatus

Two Audio Teaching Center reel-to-reel tape recorders were modified so that the distance between the record heads and the playback head could be varied producing feedback delays of between 75 msec. and 300 msec. Each machine had its own volume control.

One pair of subjects was assigned to each of the delayed auditory feedback (DAF) recorders. One subject, under the DAF condition, wore Superex monophonit headphones, which, when he spoke into the microphone, enabled him to hear his own voice delayed by a specific interval. The second subject also spoke into the microphone permitting the first subject to hear his partner's voice through the headphones.

Speech samples were tape recorded on a Sony-O-Matic Cassette-Corder, Model TC-110B. A Dejur-Versatile Mark VIII miniature cassette recorder was available to subjects for recording their own speech during their assignments in a hierarchy of speech situations.

Dependent Measures

The two measures of speech behaviour obtained from recorded speech samples were percentage of words stuttered (%SW) and speech rate in words per minute (WPM). An occurrence of stuttering had to meet one of the following criteria:

1. one or more syllables in the word were repeated,
2. the word or phrase was a repetition of the just preceding word or phrase,
3. pronunciation of the word included excessive prolongation of one or more of its sounds,
4. effortful blocks occurred in the flow of speech.

Speech rate (WPM) was the average number of words per minute spoken by the subject during a three minute tape recorded speech sample during which the subject was instructed to speak extemporaneously.

In order to assess the reliability of the experimenter's determination of speech measures, an independent rater was employed. He was required to read the criteria for considering a word a stutter and asked to apply these criteria to two three minute samples of tape recorded speech of stutterers. He was also required to count the total number of words spoken and determine the speech sample's WPM measure. When he had completed this training task, he was given four more speech samples and asked to assess %SW and WPM measures for each. These ratings were correlated with the experimenter's by means of a Pearson Product Moment correlation. The reliability correlations between the experimenter and the rater were .99 for percentage of stuttered words and .95 for speech rate.

Initial Screening Assessment

All male stutterers who applied to participate in the programme were interviewed by the experimenter. During the interviews, an initial screening assessment was conducted to ensure that each stutterer had stuttered since childhood and that stuttering was still a problem for him. The stutterer was also questioned about previous treatments he had received and what he hoped to gain from the present programme. A description of the programme, its method and objectives, was then presented to each prospective subject. Two subjects were disqualified from participation in the programme at this point in the interview. One student was unable to devote a weekend to participate in the initial intensive session; the second stutterer stated that he wanted a guarantee that the treatment would be effective. His interest diminished when the experimenter explained that no guarantee of success could be provided.

A three-minute speech sample was required from each subject; measurable occurrences of stuttering during this sample were the criteria which permitted the subject to be labelled a stutterer, and thus eligible for the programme. One subject presented himself at the interview but failed to stutter during the interview and the speech sample. Although this individual considered that stuttering was a problem for him, he was told that he was ineligible since his speech showed no measurable occurrences of stuttering.

Each of the ten subjects selected to participate in the programme was required to complete the Eysenck Personality Inventory and the "Stutterer's Self-Rating of Reactions to Speech Situations" (Johnson,

Darley, and Spriesterbach, 1963). This questionnaire lists 40 common speaking situations which the subject must rate on four 5-point scales: (a) avoidance (degree to which subject attempts to avoid the situation) (b) reaction (degree to which the subject enjoys speaking in this situation) (c) stuttering (severity of stuttering in this situation) (d) frequency (frequency with which the subject meets this situation). Subjects' responses on the stuttering and avoidance scales were utilized in order to determine appropriate speech assignments for the subject in the second stage of the programme. Those situations rated high on the avoidance and stuttering scales were regarded as potential speech assignments (see Table 2 for a summary of the subjects' responses on the two scales).

Table 2 indicates considerable variability in subjects' responses on the scales of the questionnaire. Some inconsistency between the subjects' responses on the 'stuttering' scale of the questionnaire and their performance during the pretreatment speech assessment suggests that the validity of the scale in the present experimental situation may be low. For example, subject E6 stuttered 19% of all words in the pretreatment speech assessment; however, his mean stuttering rating on the Johnson questionnaire was 1.93 which was rather low. Also older subjects, E5 and E6, found the situations listed on the questionnaire less relevant to their own experience since situations dealing with conversations with employers or clients were not listed. Such situations were among those which provided these two subjects with the greatest difficulty. It was therefore decided not to utilize this questionnaire as a measure of therapeutic efficacy.

Table 2

Subjects' mean ratings on scales of Johnson "Stutterers' Self-Rating of Reactions to Speech Situations"

Subject	Avoidance	Reaction	Stuttering	Frequency
E1	3.10	4.23	3.05	3.97
E2	2.73	3.05	3.00	4.23
E3	2.40	3.50	2.60	3.60
E4	1.73	1.97	1.85	3.20
E5	1.90	2.10	3.00	4.00
E6	1.28	1.08	1.93	3.70
E7	3.53	3.65	3.63	4.15
E8	1.02	1.13	1.70	3.70

Contingency Contract

In order to participate in the programme, each subject was required to deposit the amount of $10.00 into a fund controlled by the experimenter. A contractual agreement was made between the subject and the experimenter that no part of the amount would be refunded to the subject unless he underwent treatment until it was terminated by mutual agreement of the subject and the experimenter.

The subject was instructed that the $10.00 deposit was the financial basis for a response cost programme whereby disfluencies and incorrect speech rates during Stages I and II of the treatment programme would be penalised by loss of a portion of the money. The response cost programme was operated according to a strict schedule (see Table 3) whereby rate during each graded step of the DAF stage was intermittently monitored and failure to maintain correct rate resulted in loss of points. Also each disfluency spoken during rating sessions in Stage I was penalised by loss of one point ($0.10). At the end of each rating session, each subject was informed of the number of points he had lost during the hour. At the end of the programme, the total number of disfluencies spoken by the subject was calculated. If the subject lost 100 points or more, the total amount of the deposit was forfeited. Loss of less than 100 points allowed the subject to retain an appropriate portion of his deposit (eg: loss of 80 points or $8.00 left the subject with $2.00 at termination of treatment). The portion of the deposit not retained by the subject was donated to the charity of his choice.

Table 3

Point contingencies for speaking at prescribed and other speech rates at each feedback delay condition.

