Effect of biofeedback training on the maintenance of fluency.

Karen Olde

The University of Montana

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THE EFFECT OF BIOFEEDBACK TRAINING
ON THE MAINTENANCE OF FLUENCY

By
Karen Olde
B.A., University of Montana, 1981

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for the degree of
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>THE EFFECT OF BIOFEEDBACK TRAINING ON THE MAINTENANCE OF FLUENCY</td>
<td>2</td>
</tr>
<tr>
<td>STUDY DESIGN</td>
<td>13</td>
</tr>
<tr>
<td>Subjects</td>
<td>15</td>
</tr>
<tr>
<td>Measurements</td>
<td>16</td>
</tr>
<tr>
<td>ESTABLISHMENT PHASE</td>
<td>17</td>
</tr>
<tr>
<td>Airflow</td>
<td>17</td>
</tr>
<tr>
<td>TENSION REDUCTION AND CONTROL PROCEDURES</td>
<td>20</td>
</tr>
<tr>
<td>Biofeedback Procedures (Quiet)</td>
<td>22</td>
</tr>
<tr>
<td>Biofeedback Procedures (Speech)</td>
<td>23</td>
</tr>
<tr>
<td>Non-Biofeedback Procedures (Quiet)</td>
<td>23</td>
</tr>
<tr>
<td>Non-Biofeedback Procedures (Speech)</td>
<td>23</td>
</tr>
<tr>
<td>TRANSFER PHASE</td>
<td>24</td>
</tr>
<tr>
<td>Discriminative Stimulus Control Procedure</td>
<td>24</td>
</tr>
<tr>
<td>SUMMARY OF TREATMENT PROGRAM/STUDY</td>
<td>27</td>
</tr>
<tr>
<td>RESULTS</td>
<td>28</td>
</tr>
<tr>
<td>Outlyers</td>
<td>30</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>32</td>
</tr>
<tr>
<td>SUMMARY</td>
<td>35</td>
</tr>
<tr>
<td>FUTURE DIRECTIONS</td>
<td>35</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>37</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>40</td>
</tr>
</tbody>
</table>
INTRODUCTION

The field of speech pathology has witnessed many changes in the approaches and techniques utilized in stuttering therapy. One area of intervention that has recently begun to receive attention is the maintenance of fluency in the post-treatment environment.

This paper examines assumptions and rationales surrounding the issue of fluency maintenance. It presents several programs which offer innovative approaches to facilitating the maintenance of fluency. While serving as a Clinical Extern at Fitzsimons Army Medical Center, the author had an opportunity to participate in such a program. The Intensive Stuttering Therapy Program at Fitzsimons was designed by Jon Hasbrouck and Fran Lowry-Romero and is presented in detail within this paper.

After being involved with this exciting but still unfinished study and investigating the existing and available research, it is my hope that this paper will point to further paths of investigation, toward the ultimate efficacy of any stuttering treatment: the maintenance of fluency.
THE EFFECT OF BIOFEEDBACK TRAINING
ON THE MAINTENANCE OF FLUENCY

In recent years, a number of treatment programs have been developed which enable stuttering clients to achieve fluent speech within the clinical setting (Azrin and Nunn, 1974; Boberg, 1976; Costell, 1975; Curlee and Perkins, 1969; Ingham and Andrews, 1973; Lanyon et al., 1976; Ryan, 1974; Shames and Egolf, 1976).

Procedures such as regulated breathing, contingent reinforcement/punishment, prolongation, token economies, biofeedback and delayed auditory feedback have been used to attain fluent speech within an extremely short time period. The ultimate test of any therapeutic program is whether fluency established during treatment can be maintained in the client's natural, post-treatment environment.

Martin (1981) reviewed available literature regarding the maintenance of fluency and concluded: "... a crude estimate of the effects of stuttering therapy is that one-third of the clients achieved and maintained satisfactory fluency... another one-third of all clients achieved satisfactory fluency during treatment, but experienced significant regression over time. Finally, almost one-third of all clients studied either failed to complete a treatment program or were unavailable for subsequent follow-up assessment" (pg. 16).

Findings for other behavioral disorders demonstrate a similar 30% success rate. A summary of data from numerous abstinence programs involving cigarettes, alcohol or heroin demonstrated the percentage of abstainers at three months post-treatment was approximately 40% and by twelve months had dropped to 25-35% of the original participants (Hunt, Barnett and Branch, 1971). Comparative data

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has not been presented to suggest that stuttering may be equated with addiction. Rather, the observation is made to denote the similar difficulties that various professionals and clients encounter in maintaining induced lifestyle changes.

Reports documenting the maintenance of fluency are scarce (Boberg and Sawyer, 1977). Explanations for this paucity of data have been examined by several authors. Ingham (1981) discusses the difficulty of conducting long-term studies in terms of non-treatment variables, i.e., as the post-treatment interval increases, the number of non-treatment variables increases as well. He speculates that this exponential increase of variables serves as a deterrent to conducting long-term studies for many researchers.

In addition, Ingham identifies doctoral investigation as the primary source for research and indicates time restraints for dissertations are not conducive to the long-term evaluations necessary for maintenance studies. He suggests the dearth of maintenance data may also be attributed to journal editors' tendency to publish short-term studies as opposed to long-term evaluation data. Owen (1981, pg. 34) discusses these points as well: "The instatement and evaluation of change in the short term is clearly more immediately rewarding and less difficult than is a focus on long-term outcome, which results in delayed publication and less spectacular effects."

When discussing current literature regarding fluency maintenance, the topic of terminology must be addressed. Considerable confusion exists over the definitions and use of the terms "transfer" and "maintenance."

For the purpose of this paper, the term "transfer" will refer to activities designed to generate fluent speech in a wide variety of settings with many different people (Ryan, 1974). Transfer will be considered an active process.
occurring as part of the treatment program and at least partially supervised by the clinician(s). It may or may not be administered systematically and is considered a facilitator to fluency maintenance. The term "maintenance" will be used to denote the sustained occurrence of a learned response after active treatment has been terminated (O'Leary and Wilson, 1975). A distinction will be made between passive maintenance and active maintenance (Ingham, 1981). Passive maintenance will be considered as ongoing assessment, and active maintenance as program intervention. In a broad sense, transfer may be considered as part of a maintenance program since its ultimate purpose is to sustain fluency.

The ease of establishing fluency within a clinical setting, coupled with the disturbing relapse data, has led many clinicians and researchers to believe the lack of effective transfer and/or maintenance activities are responsible for the failure of fluency sustainment. Baer, Wolf and Risely's (1968, pg. 67) statement "that generalization should be programmed rather than expected or lamented" is a premise that some researchers have begun to incorporate into therapeutic programs. Thus, inclusion of transfer and/or maintenance strategies has emerged based on the rarely tested postulation that, in order for maintenance to occur, a maintenance strategy must be activated.

A recent review of behavioral approaches to the management of stuttering (Ingham and Lewis, 1978) revealed only one report (Boberg and Sawyer, 1977) which demonstrated the benefit of including an active maintenance procedure within a therapy program. At twelve month's follow-up, those clients who had been involved in a maintenance program (N=5) demonstrated 1.53% dysfluent syllables while those who had not were dysfluent on 7.49% syllables.
Since that review, Ingham (1980) has also undertaken the task of demonstrating maintenance program efficiency by way of performance-contingent maintenance schedule vs. a non-performance contingent schedule. Results indicated subjects exhibited a higher percentage of stuttered syllables (%SS) during non-performance contingent maintenance schedules, leading Ingham to conclude that "maintenance and generalization may be regarded as 'operants'. . . It is possible to increase the probability that a behavior change will be maintained and generalized by arranging consequences on the appearance of a maintained behavior" (pg. 740).

While two studies may not provide a stable data base for the promotion of maintenance programs as recently advocated, they may justify pursuing the assumption that these programs are integral to maintaining fluency.