	GDAF delay / Words per session						Points	
	250/120	200/180	150/240	100/300	75/400	0/400	Earned	Lost
Speech Rate (words per minute)			4	5	6	12		7
			12	15	18	26		6
		9	20	25	30	40		5
	4	16	28	35	42	54		4
	8	22	36	45	54	68		3
	12	28	44	55	66	82		2
	16	34	52	65	78	96		1
Target Rate (words per minute)	20-40	40-64	60-82	75-100	90-120	110-180	10	
	44	70	90	110	132	194		1
	48	76	98	120	144	208		2
Speech Rate (words per minute)	52	82	106	130	156			3
	56	88	114	140	168			4
	60	94	126	150	180			5
	64	100	138	160	192			6
	68	106	150	170				7

A $10.00 sum was also made available for each subject from the university funds for the payment of research subjects. This money served as back-up reinforcement for a point system. Points were provided to the subject contingent upon fluency and maintenance of correct speech rate during speech samples within treatment. Progress through steps in Stages I and II was thus reinforced by points backed up by monetary reward.

Stage I, which consisted of six graded steps, permitted the subject to earn 10 points for progress through each step. Ten points equalled $1.00, each point representing $0.10. Criterion performance in each of the Stage II speech assignments also earned the subject ten points. Progress through all four resulted in the earning of 40 points. If the subject completed both stages of the programme, he earned 100 points or $10.00.

At the termination of treatment, the subject was presented with a sum of money representing the amount he had earned by progressing through the programme plus the amount remaining of his $10.00 deposit.

Pretreatment Assessment

A sample of extemporaneous speech was recorded from each subject in the presence of two observers (graduate students or university faculty members) who were previously unknown to the subject. The subject was instructed to discuss his work, recreational activities or another topic about which he could talk easily for three minutes (see Table 4).

Table 4

Topics discussed by subjects during pretreatment interview

Subject	Topic
P1	university career
P2	research activity
E1	educational history; career choice
E2	summer employment; university courses
E3	career choice; summer employment; recreations
E4	hobby
E5	university career; present employment
E6	present employment; farming
E7	summer employment
E8	fishing; camping

Questions posed by the experimenter were used as prompts for further conversation by the subject, if necessary.

The speech measures derived from these three-minute-long tape recordings served as baseline fluency and speech rate measures.

Treatment Procedure

The treatment programme comprised two stages for each of the two groups. These stages will be described in more detail below. During Stage I, all subjects received intensive training in prolonged speech facilitated by the use of graded delayed auditory feedback (GDAF). Each treatment group had two pairs of subjects as participants. In the GDAF plus Conversation Group, all four subjects were treated together. Each pair of subjects within the group engaged in conversation while practising prolonged speech using one DAF machine for 30 minutes of each treatment hour. The remainder of the hour was spent in conversation among all four group members without the aid of DAF. Subjects were required to use prolonged speech during these group conversation sessions.

Each pair in the second group was treated separately. Pair members conversed between themselves, practising prolonged speech using a DAF machine for the full treatment hour. No other group conversation was included in the treatment of this group. Thus they received increased DAF practice with no group conversation.

For all subjects, Stage I began with an intensive introduction to prolonged speech training over a weekend (approximately 15 hours). Additional one-hour sessions were conducted daily until the subject had passed the criterion for leaving Stage I. This criterion was defined as having produced a three-minute speech sample containing no disfluencies and of normal rate during a within treatment rating session.

Learning prolonged speech and maintaining fluency were reinforced by points backed up by monetary reward. Disfluency or incorrect speech rate was subject to a response cost contingency.

Stage II had the subjects pass through a graded hierarchy or four or more speech situations under a reinforcement and response cost contingency.

Within Treatment Assessment

At the end of each treatment hour in Stage I, a rating session was conducted. During a rating session, each subject was required to speak for three minutes on the topic of his choice. Stuttering frequency and speech rate measures were obtained. Reinforcement was contingent upon fluency in these sessions. The rating session was conducted in the presence of the other member or members of the treatment group. The speech measures were obtained by the experimenter during the subject's speech or immediately afterwards using the tape recording, depending upon whether the therapist could keep up with the speech rate of the individual. On the basis of the subject's performances in these rating sessions, reinforcement and

penalties were delivered. The subjects were informed of the number of points awarded or penalised by their performance during the hour.

Pilot Study

The two subjects who participated in the pilot study were treated by exactly the same procedure as were the GDAF plus conversation group in the main study. This procedure will be outlined in greater detail below.

Stage I for Group 1

The objective of this stage is to have the subject converse fluently with his partner and with the group as a whole without the aid of the DAF equipment.

Step 1 : One pair of subjects was assigned to each of the DAF recorders.

One subject in each pair spoke under DAF conditions beginning at a delay of 250 msec. He was instructed to speak slowly, prolonging vowel sounds in words and to make smooth transitions between words. The experimenter further suggested that each subject attempt to synchronise his speech with the sound he heard through the head-phones. This mode of speaking was demonstrated to each pair of subjects by the experimenter.

The other subject in the pair was instructed to participate in the conversation in the same speaking manner without the aid of DAF.

Under the DAF condition subjects in each pair exchanged places after 15 minutes so that each subject received 15 minutes of DAF practice per therapy hour. Each subject was instructed to converse when not on DAF at the same speech rate as he had practised under DAF.

The group of four was convened after 30 minutes of DAF and a group conversation was conducted. Subjects were instructed that they would be penalised one point for each disfluency uttered. Each speaker was to converse using the mode and rate of speech he had most recently practised using the DAF machine. The experimenter monitored the conversations and recorded occurrences of disfluency. Subjects developed their own conversation topics; however, if the conversation flagged, suggestions were made by the experimenter. After 30 minutes of group conversation, a rating session was conducted. Each subject was required to speak a criterion number of stutter-free words in a non-DAF situation (see Table 3, p.42) in order to progress to a reduced delay. The speech sample was tape recorded in order that speech measures might be made from the recordings if the experimenter found it impossible to make them while the subject was speaking. Fluency and rate control during a rating session were reinforced by 10 points representing one dollar. Failure to maintain the correct rate was subject to a response cost consequence (see Table 3, p.42).

After the rating session, subjects returned to their DAF machines and resumed practice of prolonged speech. The delay was reduced only when a criterion performance in the rating session was made.

Step 2 : When the subject had reached criterion performance at 250 msec. delay, the delay was reduced by 50 msec. to 200 msec. The subject was instructed to increase his speech rate to cope with the shorter delay. He continued to practice speech on the DAF machine and without it, spoke in group conversations and was then rated. Practice at the 200 msec. delay continued until the subject reached criterion in the rating session. If at this or other delay levels, the subject produced more than 10 disfluencies per 15 minutes of practice, the delay level was increased to the next higher delay and the subject was required to reach criterion at this delay again.

Step 3 : The delay was again reduced by 50 msec. and the subject's speech was permitted to increase in rate. Practice at this delay level continued until the subject produced a criterion performance in a rating session.

Step 4 : The delay was reduced to 100 msec. The subject was instructed that his speech should now approximate a slow normal rate (ie: between 75 and 105 words per minute) and that prolongations were now labelled disfluencies; therefore, they were now subject to penalization when the subject spoke under reinforcement conditions. The subject continued to practice at this delay until he reached criterion.

Step 5 : The delay was reduced to 75 msec. and the subject was required to maintain a slightly faster rate of speech.

Step 6 : The delay was reduced to 0 msec. and the subject was required to speak fluently at a normal rate. Criterion performance in Step 6 permitted the subject to complete Stage I.

Stage I for Group 2

The sequence of stages in the procedure was similar to that used for Group 1 (DAF plus group conversation); however, increased DAF practice was included. Thus each pair of subjects spent all experimental sessions either talking under DAF or speaking with their partner who was speaking under DAF. No other group conversation was included in the procedure. Each subject received 30 minutes of DAF practice per treatment hour. Subjects left the DAF situation only to be rated and such rating sessions were conducted at the end of each hour at which time three-minute samples of extemporaneous speech were recorded from each subject in the dyad situation.

The penalty contingency was enforced for the 15-minute periods of each treatment hour when an individual was speaking in the non DAF situation.

Stage II for both Groups

Each subject in both groups was required to speak in four speaking situations which had formerly given him difficulty. A list of difficult speaking situations for each subject was drawn up by the experimenter in consultation with the subject. The situations were either suggested by the subject or selected from those rated highest on the stuttering and avoidance scales of the Johnson "Self-Rating of Reactions to Speech Situations Scale". Once the list had been drawn up, the subject was required to arrange the situations in a hierarchy of difficulty. The four most difficult speech situations for the individual were chosen as his speech assignments (see Table 5 for summary).

Table 5

Speech assignments performed by subjects

Subject		1	2	3	4
Pilot	P1	talking with close friends	telephone enquiries to travel agent	talking in person to shopkeeper	talking in class
	P2	talking with girl friend	talking with group of friends		
Experimental Groups	E2*	telephone enquiries	talking with friends	talking to shopkeeper	
	E3	telephone enquiries	talking to shopkeeper	talking to grandmother	talking in class
	E4	talking to family members	talking in class	telephone enquiries	talking in front of audience
	E5	did not reach Stage II			
	E6	did not reach Stage II			
	E7	talking with family members	talking with friend	talking with co-worker	
	E8	telephone conversation with friend	talking with family members	talking with group of friends	

* E1 dropped out of the treatment programme in Stage I

Each subject was provided with a tape recorder with which to tape his own speech in the assigned situation. Portable cassette recorders were concealed in airline flight bags which the subjects carried. If this proved to be too clumsy, the subject was provided with a miniature recorder which could be concealed in a pocket.

Recordings made during the speech assignments were then submitted individually to the experimenter who analysed them and penalised each disfluency with loss of one point and penalised abnormal speech rate according to the schedule used in Stage I (see Table 3, p.42). A criterion performance in a speech assignment was defined as fluent speech (0%SW) at a normal rate (over 110 WPM). If the subject met the criterion, he then was required to perform the next speech assignment. If he failed to meet criterion, he was required to attempt the speech situation again until he reached criterion or treatment terminated. Stage II ended when the subject had met criterion in all four speech situations or treatment had been terminated.

Subjects underwent treatment until they had completed the established programme or until personal obligations such as vacation trips or out-of-province employment forced the termination of treatment. A maximum treatment period of seven weeks was established for all subjects. Ingham and Andrews required their subjects to undergo treatment for a three-week period in their highly intensive programme. Since the present programme was less intensive, it was decided to double this treatment period allowing one extra week to permit subjects to make up appointments which might have been missed. Consideration was also given to the fact that subjects might not

be inclined to maintain a daily schedule of appointments over a longer period. The period was established in expectation that the value of the programme could be determined within that length of time.

Termination and Posttreatment Assessment

At the termination of treatment, a three-minute speech sample was again recorded under the same conditions as were present during the pretreatment speech sample. Speech measures obtained from these samples allowed assessment of treatment effects.

A follow-up ranging from three to nine weeks was conducted on each subject. At the end of the follow-up period, a final assessment was conducted under pretreatment assessment conditions.

RESULTS

Pilot Study

The treatment procedure described for the GDAF plus conversation group was completed for the two subjects in the pilot study. One subject underwent 13 treatment sessions and the other 20 (these totals include sessions where speech assignments were evaluated; see Table 6). Since one subject in the pair completed treatment before the other, the experimenter took the part of the missing pair member allowing continuation of the Stage I treatment procedure for subject 2.

A speech assessment was conducted at the end of a two-month follow-up period in the same manner as the pretreatment assessment had been made. The data are summarized in Table 6.

Only subject P1 completed both stages of the treatment programme. Subject P2 failed to complete Stage II before treatment was terminated.

As indicated in Table 6, subject P1 had remained fluent and was able to speak at a normal rate at follow-up. The disfluencies in his speech during the speech assessment were repetitions of single words. There was no overt effort associated with pronunciation of these words and the subject himself did not regard them as stutters, but rather as normal disfluencies. That this improvement had successfully generalized to other speech situations was confirmed by the subject's own report and corroborated by the reports of his friends and professors. The subject stated at the final assessment that he no longer considered himself a stutterer.

Table 6

Pretreatment and two-month follow-up performance of pilot group (n=2)

Subject	Pretreatment performance		Treatment sessions	Follow-up performance	
	% SW	WPM		% SW	WPM
P1	15.0	128	13	0.5	177
P2	10.3	113	20	5.5	129

Subject P2 showed a considerable improvement in the quality of his speech at follow-up; however, his speech was not stutter-free. The subject's own report suggested that there had been generalization to other speech situations but that this generalization was not complete. The subject's pretreatment stuttering behaviour had been characterized by hesitations and blocks. Analysis of the speech sample at posttreatment indicated that a primary effect of treatment had been to reduce the duration of the speech blocks, thus making them less disruptive. The subject spontaneously made the same observation.

Experiment I

Subjects underwent treatment until they had completed the established programme or until treatment was terminated because of personal obligations of the subject or because the maximum treatment period had passed. Only one subject (subject E1), a member of the GDAF plus conversation group, left treatment without notice before he had progressed more than two steps through the GDAF schedule (see Table 7). He was persuaded to undergo a termination-of-treatment interview. Thus any change over the treatment period could be assessed. The drop-out subject's speech was characterized by long speech blocks accompanied by severe grimacing which did not improve under the conditions of the treatment programme.

Two subjects (E3, E4) in the GDAF plus conversation group completed both stages of the treatment programme. The remaining subject failed to complete Stage II before treatment was terminated.