Neville Owen has compiled from the literature a number of therapeutic approaches which may be useful strategies to consider when designing fluency maintenance programs. The following is reproduced from Owen's review (Boberg, E., Maintenance of Fluency, 1981, pg. 37):

I. Within the intervention and maintenance setting, it is recommended to focus on:
A. Using contingencies and cues that will operate in the client's usual, natural or maintenance environment as the significant contingencies in the intervention setting;
B. training relatives or significant others in the client's usual environment as part of the intervention program;
C. varying conditions of training or "training loosely," so that a range of behaviors are practiced and reinforced in a variety of settings;
D. "fading out" of contingencies or reducing the discriminable differences between the cues and contingencies of the intervention and maintenance settings. Presenting thin schedules, variable schedules or delayed reinforcement;
E. giving clients access to a wide range of credible models or examples for the behaviors being developed. For example, through self-help, discussion or support groups.

II. Teaching clients sets of self-control, self-management or generalized problem-solving skills that should mediate generalization across settings and maintenance over time. These include:
   A. personal goal setting and planning strategies;
   B. skills in self-observation, self-monitoring and self-recording of behavior;
   C. skills in modifying environments, setting events or controlling stimuli that elicit the behaviors to be maintained;
   D. skills in the use of self-administered reinforcement and aversive consequences;
   E. covert control strategies including self-instruction and imagery techniques;
   F. other adjuncts that will increase personal resilience and offer a greater range of behavioral options.

The following section described an active maintenance program designed by Boberg and his associates:

Fluency is established within the clinic in an intensive group program which meets seven hours a day for three weeks. Group sizes range from
four to six individuals and allow for improvement of interpersonal skills while progressing through the program. Clients learn to identify and describe stuttering behavior and fluency skills including easy sound initiation, phrasing, prolongation and cancellation. These fluency skills are practiced to criterion levels. When clients can produce speech at normal rates (190 SPM ± 20) with less than 1% dysfluency, they are ready to move to the transfer phase of the program.

Boberg's transfer phase consists of twelve standard assignments hierarchically arranged by the client. Each assignment consists of one or two five-minute sessions of client talking-time which are taped and analyzed by the client. The tape must contain a minimum of five minutes of speech spoken at normal rates with less than 2% dysfluency. The client completes an analysis form including a record of dysfluent words, cancelled words and employment of fluency skills. The client then compares his/her evaluation with a similar one made by the clinician. Standard transfer assignments include:

A. Conversations with secretaries/staff within the clinic (1 session)
B. Opinion surveys with strangers (2)
C. Conversations with strangers (2)
D. Telephone assignments (2)
E. Shopping assignments (2)
F. Job interview (1)

When clients are halfway through their standard assignments, they are asked to develop a list of ten situations which are particularly difficult for them. The list is devised with minimal clinician assistance and organized hierarchically.
Personal assignments are carried out and analyzed in the same manner as standard assignments. Upon completion of the personal assignments, clients are ready to move on to the maintenance program.

Boberg's maintenance program consists of daily homework assignments, evening visits and refresher weekends. Clients are encouraged to establish realistic targets (97-98% fluency) and to communicate this, as well as to explain the use of fluency skills to friends and family members. The client chooses one of three home programs to follow on a daily basis and determines how much time he/she is able to commit. The home programs are constructed in formats of one hour, forty minutes, or twenty minutes and each program includes:

A. Recording samples of reading or speaking alone at a speech rate of 100 syllables per minute (SPM) and 200 SPM.
B. A conversation with a friend or family member and personal assignments in difficult situations. The amount of time spent varies as a function of the plan chosen.
C. Clients analyze, record and graph the results of the tape at the end of each day.
D. Records are then sent to the clinician.

Immediately following the intensive clinic, the client returns for weekly evening visits. After four weeks, the visits are reduced to once a month and discontinued after four months. Optional refresher weekends are also scheduled at approximately three month intervals throughout the year. These meetings are essentially "telescoped versions" of the intensive clinics and also allow clients an opportunity to discuss their experiences in the post-treatment environment.
The data indicates that those clients who have completed the active maintenance program (N=5) demonstrate 1.53% dysfluent syllables in comparison with 7.49% dysfluent syllables of individuals (N=8) who had not completed the program. The independent roles that the home program and the refresher treatments may or may not have played is unclear.

The following section describes in detail a passive maintenance program developed by Jon Hasbrouck and Fran Lowry-Romero at Fitzsimons Army Medical Center. Their research project attempts to provide fluency maintenance data as well as to examine the role of biofeedback vs. relaxation training in the maintenance of fluency.

The fact that stuttered speech characteristically involves excessive oral muscle tension should come as no surprise. As early as 1934, Travis reported electromyographical data that demonstrated "strikingly different" bilateral masseter action potentials for stutterers as opposed to "practically identical" action potentials for non-stutterers. Travis used these findings as evidence of a neurophysiological basis for stuttering. Further research by Williams (1955) indicated increased spiking for stuttered speech; however, it also revealed that non-stutterers were able to demonstrate faked stuttering that produced action potential records anomalous to stuttering. He used this evidence to refute the concept of a neurophysiological difference and asserted that moments of stuttering typically involve "... muscular tension in excess of that characteristic of normal speech..." (pg. 260).

Recent studies have noted abnormally high levels of laryngeal muscle activity and disrupted coordination of adductor-abductor muscles during stuttered speech (Freeman and Ushijima, 1978) and higher masseter muscle tension in
stutterers vs. non-stutterers (Kalotkin, Manschreck and O'Brien, 1979). Other researchers have hypothesized that the stuttering block is accompanied by a spasm of the laryngeal muscles (Van Riper, 1971; Schwartz, 1974; Stromer, 1977). Guitar (1975) indicates that the spasm not only accompanies the stuttering block but may precipitate it. Mysak and Bloodstein (1969) see laryngeal spasms as being part of the stutterer's "preparatory set," a defensive clenching maneuver adopted as a reaction to anticipated speech breakdown.

Existing evidence of the intimate relationship of excessive muscular tension and the occurrence of stuttering has led several researchers to investigate the possibility of reducing stuttering through the reduction of oral tension. Biofeedback has often been utilized as a means of training tension reduction as it offers an objective and concrete source of data.

The employment of biofeedback as a technique to reduce stuttering varies as a function of electrode placement and type of feedback modality used. Some researchers report the use of visual feedback, as auditory feedback may be distracting while engaging in speech (Stromer, 1979). However, others report the use of an auditory modality without disruptive effects on fluent speech production (Guitar, 1975; Hanna et al., 1975). It may be that the modality of choice varies across individuals; i.e., some clients may respond better to an auditory mode, others may have more success with visual feedback and, for some individuals, the mode of feedback may not have an effect on performance. The modality of choice would seemingly be the one with which the client is the most successful.

The issue of electrode placement in biofeedback studies is also controversial. Some researchers have chosen masseter placement (Lanyon et al., 1976;
Lanyon, 1977; Manschreck, 1980), while others have used electrode placement at the level of the larynx (Hanna et al., 1975; St. Louis et al., 1982). Another group has chosen the corner of the mouth and lateral to the nasal alae (Craig and Cleary, 1982).

Stromer (1979) addresses the issue of electrode placement. "There is no reason to assume that there is a single most effective site for electrode placement in biofeedback stuttering therapy..." He goes on to comment on the "intersubject locus variability" of tension sites in stutterers and suggests that "if there is any commonality among stutterers, it is that most exhibit airway disruptions ranging in locus from the laryngeal glottis up to the lips" (pg. 383). At least one researcher (Guitar, 1975) has adapted this attitude of individualized placement relative to the greatest EMG recording.

Whatever mode of feedback is used or electrode placement is chosen, all documented studies share the following commonalities: all report biofeedback as the only fluency procedure used. Some document relaxation training as a facilitative procedure (Craig and Cleary, 1982; Manschreck et al., 1980; Lanyon et al., 1976; Lanyon, 1977) and all studies report the ability to obtain fluency within a clinical setting. Some have successfully included false feedback (Hanna et al., 1975) or non-feedback conditions (Lanyon et al., 1976; Craig and Cleary, 1982) as a means of attributing fluency effects directly to biofeedback intervention. These researchers have also noted that, with practice, some effects of generalization to the false or non-feedback condition are evident.

In addition, several investigations utilizing biofeedback as the sole fluency technique have reported follow-up data (Manschreck et al., 1980; Legewie et al., 1975; Guitar, 1975; Craig and Cleary, 1982). All studies, with the exception
of Legewie et al. (1975), report fluency maintenance to some degree in the post-treatment environment. None of the studies report specific data post-clinically. Guitar (1975) reports that a tape recording sent by the subject nine months post-treatment revealed that "he was speaking at normal rates, without stuttering, in conversation and in telephone calls" (pg. 683). Manschreck et al. (1980) reported "significant improvements in fluency" at 3 to 6 months follow-up for eight adult subjects.

Craig and Cleary (1982) included a one-month maintenance phase after EMG feedback training was established with three adolescent males. Maintenance techniques included:

1. Five minute daily practice of skills taught in treatment.
2. Daily record of the "occurrence and context of any serious stutter" (pg. 245) which was shared with the clinician on a weekly basis.
3. A reinforcement system, developed by the client and his family, for a day free of "serious dysfluency."

The authors report a 66% decrease in percent of syllables stuttered (%SS) in conversational speech during the maintenance phase and indicate follow-up measures taped by the subjects' family in the home revealed a "stabilization" of the %SS reductions.

In summary, results of biofeedback therapeutic stuttering programs have all demonstrated the reduction of stuttering within a clinical setting, regardless of the site of electrode placement or feedback modality utilized. Results of the studies reporting maintenance data must be interpreted with caution due to the ambiguous nature of the data reported.
Some researchers have ascribed basic importance to voluntary tension reduction in therapeutic endeavors for stuttering (Azrin and Nunn, 1974; Bloodstein, 1969; Williams, 1957; Ladocueu et al., 1981). However, the role that relaxation training plays in stuttering therapy and the maintenance fluency has not been systematically researched nor has a comparison of EMG and relaxation training been made in stuttering treatment. Silver and Blanchard (1978) have examined the issue of biofeedback vs. relaxation training for psychophysiological disorders such as asthma, migraine headaches, primary dysmenorrhea and temporal joint pain. Based on this review, they conclude: "... There is no consistent advantage for one form of treatment over the other" (pg. 217).

STUDY DESIGN

The study designed by Hasbrouck and Lowry-Romero is presumably the only one of its kind that compares biofeedback plus relaxation training to relaxation training without the use of biofeedback in the maintenance of fluency. Their study investigates the use of biofeedback as a facilitating technique to maintaining fluency. The study attempts to answer the question, "Is the machine necessary?" A schematic of Hasbrouck and Lowry-Romero's treatment program and study is diagrammed in Figure 1 (pg. 14). The two groups follow identical treatment plans with the only difference being the inclusion of biofeedback training during the establishment phase for the first group.

Program Description

Hasbrouck and Lowry-Romero's intensive stuttering therapy program involves four to five adults at a time. They are in therapy seven hours per day, four
Study Schematic (Fig.1)

Pre-Treatment Assessment
- AIRFLOW
- PROGRESSIVE TENSION/RELAXATION
  - QUITE BIOFEEDBACK
  - SPEECH BIOFEEDBACK
  - DISCRIMINATIVE STIMULUS CONTROL

Pre-Treatment Assessment
- AIRFLOW
- PROGRESSIVE TENSION/RELAXATION
  - QUITE RELAXATION
  - SPEECH RELAXATION
  - DISCRIMINATIVE STIMULUS CONTROL

Establishment Phase

Transfer Phase

Post-Treatment Assessment
- FOLLOW-UP MONITORING

FOLLOW-UP MONITORING

Maintenance Phase
days a week for up to five weeks. The program utilizes airflow and progressive tension/relaxation procedures to establish fluency. The biofeedback and non-biofeedback groups are treated identically within the initial portion of the establishment phase.

The second portion of the establishment phase consists of practicing relaxation in quiet and while speaking. In addition to maintaining relaxation during the establishment phase, all clients are required to utilize airflow and maintain fluency while speaking. The transfer phase consists of utilizing airflow and relaxation training while discussing topics directly related to the individual's stuttering behavior.

The non-biofeedback group receives relaxation training described on pages 20-22 as the sole technique for learning relaxation procedures. The biofeedback group follows this schedule of relaxation training as well; however, the use of biofeedback is included to facilitate the relaxation training. The maintenance program is considered passive and consists of the collection of follow-up data.

The following sections describe in detail the manner in which data was collected and measured. The establishment, transfer and maintenance components of Hasbrouck and Lowry-Romero's program are also explicated.

**Subjects**

All subjects were adults employed by the United States military system. Ten male subjects participated in the biofeedback group. Currently, seven males and one female have participated in the non-biofeedback group. By mid-May 1984, a total of at least ten subjects will have been included. For the purposes of this paper, results will be analyzed for eight biofeedback and eight non-biofeed-
back subjects. Follow-up results are available and will be analyzed comparative-
ly for seven biofeedback and six non-biofeedback subjects.

Two biofeedback subjects, D.F. and F. D., have been identified as "out-
lyers" (>3 SD from the Mean) and were removed from comparative analysis. Both
these individuals demonstrated high percentages of stuttered words during pre-
test and follow-up measures (see Appendices V and VI). Their unique cases will
be addressed in the "Results" section of this paper.

Measurements

Pre- and post-treatment thirty-minute recordings were collected and analyzed
by Jon Hasbrouck. Pretesting was conducted within one week of therapy initiation
and post-testing occurred the day following therapy completion. All recordings
were analyzed for frequency of stuttering, dysfluency and speech rate (words
per minute--WPM). Hasbrouck (1983b) defines "stuttering" as sound repetitions,
sound prolongations and silent blocks. He considers "dysfluencies" to be word
repetitions, phrase repetitions and sound interjections. These definitions were
used in pre-, post- and follow-up analysis.

In addition to pre- and post-testing, a total of four follow-up contacts
will be made. The military population involved in this study tends to be mobile,
making consistent follow-up contacts of equal time intervals impossible to accom-
plish. Thus, one contact is made during the first six months post-treatment,
the next before twelve, eighteen and twenty-four months have passed, respectively.

These contacts are made by Hasbrouck and are typically conducted over the
telephone. Follow-up contacts consist of fifteen-minute conversations wherein
the speech rate and dysfluency/stuttering frequency is tabulated on line. Occasion-
ally, clients live near the clinic and thus a personal fifteen-minute conver-
sation with Hasbrouck is taped and analyzed at a later date. Follow-up contacts are considered assessment periods and no therapeutic counseling of any kind occurs. Inter-observer reliability was previously established for the occurrence of stuttering during one-minute samples of pretest recordings. A Pearson Product Moment Correlation revealed a coefficient of $r = .96$.

For the purposes of this paper, only the first follow-up contact will be analyzed and compared as the non-biofeedback group has been in post-treatment for only five months at the time of this writing. In addition, only the percentage of stuttered words (%SW) will be analyzed for pre-, post- and follow-up measures of this preliminary study.

For the interested reader, word rate (WPM) and percent dysfluent words for all subjects are available in Appendix V. All follow-up data collected thus far (including biofeedback 6-12 months post-treatment) are provided in Appendix VI. In addition, pre- and post-EMG readings at the level of the larynx and forehead were collected during three conditions: spontaneous speech, reading and quiet. Consideration of this data is beyond the scope of this paper; however, they are provided in Appendix VII for those interested.

ESTABLISHMENT PHASE

Airflow

Airflow is a procedure whereby a small amount of air is released through the vocal folds just prior to the onset of phonation. Other researchers have reported the use of similar procedures (Azrin and Nunn, 1974; Ladouceur et al., 1981).
Azrin and Nunn (1974) describe starting speech immediately after inhaling as an "incompatible activity" with stuttering, as the vocal musculature is in a relaxed state following slow inhalation. Unlike Schwartz' (1976) airflow procedure which involves syllable prolongation following airflow, the procedure about to be described does not alter the sound or syllable production following airflow.