Table 7

Treatment sessions attended and treatment level attained by subjects in GDAF plus conversation group and GDAF only group (n=8)

	Subject	Treatment sessions		Treatment level attained
		Stage I	Stage II	
GDAF plus conversation group (n=4)	E1	17	0	failed to complete Stage I
	E2	11	5	completed Stage I; failed to complete Stage II
	E3	6	6	completed programme
	E4	8	6	completed programme
GDAF only group. (n=4)	E5	24	0	failed to complete Stage I
	E6	19	0	failed to complete Stage I
	E7	9	11	completed Stage I; failed to complete Stage II
	E8	15	4	completed Stage I; failed to complete Stage II

In the GDAF only group, two subjects (E5, E6) failed to complete the last two steps of Stage I. The other two subjects (E7, E8) failed to successfully pass through Stage II.

All subjects made substantial improvement in the quality of their speech (Table 8). An analysis of covariance was performed on the termination of treatment speech measures to compare the efficacy of each treatment technique. The analysis controlled for the effects of pretreatment speech measure differences between the two groups as well as for age. No significant difference between the treatment groups on either speech measure was found (% SW, $F=0.605$; WPM, $F=1.191$).

Comparisons between the means of the pretreatment speech measures and the terminations of treatment speech measure for all eight subjects indicated that there was a significant improvement on both measures over treatment (% SW: $t=4.34$, $p < .01$; WPM: $t=3.03$, $p < .05$).

Another analysis of covariance was performed on the follow-up speech measures of the two groups to discover whether the treatment techniques differed in the stability of their effects. The covariates in this analysis were age, pretreatment speech measures, and duration of the follow-up period. Follow-up speech measures were not available for subject 1. No significant difference between the two groups on either speech measure was found (% SW, $F=6.646$; WPM, $F=0.008$). The two treatment groups did not differ significantly on the stability of their treatment effects.

Table 8

Fluency measures at pretreatment, termination and follow-up assessments and degree of relapse

	Subject	Age	Pretreatment		Termination		Follow-up		Follow-up period (weeks)	Gain or Relapse as proportion of gain at termination[a]
			% SW	WPM	% SW	WPM	% SW	WPM		
GDAF plus conversation group	E1	20	9.3	132	7.3	142	not available		-	-
	E2	21	3.5	124	1.4	175	2.1	167	5	-.33
	E3	16	10.6	110	0.6	131	5.7	111	9	-.51
	E4	17	4.1	159	1.4	155	1.5	182	8	-.04
GDAF only group	E5	27	23.5	104	14.0	125	16.1	109	6	-.22
	E6	30	19.0	53	6.4	96	5.8	130	6	+.05
	E7	19	17.6	85	2.5	124	16.6	87	3	-.93
	E8	16	9.0	141	1.4	138	2.5	180	6	-.14

[a] Calculation of proportion of gain or relapse was by the formula

$$\frac{\text{Termination \% SW} - \text{Follow-Up \% SW}}{\text{Pretreatment \% SW} - \text{Termination \% SW}}$$

Comparisons of the pretreatment speech measures with the follow-up measures for all seven subjects yielded significant differences (% SW: $t=3.227$, $p < .01$; WPM: $t=2.57$, $p < .05$). Thus the data indicate that a significant improvement effect was still present at follow-up. Although some subjects showed some regression in the quality of their speech from termination of treatment to follow-up, the mean changes were not significant (% SW: $t=1.66$, $p > .05$; WPM: $t=0.27$, $p < .10$).

No significant correlation between regression and the follow-up period was found (% SW, $r=-.14$; WPM, $r=.21$). Therefore it would appear that regression could not be accounted for simply by passage of time.

At termination of treatment, subjects were paid amounts representing the money they had earned by progressing through the programme plus the amount remaining of their $10.00 deposit. The amounts each subject received are listed in Table 9.

Table 9

Amounts earned through progress through programme and amounts lost from deposit

Subject	Amount earned by progress through programme steps	Amount lost by penalization of disfluency	Amount received at termination of treatment
E1	$0.00	(forfeited deposit)	
E2	$6.00	$8.20	$7.80
E3	$10.00	$5.70	$14.30
E4	$10.00	$5.80	$14.20
E5	$5.00	$10.00	$5.00
E6	$4.00	$10.00	$4.00
E7	$8.00	$10.00	$8.00
E8	$5.00	$10.00	$5.00

DISCUSSION

Efficacy of Treatment

A treatment programme which combined graded delayed auditory feedback/prolonged speech with a point reinforcement schedule for fluency and speech rate control, and response cost for disfluency and failure to control rate, was tested with a sample of ten male stutterers. Subjects were treated on an outpatient basis requiring them to attend daily hour-long sessions which followed an intensive two-day initial session. Two subjects participated in a pilot study; eight subjects participated in an experiment in which the treatment variable, inclusion of group conversation in the procedure, was investigated.

Of the seven subjects in the experimental group who underwent treatment to its termination, all showed substantial improvement on fluency and speech rate measures. Comparisons between the means of pretreatment and termination of treatment speech measures for all eight subjects indicated a significant improvement on both measures of fluency over treatment (%SW: $t=4.34$, $p<.01$; WPM: $t=2.57$, $p<.05$). This improvement was largely maintained over follow-up periods of from three to nine weeks.

Within the pilot group, one subject showed improvement in the fluency of his speech over treatment; the second subject attained complete fluency which he maintained over an informal follow-up period of three months.

These results suggest that a treatment programme combining graded delayed auditory feedback and contingency control can be utilized in an outpatient setting to effect an improvement in the speech of stutterers. Only one subject (P1), however, was stutterfree at the end of treatment. Stutterfree speech is the goal of stuttering treatment programmes but it is infrequently attained in outpatient treatment programmes. In view of this stringent criterion of success, the efficacy of the present treatment programme as it was carried out must be regarded as limited. Yet it produced increased fluency which suggests that the combination of procedures has a useful place among outpatient treatment programmes. Strengthening the programme to increase efficacy is the task of further research.

A less stringent test of efficacy lies in the degree of change in the specified behaviour required to be considered socially important to the individual subject. Although difficult to assess, the importance of the fluency improvement to the subjects was suggested by their reports. Eight of the ten participants stated that they had benefited from treatment. P1, who had left the study of law because of his stuttering, decided to become a school teacher and was planning to take up a position four months after the termination of the treatment. He stated that he no longer considered himself to be a stutterer. E5 volunteered his time as a boys' camp counsellor at the end of treatment and reported that his fluency in that situation was "surprising", although he had anticipated considerable difficulty. E6 noted that his fluency in social situations had increased. The other subjects reported less speech

difficulty in a wide range of speech situations. Of the two subjects who did not report improvement, one subject (E1) dropped out of treatment; the other (E7) showed considerable relapse. He reported that such a result largely confirmed his expectancies since he had undergone several different treatments and considered that his speech problem was resistant to treatment.