A four-stage hierarchical procedure is used to train airflow (Appendix I). Exit criteria for each stage is 100% use of airflow and no occurrence of stuttering. The four stages are as follows:

**Stage 1: Use of Airflow on Printed Vowels**

Clients release a small amount of air prior to the onset of phonation while reading from a list of printed vowels. Inspiration proceeds each vowel production. Airflow is continuous from the onset of flow through vowel production. Clients must pass two 5-minute rating sessions before passing on to Stage 2. If clients fail to use airflow or stutter, they are required to repeat that rating session. If they fail within this stage a second time, they begin the progression of ratings within Stage 1 again. Upon failure of a rating session, the correct procedure is explained and demonstrated by the clinician. The client practices the correct method with the clinician and demonstrates the appropriate behavior before leaving the rating session. Orientation to Stage 2 is provided following successful completion of the second 5-minute rating session in Stage 1. Orientation involves clinician explanation and client practice of the next stage.
Stage 2: Use of Airflow on Printed Monosyllabic Words

This stage is identical to Stage 1; however, a list of single syllable words which include all permissible English phonemes in the initial position is utilized. Rules for failure and orientation to the next stage are applied in the same manner as in Stage 1.

Stage 3: The Use of Airflow While Speaking Spontaneously in Short Phrases

Clients use one-, two-, three- or four-word phrases while speaking spontaneously. They inspire previous to initiation of each phrase, release a small amount of air through the vocal folds prior to phonation and maintain airflow across the phrase unit. Clients must pass ten 5-minute rating sessions before proceeding to Stage 4. If clients fail to use airflow or stutter, they are required to repeat that rating session. If subsequent rating sessions are failed within Stage 3, the client must begin the progression of ratings within this stage over again.

Stage 4:

This stage is identical to Stage 3; however, clients use normal phrasing while speaking spontaneously. Rules for failure are applied in the same manner as in Stage 3.

Once clients have entered Stage 3, they are to use 1-4 word phrases with airflow at all times. When they have begun Stage 4, they are required to use airflow following inspiration or a pause at all times. Failure to utilize airflow results in a failed rating session and will be consequated as such by the
rules outlined in Stage 3. Hasbrouck (1983) reports that by using the airflow procedure as described, "The average client is fluent within six rating sessions and completes Stage 4 within 24 to 30 rating sessions" (pg. 160).

**TENSION REDUCTION AND CONTROL PROCEDURES**

The relaxation procedure utilized in this program (Appendix II) was developed by Lowry-Romero (Hasbrouck and Lowry-Romero, 1983) and is taught concurrently with the airflow training. The following summarizes the stages of relaxation training which is taught in five 1-hour sessions. Both biofeedback and non-biofeedback subjects are educated utilizing the following procedures.

1. **Progressive Tension/Relaxation Procedure**

Clients are taught to systematically tense and relax all major muscle groups of the upper body by assigning numbers 1 through 5 to different levels of tension. The steps of tension are as follows:

(1) relaxed awareness
(2) slight tension
(3) minimal tension
(4) moderate tension
(5) maximum tension

(Please see Appendix II for a more detailed description)

Steps are produced with subjectively equal degrees of tension between each number. Ultimately, the client learns to recognize and produce differing degrees of tension in the muscles of the face and upper body and corresponds them with a number system. In addition,
he/she learns to completely relax each muscle group (level 1) at the end of each one to five tension level sequence. The ultimate goal within this stage is for the client to learn recognition and production of varying degrees of tension and immediate relaxation of the upper body and facial muscles.

2. Random Tension/Relaxation Procedure

Clients are taught to randomly produce numbered levels of tension followed by immediate deep relaxation (level 1).

3. Identification of Tension

Clients are taught to identify levels of tension in their shoulders, larynx and jaw while they are quiet, during fluent speech production and while stuttering. Ultimately, they are to identify sites of tension that are problematic for fluent speech production and assign numerical levels of tension.

4. Controlling Tension

Clients are taught to vary tension levels of problematic areas. They are required to produce a tension level which has been previously identified (Stage 3) as being difficult for speech production. This level is immediately followed by a reduction of tension to a level 2 while producing speech sounds.

5. Controlling Tension in a Small Group

The same as level 4, but while conversing in small groups comprised of fellow clients in the intensive stuttering group.

The biofeedback and non-biofeedback groups are treated identically thus far in the treatment program. All clients are instructed in the method of "airflow"
utilizing a systematic hierarchy of speech complexity. Five minute rating sessions are provided on a rotating basis. Clients are also taught to identify and reduce tension utilizing the Lowry-Romero Relaxation Technique. One hour of relaxation instruction is provided daily for five consecutive days.

During the initial establishment phase, clients are provided with approximately eight hours of clinician contact, i.e., three hours of airflow training and five hours of relaxation training. Most clients complete this part of the program within the initial two weeks of therapy.

In addition to receiving relaxation training, one group was trained to utilize biofeedback as an adjunctive training technique during the next phase of the program. The following section describes the procedures utilized by the biofeedback and non-biofeedback groups during the next portion of the Establishment Phase.

Biofeedback Procedures (Quiet)

Biofeedback training (utilizing an Autogenic 1500 C electromyograph and Autogenic 5100 Analyzer, Autogenic Systems, Inc., Berkeley, CA) is introduced following airflow and tension/relaxation training. Tension is monitored electromyographically by electrodes attached to the neck, external to the larynx.

Clients are provided with both audio and visual feedback and tension levels are averaged and presented every 15 seconds. A tension level of 2 microvolts\(^1\) or less obtained in 80% of the 15-second-averaged readouts is required for three consecutive 20-minute rating sessions. Clients are provided with individual

\(^1\)Hasbrouck and Lowry-Romero have discovered through clinical experience that a tension level of approximately 2 microvolts is necessary for articulatory movement to occur.
biofeedback units (Autogenic Systems Inc., HT-1) to facilitate practice between rating sessions. Practice times are provided for both quiet and speech biofeedback conditions.

**Biofeedback Procedures (Speech)**

Biofeedback training during speech production is initiated following biofeedback training in quiet. A tension level of 2-7 microvolts\(^2\) during conversation is required for three consecutive twenty-minute trials. Readouts from the last three sessions are averaged and a "talking tension level" is computed. This individual talking tension level is subsequently used as part of the criteria for the Discriminative Stimulus Control Procedure.

**Non-Biofeedback Procedures (Quiet)**

The utilization of relaxation training while quiet is initiated following airflow and tension/relaxation training. Tension is monitored visually by the attending clinician for three consecutive 20-minute rating sessions. During the sessions, the clinician provides suggestions for modifying body position to reduce tension. There is no criteria for failure during these sessions as no objective data (EMG readings or speech) are available. The number of rating sessions (3) for this portion of the transfer phase was derived from the mean number of ratings the biofeedback group required to meet the previously-discussed criteria for biofeedback in quiet.

**Non-Biofeedback Procedures (Speech)**

Utilizing relaxation training during spontaneous speech production is

\(\text{\footnotesize \textsuperscript{2}Seven microvolts is an arbitrarily defined upper limit.}\)
initiated upon completion of the relaxation in quiet condition described above. Tension is monitored visually and auditorily by the attending clinician for three consecutive twenty-minute rating sessions. In the event that a client stutters or fails to use airflow, he/she returns to the fifth rating session of Airflow, Stage 4. Upon successful completion of this repeated stage (following the rules designated in Airflow, Stage 4), the client once again begins the non-biofeedback procedures for speech described earlier in this section.

TRANSFER PHASE

**Discriminative Stimulus Control Procedure**

When designing their intensive therapy program, Hasbrouck and Lowry-Romero originally included the use of taped outside assignments. They have since abandoned this type of transfer approach since Hasbrouck (1983a) reports: "The procedures were costly in time; the variety, frequency, and quantity of stimulus exposures were minimal; significant real experiences were difficult to create; attending clinicians were stimuli for fluency; and, if left alone, many clients altered their recordings to meet criteria for fluency" (pg. 158).

The program currently utilizes a "discriminative stimulus control procedure." The procedure involves addressing various situations, while in the clinical environment, which are known to cause or maintain stuttering (Appendix III). Clients are given lists of the following ten categories:

1. Outside situations and places
2. Placing a call on the telephone
3. Receiving a call on the telephone
4. Public speaking  
5. People  
6. Stuttering expectation  
7. Physical and emotional status  
8. Self-stimuli for stuttering  
9. Listener reactions  
10. Avoidance and escape devices

Each category includes a number of different stimuli ranging from 17-52 items and combining for a total of 269 stimuli. Clients arrange the ten categories hierarchically and subsequently rank the stimuli within each category for those situations which have the lowest stimulus value to those which have the highest. Clients rank only those stimuli which apply to them or have affected them in the past. For instance, within the general category of "People" there are 27 stimuli. A client may indicate that, of those 27 stimuli, 20 of the items have affected his/her speech at some time. The client ranks those 20 items hierarchically; e.g., if "strangers" have the lowest stimulus value (are the least difficult to talk with) and "Mother" has the highest stimulus value (the most difficult) for this client, then "strangers" would be ranked as a number 20 within this category and "Mother" as number 1. When appropriate, clients include additional personal stimuli and rank them accordingly. Ultimately, a "personal hierarchy," depicting individual stimuli for stuttering, is developed by each client.

The following are examples of the various stimuli dealt with:

Self-Stimuli for Stuttering

1. Pause in response to a question so that someone else will answer it for you.
2. Stutter to gain sympathy or to make people feel sorry for you.

3. Stuttering leads to stuttering.

Avoidance and Escape Devices
1. Avoiding meeting new people
2. Using a word or phrase interjection to start a difficult word.
3. Talking softly to avoid stuttering.

Receiving a Call on the Telephone
1. Receiving a call from a friend.
2. Receiving a call from your bank.
3. Talking too fast when receiving a call.

Beginning with the item of lowest stimulus value, clients are required to discuss how each stimulus affects their stuttering for at least one minute. Clients involved in the non-biofeedback group are required to use airflow and to speak without stuttering. The biofeedback group adheres to these criteria as well as maintaining tension levels below the previously established personalized "talking tension level." Failure to meet criteria results in an immediate time-out from speaking for both groups. Those clients receiving biofeedback are required to sit quietly until they achieve a 15-second readout with an average of 2 microvolts. Those clients who do not receive biofeedback are required to sit quietly (timed-out) for 15 seconds (based on the mean time-out calculated for the biofeedback group).

Discussion of the stimulus continues, following fulfillment of the time-out criterion. If a client demonstrates failure on a particular stimulus twice, Hasbrouck (1983a) recommends dealing with the stimulus by "structuring questions about the stimulus in such a way that the client is moved away, in time and/or
space, from the original stimulus item" (pg. 161). Methods for structuring questions in this manner are provided in Appendix IV.

The theory behind the discriminative stimulus control procedure assumes that if a client enters a situation which was formerly a stimulus for stuttering, in a relaxed manner, utilizing airflow and fluent speech, the situation will become a stimulus for fluency. It is further assumed that when similar situations are encountered in the real world, they too will be handled fluently, a finding which clients have reported to Hasbrouck (1983a).

SUMMARY OF TREATMENT PROGRAM/STUDY

Fluency is established within the clinical environment through a systematic series of criterion-referenced levels utilizing airflow and relaxation training. Transfer activities are also conducted within the clinic utilizing a "discriminative stimulus control procedure" wherein clients create personal hierarchies of speaking situations and discuss them while in the clinical environment. The maintenance program is considered passive and consists of follow-up assessments approximately every six months for two years.

In addition to presenting the intensive stuttering treatment program used at Fitzsimons Army Medical Center, the preceding section of this paper has described a portion of a larger study currently being undertaken at this facility. This preliminary study examines the role of biofeedback training as a facilitator to fluency maintenance. The following section presents comparative results that assist in defining the role of biofeedback training in the maintenance of fluency during the first six months post-treatment.
RESULTS

The percentage of stuttered words (%SW) obtained during pre-, post- and follow-up measures are illustrated in Table 1. As was previously discussed in the "Subjects" section, biofeedback subjects D. F. and F. D. were excluded from group analysis and will be dealt with separately within this section. For the purposes of this preliminary study, only the %SW during pre-, post- and follow-up (within the first six months post-treatment) periods are analyzed. Available data depicting number of words stuttered, number of words dysfluent, percentage of words dysfluent, number of words spoken and WPM are presented in Appendix V. Pre- and post-EMG recordings for the larynx and forehead are presented in Appendix VI for the interested reader.

The mean %SWs during pretest conditions was 3.34 (SD 2.96) for the biofeedback group and 3.78 (SD 2.96) for the non-biofeedback group. Post-test measures revealed a mean of .12% (SD .11) stuttered words for individuals receiving biofeedback training and .09% (SD .04) for non-biofeedback subjects. Measures of follow-up performance indicated a mean of .32% (SD .26) stuttered words for the biofeedback group while the non-biofeedback group demonstrated a mean of .12% (SD .06).

To test for significant differences between groups, independent t-tests comparing the percentage of stuttered words obtained during pre-, post- and follow-up measures were conducted. Due to the use of multiple t-tests, an alpha level of .01 was required for significance. The t-value for the pre-test (t = .47; dF = 14; p > .01) indicated that the biofeedback and non-biofeedback subjects did not differ significantly before treatment in reference to %SW. Differences between post-test results were similarly nonsignificant (t = .45;
Table 1. Comparison of the percentage of stuttered words during pre-, post- and followup measures for biofeedback and non-biofeedback treatment groups.

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<th>Subject</th>
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<th>Post-</th>
<th>Followup</th>
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<tr>
<td>N.H.</td>
<td>4.75</td>
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<td>K.R.</td>
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<td>E.J.</td>
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<td>SD</td>
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| t | 0.47 | 0.45 | 0.51 |

\[1\] No t-tests were found to be significant at the .01 level of confidence.

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dF = 14; p < .01) as were t-values reflecting differences between groups at follow-up (t = .51; dF = aa; p > .01).

These results indicate that the biofeedback and non-biofeedback groups were not significantly different prior to treatment in regard to %SW. In addition, treatment was equally effective for both groups as reflected by similar post-test scores. Both non-biofeedback and biofeedback subjects demonstrated a relapse relative to post-treatment measures during the first six-months post-treatment. Thus, no significant differences were found between the biofeedback and non-biofeedback groups during pre-, post- or follow-up conditions as measured by percentage of words stuttered.

A correlated t-test was computed to discover the significance of difference between post-test and follow-up measures for each group; i.e., how much had each group changed from post-test to follow-up and how significant were the changes.

Results yielded significant correlated t-test values for both the biofeedback group (post-test $\bar{x} = .12\%$, SD = .11; follow-up $\bar{x} = .32\%$, SD = .26; t = 2.00; dF = 6; p < .05) and the non-biofeedback group (post-test $\bar{x} = .09\%$, SD = .04; follow-up $\bar{x} = .12\%$, SD = .06; t = 2.19; dF = 5; p < .05). These results indicate both groups experienced a statistically significant increase in %SW during the first six months post-treatment relevant to post-test performance.

**Outlyers**

Subjects D. F. and F. D. were not included in the comparative analysis due to the high frequency of stuttered words exhibited by each. Table 2 illustrates the subjects' comparably high percentage of stuttered words during pre-testing,
their successful post-treatment scores and their eventual relapse, apparent in follow-up measures.

Table 2. Percentage of stuttered words during pre-, post- and follow-up measures for outlying subjects.

<table>
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<th>Precent Stuttered Words</th>
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<td></td>
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<td>D. F.</td>
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<tr>
<td>F. D.</td>
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<td>21.96</td>
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These findings are illustrative of the resistance of more severe stutterers to maintenance of fluent speech patterns in the post-treatment environment. Perkins (1981) speaks of maintenance as a "problem of cost/effectiveness": i.e., "... the cost of maintaining fluency against the effective benefits of sounding normal" (pg. 168). He suggests that those individuals who stutter severely must pay a higher price, i.e., must monitor their speech constantly and thus are more likely to relapse. The follow-up data collected so far (Appendix VI) fails to reveal a subject in either group who demonstrated a relapse such as the ones presented by D. F. and F. D. Assuming the validity of this hypothesis, the monitoring was a price too high for either of these individuals to pay for fluent speech.
DISCUSSION

The hypothesis that the use of biofeedback training during stuttering treatment would improve the subjects' ability to maintain fluency in the post-treatment environment was tested. This hypothesis was not supported. No significant differences were demonstrated between groups receiving relaxation training facilitated by biofeedback training and relaxation training alone.