The results must be considered in the light of some weaknesses in experimental design. Because it was impossible to find subjects willing to serve as a no-treatment control group, such a control group was not included in the study. Therefore, questions as to the precise identity of the therapeutic agency must be considered. Could spontaneous remission be responsible for the measurable improvement in the speech of subjects? The probability of spontaneous remission among the subjects is small since all were aged 16 years and over. Andrews and Harris (1964) reported that 80% of their large sample of stutterers had remitted by age 16. Shearer and Williams (1964) in a questionnaire study of college students who were former stutterers, report that spontaneous remission did not seem to peak at any one year, although a slight increase occurred between 13 and 16 years. No precise data on the likelihood of remission at age 16 years and over exists; however, it is interesting to note that Wingate, who studied spontaneous remission of stuttering in college students, found that all but one of the sample reported that spontaneous remission was gradual (Wingate, 1964). In the present study, each subject's initial interview included questions on the individual's stuttering during the previous two years. No subject reported any significant improvement in his speech over that period. This suggests that spontaneous

remission, which is typically gradual, cannot fully account for the improvement in subjects' speech over the relatively short duration of the treatment programme.

The lack of an attention control group in the study makes the existence of a placebo effect difficult to discount. However, some subjects had received treatment of various types prior to entering the present programme. These subjects reported that previous treatment had effected no lasting change in their speech. The present study achieved an improvement in the fluency of some subjects which persisted among most subjects for the duration of the follow-up. Certainly a longer follow-up would be desirable in order to test the durability of the fluency over time. This was not possible in the present study since two of the subjects and the experimenter were required to leave the province three months after the last subjects completed treatment. Yet since the subjects had received forms of treatment in the past from professionals, it seems unlikely that placebo effect in this study would be sufficiently strong to account for the fluency improvement among the subjects and its persistency, albeit over a relatively short time.

Additional self reports provided by some of the subjects provided behavioural evidence that subjects had increased control over their stuttering behaviour. Subjects E4 and E6 stated that they were better able to control their fluency outside the treatment setting. When they encountered speech difficulty, they resorted to a slightly slower, smooth speech pattern which they had practised in the later sessions

of Stage I. This type of speech resulted in immediately improved fluency. Such incidental evidence suggests that these subjects had learned a skill, a type of speech which tended to inhibit stuttering behaviour. Through the practice of this type of speech, they were able to exert a certain degree of control over their stuttering. It seems unlikely that an expectancy effect could be responsible for actual behavioural control of stuttering. Further research using more extensive experimental controls is required in order to investigate the placebo effect in stuttering. To date, experimenters have not attempted to isolate the effect of expectation in stuttering treatment.

Efficacy and the Intensity of Treatment

Ingham and Andrews (1973b) tested a treatment procedure which combined graded delayed auditory feedback and a token economy in the treatment of stutterers. A feature of the programme was its intensity, since patients were required to remain in hospital for the duration of the three-week programme. In the present study, a less intensive programme which included similar procedures to those used by Ingham and Andrews, was tested.

Subjects in both studies were stutterers since childhood. In the Ingham and Andrews (1973b) study, subjects had been referred by speech therapists or medical practitioners while six of those in the present study were referred by such treatment agents as school and university counsellors. The remainder of the sample replied to advertisements. The mean age of stutterers in the Ingham and Andrews study was 20.7 years while subjects in the present study averaged 25.2 years.

Of the 39 subjects who participated in the Ingham and Andrews programme, 65% were stutterfree at the end of treatment. In the present study, only one subject, or 10% of the sample, was stutterfree at the end of treatment. Ingham and Andrews (1971b) report some degree of relapse among their subjects when covertly assessed some 15 months after the end of treatment. Such a follow-up was not possible in the present study.

It is clear from consideration of the results of the two studies that the Ingham and Andrews programme achieved a greater general improvement in the quality of the subjects' speech. Such discrepancy in efficacy in two studies which utilize similar procedures suggests that the intensity variable, perhaps interacting with subject variables, could account for differential responsiveness to treatment.

The amount of practice which subjects receive in the use of prolonged speech may be crucial to the efficacy of treatment. It is true that subjects in the Ingham and Andrews study received more programmed practice than those in the present study. Yet is it necessary to have subjects participate in an inpatient programme in order to achieve stutterfree speech? Incidental findings during the pilot study suggest that it is not. During the treatment of the pilot group, one subject (P1) reported that he spoke outside treatment in exactly the same manner that he had practised within the most recent therapy session. His friends corroborated his report. His behaviour was in accordance with instructions put forward by the experimenter during Stage I. The second pilot subject (P2) stated that he did not regularly emplóy

prolonged speech between treatment sessions. He reported that he was unable to remember to do so and that the speech pattern made him feel conspicuous. The difference in the degree of improvement attained by these two subjects during treatment was considerable. P1 achieved complete fluency which was maintained over an informal follow-up of three months. P2 achieved an improvement in his fluency but his speech was not stutterfree. P2 reported two months after treatment that his speech, although still more fluent than it had been pretreatment, had relapsed slightly. He stated that this change in level of fluency became apparent in difficult speech situations, particularly conversations with close friends.

These findings suggested that the pilot subjects' responsiveness to treatment was influenced by their propensity for engaging in extramural practice during the programme. Such a finding was strengthened by the reports of subjects in the experimental study. Although all subjects in the experimental study showed significant improvement in fluency, some showed a greater degree of relapse at follow-up than others (see Table 8, p.59). Degree of relapse appeared to be related to the subjects' reports of utilizing the prolonged speech pattern outside the therapeutic setting. Subjects E2, E4, E6 and E8, who showed either slight relapse or improvement at follow-up, also reported the greatest success in practising the speech pattern outside treatment. E1, who dropped out of the treatment, reported that he did not engage in extramural practice. Little utilization of the prolonged speech pattern outside the treatment situation was reported by E3 and E7 for whom the programme produced less sustained improvement. Subject E5

reported variable success in using prolonged speech; however, he utilized it successfully in a demanding situation when he was working as a counsellor in a boys' camp and with good effect.

Propensity for engaging in extramural practice may be the behavioural evidence of a motivation variable. Yet it has obvious implications for explaining treatment efficacy. Those subjects who practice prolonged speech outside the clinic while the programme is underway, receive far in excess of the scheduled amount of treatment time. Therefore, the desired response, speech which contains no stutters, is more likely to be strengthened. Perhaps more important is the response of subjects to increased disfluency which might precede relapse. Subjects who respond to increased disfluency after treatment had terminated by reverting to the stutterfree prolonged speech pattern, reduce the possibility that the disfluent speech pattern will be reinstated.

Reducing the variability among subjects on such an influential variable is a problem for a treatment programme operating on an outpatient basis. One approach to this problem would involve altering the procedure to increase the probability of the subjects' engaging in extramural practice through both the extension and the strengthening of the reinforcement schedule. An intensive inpatient programme like that of Ingham and Andrews exerts tight control on the speech of the subjects continually for the duration of the therapy. In the present programme such tight control was not achieved. Subjects were simply instructed to

use the speech pattern practised during the most recent therapeutic session when conversing outside the clinic. For many subjects, instructional control is insufficient and additional management of contingencies outside the therapeutic sessions is necessary.

Testable modifications of the present programme can be suggested. Since lack of generalization of prolonged speech to extramural settings is not a fault of the procedures used, but rather a sign that generalization has been ineffectively programmed, the inclusion of speech assignments throughout Stage I would be tested. After the initial weekend session, subjects would be required to tape record samples of their own speech in three different conversational settings which they ordinarily meet in the day. It would be impossible to require the subject to speak in the exceedingly slow, prolonged way which he practices in the early sessions of treatment since he would find such requirements too threatening. To avoid this, the subject would be instructed to speak slowly enough and in such a prolonged manner as to achieve a level of fluency as an objective. This level of fluency would consist of a 10% improvement on the baserate level of fluency measured by the %SW index in the pretreatment assessment. Failure to achieve the objective would be penalized through a strong response cost contingency. Each day's speech assignments would be required to be 10% more fluent than speech recorded on the previous day.

A further testable modification of the present procedure would involve strengthening the reinforcer used. It is possible that the $10.00 monetary reinforcer in the present study is insufficiently

reinforcing for some subjects. A more powerful contingency would require subjects to deposit valuable personal possessions with the therapist. These would be returned to the subject contingently. Such a contingency contract would reduce the probability of subjects' dropping out of treatment.

These valuables would be utilized as back-up reinforcers for a token system whereby a subject would be required to earn a predetermined number of tokens in order to "buy back" his possessions. A pool of six of the subject's possessions would be established and a price set for each. During Stage I, a procedure similar to that used with Group I in the present study would be followed. During group conversation, subjects would be penalized one token for each occurrence of stuttering. Criterion performance for within treatment rating sessions would be 0%SW at a rate determined by Table 3, p.42. Subjects would earn four tokens for each criterion performance and lose a token for each .1%SW. Stage I speech assignments suggested above would be operated according to contingency control. In order to earn tokens, a subject would be required to maintain his pretreatment baserate %SW performance in the speech assignments. Such a performance would be rewarded by 2 tokens. Each one-tenth increase or decrease in the baserate would be penalized or rewarded by 4 tokens. The baserate %SW performance for following speech assignments would be the average %SW rating of the previous day's assignments. In this way, to earn a substantial number of tokens, the subject would be required to improve his fluency in speech assignments.

The criterion performance for the Stage II speech assignments would be 0%SW and normal speech rate. Each stutter or incorrect rate would be penalized. Criterion performance would be rewarded by ten tokens.

The maximum duration for this programme would be 9 weeks. The prices set for the back-up reinforcers would be established so that a subject could buy back only three possessions by maintaining baserate performances in the Stage I speech rate assignments and by completing the graded delay intervals. Completion of both stages of the programme would be required in order to buy back all possessions.

Some preliminary study would be required in order to determine the value or cost of the possessions of the subjects. However, it is probable that such a strong contingency control system and further structure in the duration of the programme would greatly increase the degree of success it would achieve. In order to test it thoroughly, a purely monetary reinforcer system could be alternated with the token system described above in an ABAB design. The resulting performances in rating sessions while each contingency was in effect would compare their effect on the subjects' speech behaviour.

Effectiveness of Group Conversation

A treatment variable, the inclusion of group conversation unaided by the use of GDAF, was also investigated in this study. No significant differences were found between the group having group conversation and the group which had only DAF practice for either of the speech measures.

These results, although derived from a very small sample, provide no evidence that the inclusion of group conversation in the programme either affects the treatment efficacy, or facilitates generalization as measured by the degree of relapse from the end of treatment to follow-up.

Although inclusion of group conversation does not appear to affect treatment efficacy, it might be hypothesized that it may encourage extramural practice of prolonged speech. This hypothesis derives from the observation that the group conversation setting within the treatment is more similar to conversation outside treatment than in the alternative DAF practice. However, a Fisher's Exact Probability on the data indicated that no significant relationship exists between group conversation during treatment and reported extramural practice ($p=.48$).

The lack of relationship suggests that group conversation during treatment does not promote generalization of the new prolonged speech pattern to speech situations outside the clinic. It is possible that the group conversation situation is insufficiently similar to extramural situations to foster generalization. A testable modification of the procedure in the present study would involve varying the group conversation setting to more closely approximate speech situations outside the clinic. One way to accomplish this would be to introduce individuals who are not patients into the therapy setting. Simulation of common speaking situations could be programmed within the group conversation periods.

Since the inclusion of group conversation as carried out in the present study has neither a positive nor a negative effect on treatment efficacy, its inclusion is left to the inclination of the experimenter or clinician. Yet it has some value since it provides a break for subjects from the highly structured DAF situation. In a programme which requires the subject to speak for long periods of time with his co-participant, it is useful to include a more relaxed group conversation during which the subject can talk with persons other than his partner. Such practice permits new conversational topics to be shared among the group as a whole which helps prolong subjects' interested participation.

Extraversion and Neuroticism

The degree of relapse after the termination of treatment reflects the degree of generalization to extra-clinical situations of speech fluency achieved during treatment, since it may be predicted that increased disfluency after treatment in various speech situations leads to a strengthening of the disfluent speech pattern which will be reflected in the follow-up assessment. In order to determine whether a relationship existed between degree of relapse and both the neuroticism and extraversion scores on the Eysenck Personality Inventory, a Spearman Rank Order correlation was computed for the data. The measure of relapse used was posttreatment change as a proportion of gain in %SW index at termination of treatment (See Table 8, p.59). The correlation between relapse and extraversion proved to be insignificant (rho=.21). Similarly, no significant relation between degree of relapse and neuroticism was found (rho=.42). From these results, there is no evidence that response to

treatment in terms of the durability of treatment change is predicted by either extraversion or neuroticism scores.

Further tests were performed in order to determine whether either extraversion or neuroticism scores could be related to subjects' reported engagement in extramural practice during treatment. For the purpose of these tests, subjects scoring below 10 on neuroticism and 12 on extraversion were considered to have low scores since these scores mark approximately the 50 percentiles in the general population. The Fisher Exact Probability tests on these scores indicated no significant relationship existed between scoring low or high on either scale and reported extramural practice (N: $p=.27$; E: $p=.43$).