These results must be interpreted with caution as the number of subjects was small (follow-up data was analyzed for 7 biofeedback and 6 non-biofeedback subjects) and the amount of time elapsed since treatment was limited (follow-up data for both groups was available for the first six months post-treatment only). More research is necessary to discern the possibilities of significant differences occurring with larger sample sizes and/or longer time intervals post-treatment.

The preliminary results suggest that biofeedback does not make a difference in subjects' ability to maintain fluent speech within six months post-treatment. It is possible that over time the effects of biofeedback training may be realized and those subjects exposed to this form of training will demonstrate significant differences in their ability to maintain fluent speech twelve or twenty-four months post-therapy. Hasbrouck will be following these subjects for two years.

Collection of long-term follow-up data will not only assist in answering questions concerning the long-term effects of biofeedback training but will also contribute to this field's knowledge concerning the time intervals of data collection. Several researchers have suggested performance at six months post-treatment is predictive of a client's ultimate speech behavior (Boberg, 1979; Perkins, 1974). However, Ingham (1981) asserts follow-up data should be collected.
over a two-year period. More research is necessary concerning the length of
time newly-learned speech patterns fluctuate before becoming stable; i.e., how
long must we follow our fluency clients? Hasbrouck and Lowry-Romero's study
may assist in answering this important question.

The possibility that neither relaxation nor biofeedback-facilitated relaxation
training affects one's ability to maintain fluency also exists. It seems
that the next logical direction of inquiry is to administer the same treatment
program without a relaxation component. This may help to clarify the role that
relaxation plays in stuttering treatment and fluency maintenance.

The slight relapse demonstrated by both groups from post-treatment to follow-
up measures is consistent with other research. After an extensive review of
the literature, Boberg, Howie and Woods (1979) conclude: "... relapse or re-
gression following treatment for stuttering is a common experience and [that]
this regression is likely to occur within the first six months" (pg. 104).

That relapse is such a common occurrence may be attributed to several
factors, all of which relate to the reluctance of clients to consciously control
and practice newly-learned speech skills. The euphoria of fluency following
intensive treatment may cause clients to assume there is no need for practice.
In addition, practice may actually be viewed as punishing since it requires
careful monitoring, which may result in a loss of spontaneity. Thus, in real
life situations, "lucky fluency" (Perkins, 1981) may be chosen over speech
which is not spontaneous. Practice may also be viewed as unnecessary since the
consequences of not practicing are delayed; i.e., it is unlikely that missing
one day of speech practice would affect an individual's long-term speech pattern.
Perkins' previously discussed cost/effectiveness theory may also relate to cases
of less severe relapse.
Boberg et al. (1979) suggest that the reluctance of clients to practice newly-learned speech skills ultimately results in "micro-stutters." They assert that after exiting a treatment program clients will most likely respond to environmental cues with tension so mild that it goes unnoticed by the listener and even by the speaker. Boberg and his colleagues hypothesize that these micro-stutters are reinforced, since they assist in avoiding further speech breakdown. With time, the micro-stutters will become worse and occur more often, eventually becoming overt stuttering.

Boberg et al. (1979) share several research-worthy ideas for possibly resolving the problem of relapse. They suggest that clients should be trained within the therapy program to recognize the micro-stutters and deal with them appropriately. They also suggest that an achievement level of 100% fluency upon exiting a therapy program may be unwise. They assert that a client taught to deal effectively with residual stuttering while in the clinic may be more successful in managing the reappearance of stuttering in the real world. These are interesting and important concepts to consider and should be pursued in future research.

Only a portion of the data collected by Hasbrouck has been used in this preliminary study. The data reflecting rate of speaking and EMG tension levels may provide useful information for future inquiry into the relationship of fluency to speech rate or tension levels.

Results of this preliminary study reveal clients who were enrolled in Hasbrouck and Lowry-Romero's intensive stuttering treatment program were able to effectively reduce their percent of stuttered words and to maintain these changes (within reasonable limits) over time. Results were unable to document any
significant benefits of utilizing biofeedback training for the maintenance of fluency within six months post-treatment. If these preliminary findings are truly indicative of long-term performance, then clinicians need not invest in a biofeedback unit to administer a successful treatment program similar to the one described in this paper. These are important findings and present exciting possibilities to professionals involved in the treatment of stuttering.

SUMMARY

The difficulty of maintaining fluency in the post-treatment environment was discussed and ideas for improving post-treatment performance were shared. An intensive stuttering treatment program developed by Hasbrouck and Lowry-Romero was presented. The primary purpose of this paper was to report preliminary results concerning one of the components of Hasbrouck and Lowry-Romero's program, i.e., relaxation training facilitated by biofeedback training. This paper presented preliminary findings that suggest the use of biofeedback training does not make a significant difference in maintaining fluency.

FUTURE DIRECTIONS

The research involved in the paper has sparked a realization of the need for further investigations into the area of fluency maintenance. Perhaps, first and foremost, the question of the normalcy of a newly-learned fluent speech pattern must be addressed. That is, what is the quality of speech and how does it compare to "normal" speakers? If it is identifiably different, what are the
variables involved and what type of listeners (naive or trained) attend to the differences?

Another area in need of research involves quality and quantity of speech samples. How long and in what situations must a sample be collected for it to be truly reflective of a client's speech in the post-treatment environment?

Finally, more research is needed to determine the effects of an active versus passive versus no transfer therapy program. The role that these different programs play in maintaining fluency has yet to be clearly defined and is an important area to be considered when developing an effective stuttering treatment program.

ACKNOWLEDGEMENTS

For all the folks in Montana and Colorado whose incredible support made this undertaking possible.
REFERENCES


Hasbrouck, J., 1983b Personal communication during November of 1983.


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SECONDARY SOURCES


APPENDIX I.A

VOWEL LIST

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Hasbrouck and Lowry-Romero (1983)

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### APPENDIX I.B

**WORD TEST LIST**

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\(^1\) Hasbrouck and Lowry-Romero (1983)

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### APPENDIX I.B--Continued

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APPENDIX I.C

SCHEMATIC
AIRFLOW ON 1, 2, OR 3 WORDS, IN SPONTANEOUS CONVERSATION

\[\text{I am \underline{stationed} \ at Fort Carson, \ Colorado.}\]
\[\text{I am \underline{a tank gunner} \ on an \underline{M60 tank}.}\]
\[\text{I did my \underline{basic} \ at \underline{Fort Dix}, \ and \underline{my} \underline{A.I.T. at \ Fort Knox, \ where the \underline{armor school is}.} \]
\[\text{The schools \underline{were a lot} \underline{of work}, \ I \underline{was} \underline{really glad to \underline{get to \underline{my} \underline{duty station}}.} \]
\[\text{where I \underline{could rest} \underline{once in a \underline{while}}.}\]

\[\text{\underline{Hasbrouck} and \underline{Lowry-Romero (1983)}}\]
APPENDIX I.D

SCHEMATIC
AIRFLOW FOLLOWING INSPIRATION AND
PAUSING IN SPONTANEOUS CONVERSATION

1

I am stationed at Fort Carson Colorado.

I am a tank gunner on an M60 tank.

I did my basic at Fort Dix and my A.I.T. at
Fort Knox where the armor school is.

The schools were a lot of work. I was really
glad to get to my duty station where I could
rest once in a while.

Hasbrouck and Lowry-Romero (1983)
APPENDIX II
LOWRY-ROMERO RELAXATION TECHNIQUE

INTRODUCTION;
Following are relaxation techniques specific to body-area tensions which affect speech and voice production.

GENERAL:
1. Lie on the floor or in bed, or sit in the center of a couch, or sit in a comfortable chair with padded arms.
2. If sitting, stretch legs out and put head back. Use pillow padding if body parts are uncomfortable (such as under/behind back, arms, or knees).
3. If a particular area is difficult to relax, repeat the exercise for that area.
4. Do not do these exercises in bed when you are ready to retire. You may never complete the entire sequence before falling asleep.
5. Body positions during practice should allow you to be comfortable. You may lie flat, put one knee up, put both knees up, etc.
6. Practice daily.

SPECIFIC:

PROGRESSIVE TENSION - IMMEDIATE RELAXATION

1. HANDS AND ARMS: Demonstration areas
   a. Bend arms, keeping elbows on chair or bed. Lift forearms to about 45°.
   b. Slowly clench fists and count silently to 5. Feel an increase in tension at each number and reach maximum tension at the count of 5.
   c. Hold maximum tension and feel the tightness.
   d. RELAX - let arms drop. Feel the difference. Feel the total relaxation.