Concluding Comments

The results of this study suggest that graded delayed auditory feedback and contingency contracting can be used to improve the quality of the speech of stutterers in a counselling setting. The fact that complete fluency was not achieved in the present study should not deter experimenters and clinicians from conducting further research into the modification of procedures to improve the success of the programme. Testable modifications of the present study in order to strengthen the contingency control and to programme increased generalization have been suggested. Considerable research has indicated that GDAF and contingency control are strong and effective procedures. Determination of their true utility in a counselling setting requires that their efficiency be maximised. Few stutterers can afford to take three weeks away from their work or education in order to enter a hospital and participate in an

inpatient programme. Therefore the goal of incorporating proven procedures into an effective outpatient programme is a worthy one.

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APPENDIX A

Analysis of covariance on terminations of treatment WPM measure

Source	df	YY	SS (due)	SS (about)	df	MS	F
treatment (between)	1	1800.0					
error (within)	6	2011.5	909.325	1102.175	4	275.5437	1.191
treatment error (total)	7	3811.5	2381.0566	1430.4434	9		
Difference for testing adjusted treatment means				328.2683	1	328.2683	

Analysis of covariance on termination of treatment % SW measure

Source	df	YY	SS (due)	SS (about)	df	MS	F
treatment (between)	1	23.1199					
error (within)	6	126.4949	78.6614	47.8335	4	11.9584	.605
treatment error (total)	7	149.6149	94.5429	55.5429	5		
Difference for testing adjusted treatment means				7.2384	1	7.2384	

APPENDIX B

Analysis of covariance on follow-up % SW measure

Source	df	YY	SS (due)	SS (about)	df	MS	F
treatment (between)	1	87.6384					
error (within)	5	164.7297	156.3838	8.3459	2	4.1730	6.64
treatment error (total)	6	252.3682	216.2897	36.0785	3	27.7326	
Difference for testing adjusted treatment means				27.7326	1	27.7326	

Analysis of covariance on follow-up WPM measures

Source	df	YY	SS (due)	SS (about)	df	MS	F
treatment (between)	1	1234.3125					
error (within)	5	7541.6875	3997.7922	3543.8953	2	1771.9475	.00
treatment error (total)	6	8776.0	5218.3516	3557.6484	3		
Difference for testing adjusted treatment means				13.7532	1	13.7532	

APPENDIX C

Advertisement in university students' newspaper

DO YOU STUTTER?

If you do and wish to improve your fluency, the program being offered in the Psychology Department is designed for you.

You will participate in an organized treatment program designed to alleviate stuttering or stammering.

If you are interested, please contact Geralyn Poynter in the Psychology Department, T2-17

APPENDIX D

Notice sent to university faculty members

NOTICE

Faculty members:

A research project which includes an intensive speech treatment program for individuals who stutter is now being conducted in the Psychology Department at Memorial University. The program is being conducted by Ms. Geralyn Poynter, a graduate student in the clinical psychology degree program, under the supervision of Dr. David Hart.

The month-long program will be beginning on May 18. If you know of students for whom stuttering is a problem, please inform them of this program. Any interested student is requested to leave his name, address and telephone number with Mr. John Harnett, the Guidance Counsellor, as soon as possible. They will be contacted and provided with all necessary information after which they may decide if they wish to participate.

Geralyn Poynter
c/o Psychology Dept.
Memorial University

APPENDIX E

Information provided to subjects at initial screening interview

STUTTERING TREATMENT PROGRAM RESEARCH PROJECT

To the participant

1. The Stuttering Treatment Program being offered is a research project, the aim of which is to develop a more effective treatment procedure than those currently available.

2. Each of the procedures to be used has been shown to improve the fluency of people who stutter. What is new is the way in which the several procedures are combined in a program. We believe that we can demonstrate that this program is both effective and efficient.

3. The project is being conducted by Ms. Geralyn Poynter, a student in the second year of the M.Sc. in Applied Clinical Psychology program, and is under the supervision of Dr. David Hart of the Department of Psychology.

4. Participants in the program are requested to make a deposit of $10.00. All of this amount and possibly an additional $10.00 can be earned by making progress towards fluency. Any money not earned back in this manner will be donated to a charity of your choice.

5. All records of your participation in the project will be confidential.

Signed:

Geralyn Poynter

Dr. David S. Hart

APPENDIX F

Instructions to GDAF plus Conversation group

INSTRUCTIONS TO PARTICIPANTS

The objective of this intensive weekend treatment session is to teach you and have you practise a mode of speech which essentially involves speaking at a slow rate, prolonging vowell sounds and making smooth transitions from one word to the next by running words together. To aid you in learning 'prolonged speech', you each will have considerable opportunity to speak under conditions of 'delayed auditory feedback'. The delayed auditory feedback equipment consists of two modified tape recorders which, when you speak into the microphones, feeds back the sound of your own voice at a time delay varying from 250 to 0 msec.

These conditions make normal speech difficult; however, if you attempt to synchronize your own voice with the sound you hear through the earphones, speech will become slightly easier. Try to prolong sounds and run your words together and when you begin, avoid using long words.

As you learn to cope with the long delays and are able to speak fluently and at the correct rate under these conditions, the delay will gradually be reduced. Hence the rate of your speech will increase. This procedure will continue until you are able to speak fluently and at a normal rate with no delay.

TREATMENT SCHEDULE

A pair of you will be assigned to each of the DAF machines. One person will speak into the machine using prolonged speech which will be demonstrated to you by the instructor. The other person will converse with the individual on DAF attempting to use prolonged speech also. After 15 minutes you will switch positions so that each of you gets an equal opportunity to speak into the machine. It is important that you attempt to use prolonged speech and remain as fluent as possible even when you are not on the machine.

After one-half hour of this type of practice, all participants will leave the machine and join in a group conversation. During this conversation you will continue to speak at the slow rate which you have been practising on the machine and use prolonged speech. During this time a signal will be given each time you are disfluent. This means that you will lose a portion of the $10 which you put down for each time the signal is given to you.

After 30 minutes of group conversation, each of you will be required to speak for approximately three minutes. This sample will be recorded and rated by the instructors. If you remain fluent and speak at the correct rate during this speech sample, you will return to the machine and practise speaking at a reduced delay. If you fail to remain fluent during the rating session or speak too fast or too slow, you will continue to practise on DAF at the same delay. If you pass the rating session, you earn money but if you are disfluent or speak at an incorrect rate you lose money for each disfluency or for speaking too fast or too slow.

This schedule of DAF and nonDAF practice, group discussions and rating sessions will continue throughout the weekend.

You are requested to make a determined effort to converse in this program; speech equals practice and you will be penalized for failure to engage in conversation.