   Tension Levels:
   1 - awareness of hands and arms        4 - finger pressure on palms
   2 - cup fingers                        5 - make a fist - maximum tension
   3 - touch finger tips to palms

2. FOREHEAD:
   a. Slowly elevate eyebrows.
   b. Silently count to 5. Feel an increase in tension at each number and reach maximum tension at the count of 5.
   c. Hold maximum tension and feel the tightness.
   d. RELAX - let eyebrows drop. Feel the difference. Feel the total relaxation.

   Tension Levels:
   1 - awareness of forehead, stare ahead 4 - lift eyebrows higher and widen eyes more
   2 - slightly lift brows and look up 3 - lift brows more and widen eyes 5 - widen eyes as though scared

1 Hasbrouck and Lowry-Romero (1983)
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APPENDIX II—Continued

3. EYES:
   a. Either slowly squint eyes or slowly open wide or slowly close eyes.
   b. Silently count to 5. Feel an increase in tension at each number and reach
      maximum tension at the count of 5.
   c. Hold maximum tension and feel the tightness.
   d. RELAX - either stare ahead with eyes open or keep eyes closed with no
      squinting. Feel the difference. Feel the total relaxation.

   Tension Levels: (Alternatives)
   1 - awareness of eyes           1 - awareness of eyes           1 - awareness of eyes
   2 - stare, fix on target        2 - stare, fix on target        2 - stare, fix on target
   3 - start to squint             3 - open slightly              3 - start to close eyes
   4 - squint more                 4 - open wider               4 - close completely
   5 - maximum squint              5 - maximum wide eyes        5 - close tightly

4. JAW:
   a. Slowly move teeth together.
   b. Silently count to 5. Feel an increase in tension at each number and reach
      maximum tension at the count of 5. Feel the tension you create by not
      allowing the teeth to touch or by tapping the teeth together to determine
      position in space and then slightly separating them.
   c. Hold maximum tension and feel the tightness under and along sides of
      mandible.
   d. RELAX - let jaw drop and lips separate. Feel the difference. Feel the
      total relaxation.

   Tension Levels: (Alternatives)
   1 - awareness of jaw (lips/teeth separated)                   1 - awareness of jaw
   2 - close teeth almost together or tap teeth                 2 - touch teeth together
      for position and then slightly separate                    3 - slight clenching
   3 - tighten jaw without allowing teeth to touch             4 - more clenching
      and without jutting jaw                                   4 - maximum clenching as
   5 - tighten more allowing jutting if desired                 5 - maximum clenching as
      though angry                                                 though angry

5. LIPS:
   a. Either slowly pucker lips or slowly form them into a tight line.
   b. Count silently to 5. Feel an increase in tension at each number and reach
      maximum tension at the count of 5.
   c. Hold maximum tension and feel the tightness.
   d. RELAX - let lips separate and jaw drop. Feel the difference. Feel the
      total relaxation.

   Tension Levels:
   1 - awareness of lips                                         4 - more tension
   2 - put lips together                                         5 - maximum lip tension
   3 - squeeze lips together with                                 slight tension
APPENDIX II--Continued

6. TONGUE:
   a. Slowly push tongue tip against the back of the front teeth or the alveolar ridge.
   b. Silently count to 5. Feel an increase in tension at each number and reach maximum tension at the count of 5.
   c. Hold maximum tension and feel the tightness.
   d. RELAX - let tongue drop to bottom of mouth. Feel the difference. Feel the total relaxation.

   Tension Levels:
   1 - awareness of tongue
   2 - tongue forward to teeth or up to alveolar ridge
   3 - slight pressure
   4 - push harder
   5 - maximum pushing

7. SHOULDERS:
   a. Slowly push shoulders forward.
   b. Silently count to 5. Feel an increase in tension at each number and reach maximum tension at the count of 5.
   c. Hold maximum tension and feel the tightness.
   d. RELAX - let shoulders "settle" back and down. Feel the difference. Feel the total relaxation.

   Tension Levels:
   1 - awareness of shoulders
   2 - tense across shoulders in back
   3 - shoulders forward or up, very slight movement
   4 - shoulders forward or up more
   5 - shoulders forward or up - maximum tension

8. BACK:
   a. Take a deep breath and hold it. Slowly arch back away from floor or chair, keeping head on floor or back of chair.
   b. Silently count to 5. Feel an increase in tension at each number and reach maximum tension at the count of 5.
   c. Hold maximum tension and feel the tightness.
   d. RELAX - blast the air out of your mouth and settle back on the floor or chair. Feel the difference. Feel the total relaxation.

   Tension Levels:
   1 - awareness of stomach, inhale
   2 - hold breath, feel in stomach
   3 - tense stomach, slightly pull in
   4 - more tension
   5 - maximum tension, then explode air
APPENDIX II--Continued

9. STOMACH:
   a. Take a deep breath and hold it. Slowly tighten stomach as though someone was going to hit you. Feel the tension in stomach and chest.
   b. Silently count to 5. Feel an increase in tension at each number and reach maximum tension at the count of 5.
   c. Hold maximum tension and feel the tightness.
   d. RELAX - blast air out of mouth and breathe in a normal rhythm. Feel the difference. Feel the total relaxation.

   Tension Levels:
   1 - awareness of stomach, inhale 4 - more tension
   2 - hold breath, feel in stomach 5 - maximum tension, then
   3 - tense stomach, slightly pull in explode air

10. LARYNX:
   a. Take a breath and hold it. Feel the tension slowly increase in your throat/stomach/ chest.
   b. Silently count to 5. Feel an increase in tension at each number and reach maximum tension at the count of 5.
   c. Hold maximum tension and feel the tightness.
   d. RELAX - flow air out. Breathe at a normal rate. Feel the air flowing in and out. Feel your open throat allowing that air to move. Feel the difference between the tight throat and the open throat. Feel the total relaxation.

   Tension Levels:
   1 - awareness of throat and vocal cord area, breathe in 4 - tighten more
   2 - barely hold breath to close vocal cords 5 - maximum tension (tight
   3 - tighten throat throat) then let go and
       breathe normally (open

NOTE:

Level 1 tension is preferred in all areas during rest.

Tension levels necessary during speech and voicing are as follows:
   Jaw - Level 2
   Larynx - Level 2
   Shoulders - Level 1

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APPENDIX III.A

STUTTERING EXPECTATION

1. Unable to predict stuttering and being surprised by its occurrence.
2. Able to predict stuttering, but unable to do anything about it.
3. Able to predict stuttering, and do something to prevent it.
4. Able to predict sounds or words on which stuttering will occur.
5. Able to predict bad stuttering days in advance.
6. Able to feel or hear stuttering as it occurs.
7. Able to see the occurrence of your stuttering in the listener's response.
8. Tend to stutter on first words of utterances.
9. Tend to stutter on first sounds of words. (List)
10. Tend to stutter on longer words. (List)
11. Tend to stutter on short words. (List)
12. Tend to stutter on specific words. (List)
13. Tend to stutter when singing.
14. Tend to stutter when talking or reading out loud to yourself.
15. Fluency leads to stuttering.

\(^1\)Hasbrouck and Lowry-Romero (1983)
APPENDIX III.B
LISTENER'S REACTIONS

1. People making fun by imitating or mocking your stuttering.
2. People asking you about your stuttering.
3. People advising you on how to speak without stuttering.
4. People telling you how to treat stuttering.
5. People joking about your stuttering.
6. People telling you that you can't talk.
7. People telling others that you can't talk.
8. People asking you to repeat because you stutter.
9. People saying things like, "I'm starting to sound like you."
10. People laughing or snickering at your stuttering.
11. People filling-in words or sounds for you.
12. People saying things like, "I don't know what you're talking about," to get you to stop talking.
13. People butting-in while you are talking and not allowing you to finish.
14. People asking you if you are sick or on drugs when you stutter.
15. People acting like you are "putting them on" and asking things like, "Are you for real?"
16. People turning, looking, or walking away when you stutter.
17. People making up excuses to leave when you stutter.
18. People staring or frowning at you when you stutter.
19. People actively avoiding you because you stutter.
20. People being hostile to you or picking on you because you stutter.
21. Teachers or instructors skipping you when it is your turn to read or speak in classes.
22. People not listening to you because you stutter.
23. People's reaching to you when you tell them you have a speech problem.
24. People becoming impatient and trying to rush you.
25. People in a group becoming quiet and all turning to look at you when you speak.
26. People ignoring your response to a question and asking someone else.