APPENDIX C

Instructions to GDAF only group

INSTRUCTIONS TO PARTICIPANTS

The objective of this intensive weekend treatment session is to teach you and have you practise a mode of speech which essentially involves speaking at a slow rate, prolonging vowel sounds and making smooth transitions from one word to the next by running words together. To aid you in learning 'prolonged speech', you each will have considerable opportunity to speak under conditions of 'delayed auditory feedback'. The delayed auditory feedback equipment consists of two modified tape recorders which, when you speak into the microphones, feeds back the sound of your own voice at a time delay varying from 250 to 0 msec.

These conditions make normal speech difficult; however, if you attempt to synchronize your own voice with the sound you hear through the earphones, speech will become slightly easier. Try to prolong sounds and run your words together and when you begin, avoid using long words.

As you learn to cope with the long delays and are able to speak fluently and at the correct rate under these conditions, the delay will gradually be reduced. Hence the rate of your speech will increase. This procedure will continue until you are able to speak fluently and at a normal rate with no delay.

TREATMENT SCHEDULE

A pair of you will be assigned to each of the DAF machines. One person will speak into the machine using prolonged speech which will be demonstrated to you by the instructor. The other person will converse with the individual on DAF attempting to use prolonged speech also. After 15 minutes you will switch positions so that each of you gets an equal opportunity to speak into the machine. It is important that you attempt to use prolonged speech and remain as fluent as possible even when you are not on the machine.

While you are conversing without the aid of the DAF machine, the instructor will listen and record each occurence of a disfluency. Each time one occurs, you will lose a portion of the $10 which you put down at the beginning of the program. Therefore it is to your benefit to strive to be as fluent as possible and use the manner of speech which you have practised on the DAF machine.

Each hour a rating session will be conducted. During a rating session a recording will be made of a three-minute sample of your speech. You are required to speak at the same rate and in the manner you have just practised. If you succeed in remaining fluent and speaking at the correct rate during the rating session, you will return to the machine and practise speaking at a reduced delay. If you fail to remain fluent or speak too fast or too slow, you will be penalized by the loss of a portion of your money and you will be required to continue practising at the same delay interval. Each time you progress by advancing to a reduced delay, you earn a portion of the money which the instructor put down for you.

This schedule will continue throughout the weekend. You are requested to make a determined effort to converse in this program; speech equals practice.

APPENDIX H

Johnson "Stutterers' Self-Rating of Reactions to Speech Situations" questionnaire

FORM 16. STUTTERER'S SELF-RATINGS OF REACTIONS TO SPEECH SITUATIONS

Name _____ Age _____ Sex _____

Examiner _____ Date _____

After each item put a number from 1 to 5 in each of the four columns.

Start with right-hand column headed Frequency. Study the five possible answers to be made in responding to each item, and write the number of the answer that best fits the situation for you in each case. Thus, if you habitually take your meals at home and seldom eat in a restaurant, certainly not as often as once a week, write the number 5 in the Frequency column opposite item No. 1, "Ordering in a a restaurant." In like manner respond to each of the other 39 items by writing the most appropriate number in the Frequency column. When you have finished with this column fold it under so you cannot see the numbers you have written. This is done to keep you from being influenced unduly by the numbers you have written in the Frequency column when you write your responses to the 40 situations in the Stuttering column.

Now, write the number of the response that best indicates how much you stutter in each situation. For example, if in ordering meals in a restaurant you stutter mildly (for you), write the number 2 in the Stuttering column after item No. 1. In like manner respond to the other 39 items. Then fold under the Stuttering column so you will not be able to see the numbers you have written in it when you make your responses in the Reaction column.

Following the same procedure, write your responses in the Reaction column, fold it under, and, finally, write your responses in the Avoidance column.

Numbers, for each of the columns, are to be interpreted as follows:

A. Avoidance:
1. I never try to avoid this situation and have no desire to avoid it.
2. I don't try to avoid this situation, but sometimes I would like to.
3. More often than not I do not try to avoid this situation, but sometimes I do try to avoid it.
4. More often than not I do try to avoid this situation.
5. I avoid this situation every time I possibly can.

B. Reaction:
1. I definitely enjoy speaking in this situation.
2. I would rather speak in this situation than not.
3. It's hard to say whether I'd rather speak in this situation or not.
4. I would rather not speak in this situation.
5. I very much dislike speaking in this situation.

C. Stuttering:
1. I don't stutter at all (or only very rarely) in this situation.
2. I stutter mildly (for me) in this situation.
3. I stutter with average severity (for me) in this situation.
4. I stutter more than average (for me) in this situation.
5. I stutter severely (for me) in this situation.

D. Frequency:
1. This is a situation I meet very often, two or three times a day, or even more, on the average.
2. I meet this situation at least once a day with rare exceptions (except Sunday, perhaps).
3. I meet this situation from three to five times a week on the average.
4. I meet this situation once a week, with few exceptions, and occasionally I meet it twice a week.
5. I rarely meet this situation—certainly not as often as once a week.

	Avoidance	Reaction	Stuttering	Frequency
1. Ordering in a restaurant				
2. Introducing myself (face to face)				
3. Telephoning to ask price, train fare, etc.				
4. Buying plane, train, or bus ticket				
5. Short class recitation (10 words or less)				
6. Telephoning for taxi				
7. Introducing one person to another				
8. Buying something from store clerk				
9. Conversation with good friend				
10. Talking with an instructor after class or in his office				
11. Long distance telephone call to someone I know				
12. Conversation with father				
13. Asking girl for date (or talking to man who asks me for a date)				
14. Making short speech (1 or 2 minutes) in familiar class				
15. Giving my name over telephone				
16. Conversation with my mother				
17. Asking a secretary if I can see her employer				
18. Going to house and asking for someone				
19. Making a speech to unfamiliar audience				
20. Participating in committee meeting				
21. Asking instructor question in class				

	Avoidance	Reaction	Stuttering	Frequency
22. Saying hello to a friend going by				
23. Asking for a job				
24. Telling a person a message from someone else				
25. Telling funny story with one stranger in a crowd				
26. Parlor games requiring speech				
27. Reading aloud to friends				
28. Participating in a bull session				
29. Dinner conversation with strangers				
30. Talking with my barber (or beauty operator)				
31. Telephoning to make appointment, or arrange meeting place with someone				
32. Answering roll call in class				
33. Asking at a desk for book, or card to be filled out, etc.				
34. Talking with someone I don't know well while waiting for bus or class, etc.				
35. Talking with other players during a playground game				
36. Taking leave of a hostess				
37. Conversation with friend while walking along the street				
38. Buying stamps at post office				
39. Giving directions or information to strangers				
40. Taking leave of a girl (boy) after a date				
Total				
Average				
No. of 1's				
" " 2's				
" " 3's				
" " 4's				
" " 5's				

Additional copies of this form may be obtained from the Interstate Printers and Publishers, 19-27 North Jackson Street, Danville Illinois