1^Hasbrouck and Lowry-Romero (1983)
APPENDIX III.C
PUBLIC SPEAKING

1. Speaking or reading out loud in class or church.
2. Being called on to answer a question in class.
3. Asking a question in class.
4. Teaching a class.
5. Providing a military briefing.
6. Talking to a group of people listening intently.
7. Talking to a promotion board.
8. Speaking to one person.
9. Training a group of peers (OJT).
10. Reading out loud to a group.
11. Socializing with a group of people.
12. Speaking your mind to one person.
13. Speaking your mind among a group of people.
14. Arguing a point with a group of people.
15. Arguing with one person.
16. Answering a question for one person.
17. Answering a question for a group of people.
18. Asking directions.
19. Giving directions to someone.
20. Asking a favor of someone.
21. Talking to friends asking a favor or trying to borrow something.
22. Asking questions of someone.
23. Explaining something to someone.
24. Being asked a question by someone and not knowing the answer.
25. Drilling troops and/or calling cadence.
26. Organizing and directing the activities of a group of people.
27. Being rushed to communicate.

1Hasbrouck and Lowry-Romero (1983)
APPENDIX III.D
PLACING A CALL ON THE TELEPHONE¹

1. Calling a friend.
2. Calling an acquaintance.
3. Calling your family.
4. Calling a person who will be asking you a lot of questions.
5. Placing a long distance call.
6. Calling a stranger to ask for information (airline, busline, store hours)
7. Calling an airline or busline to make a reservation.
8. Calling about house or apartment rentals.
9. Calling your own office or unit.
10. Calling your supervisor.
11. Calling your bank.
12. Calling your insurance company.
13. Calling a car dealer.
14. Calling an auto parts store.
15. Calling a restaurant to make a reservation.
16. Calling a restaurant to place a "take-out" order.
17. Calling a doctor/dentist office.
18. Calling a female/male for a date.
20. Talking to a paging system.
21. Leaving a message with a recording system (phone-mate).
22. Having a stranger answer the phone, unexpectedly.
23. Having someone keep saying "what?" as you try to talk.
24. Having someone hang up on you as you try to talk.
25. Having to read something on the phone.
26. Having people comment on your stuttering while you talk on the phone.
27. Having people act like you are making a crank call.
28. Having other people within listening range as you place a call.
29. Calling a higher ranking officer.
30. Calling a lower ranking person.
31. Using rhythmic motor movements to talk on the phone.
32. Talking too fast when placing a call.

¹Hasbrouck and Lowry-Romero (1983)
APPENDIX III.E

PHYSICAL AND EMOTIONAL STATUS

1. Being excited or happy.
2. Being frustrated.
4. Being mad or angry at yourself.
5. Being mad or angry at someone else.
6. Being anxious, scared, nervous, or tense.
7. Being embarrassed
8. Being well rested.
9. Being physically tired, weak, or ill.
10. Being hot
12. Feeling "dumb."
13. Feeling "inadequate."
15. Being frustrated when you can't say a sound or word.
17. Being "in trouble."
18. Drinking alcohol.
19. Being pressured by events or others.
20. Keeping everything to yourself or not letting your emotions show.

1Hasbrouck and Lowry-Romero (1983)

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APPENDIX III.F
SELF STIMULI FOR STUTTERING

1. Stutter to get out of aversive situations.
2. Stutter to gain or hold listeners' attention.
3. Stutter to gain sympathy or to make people feel sorry for you.
4. Stutter while talking to people of higher rank to make them avoid you.
5. Stutter while in ranks to avoid being questioned or having to give general orders.
6. Stutter to avoid being put in leadership positions or to avoid C.Q.
7. Stutter so that women feel sorry for you.
8. Stutter to intentionally drive people away or to keep them away.
9. Attempt to gain pity from listeners by self reactions to your own stuttering (sighing, swearing, and/or acting disgusted, etc.).
10. Pause in response to a question so that someone else will answer it for you.
11. Thinking about stuttering all the time leads to stuttering.
12. Stuttering leads to stuttering.
13. In thinking about what you are going to say, leaving gaps for stuttering.
15. Work environment causes stuttering.
17. Fluency leads to stuttering.

1Hasbrouck and Lowry-Romero (1983)
APPENDIX III.G

AVOIDANCE AND ESCAPE DEVICES

1. Sound interjections (uh, uh, uh) to avoid stuttering.
2. Word repetitions ("to, to, to") to avoid stuttering.
3. Phrase repetitions ("to avoid, to avoid") to avoid stuttering.
4. Pausing to avoid stuttering.
5. Pausing and lighting a cigarette to avoid stuttering.
6. Pausing and saying something like "you know what I am talking about," to avoid stuttering.
7. Using motor secondary behaviors as starters (eyeblink, head jerk, foot stomp, lip smack, thigh slap, etc., etc.).
8. Speeding up speech rate to avoid stuttering.
9. Slowing down speech rate to avoid stuttering.
10. Speaking in a monotone or in a rhythm, or word by word to avoid stuttering.
11. Speaking on the end of a breath to avoid stuttering.
12. Using word substitutions or circumlocution (talking around difficult words) to avoid stuttering.
13. Using a word or phrase interjections to start a difficult word.
14. Preplanning or rehearsing, word for word, what you are going to say.
15. Spending all day avoiding speaking situations.
16. Using silence to avoid talking.
17. Avoiding social situations.
18. Discouraging friends from visiting you at home.
19. Discouraging your spouses' friends from visiting your spouse at home.
20. Avoiding classroom situations in general.
21. Avoiding meeting new people.
22. Avoiding meeting people you know.
23. Avoiding looking at the person you are talking to.
24. Talking softly to avoid stuttering.
25. Raising or lowering the pitch of your voice to avoid stuttering.

1Hasbrouck and Lowry-Romero (1983)
26. Assuming a different identity or role to avoid stuttering.
27. Failing to finish a word you are stuttering on and moving to the next word.
28. Changing the subject, while talking, to avoid stuttering.
29. Being brief by saying only the most important things and "making a long story short."
30. Not volunteering an answer to a question when you know the answer.
31. Not entering a discussion when you really would like to take part.
32. Failing to voice your opinion whenever you feel strongly about something.
33. Avoiding speaking in situations that don't involve you directly.
34. Avoiding answering a question until in an easier, more relaxed situation.
35. Giving alternative responses to questions in order to hold the floor until you can say the "real" correct answer.
36. Physically walking away from a conversation to escape stuttering.
37. Feigning illness, "I have a sore throat," to avoid talking.
38. Feigning ignorance, "I don't know," to avoid talking.
39. Pointing to a book or diagram rather than talking.
40. Writing something rather than saying it.
41. Writing a note to someone to tell them off or instruct them, then discuss the information with them afterward.
42. In a teaching situation, throwing a question asked of you back to another student in the class.
43. Ordering in a restaurant by pointing to the order on the menu.
44. Ordering in a restaurant by saying a number only or saying "special."
45. Changing your order in a restaurant or bar because you expect to stutter.
46. Saying something like, "I'll have the same," when ordering with someone else in a restaurant or bar.
47. Having someone else order for you in a restaurant or bar.
48. Getting aggressive with a questioner to shut off questions.
49. Continuing to look for something you can't find in a store rather than asking a clerk.
50. Getting others to present lectures, etc., for you rather than doing it yourself.
51. Getting someone to place a phone call for you.
52. Getting someone to answer the phone for you.
APPENDIX III.H

PEOPLE

1. Father
2. Mother
3. Aunts
4. Uncles
5. Grandfathers
6. Grandmothers
7. Brothers
8. Sisters
9. Sons
10. Daughters
11. Mother-in-law
12. Father-in-law
13. Sisters-in-law
14. Brothers-in-law
15. Higher ranking officers
16. Higher ranking NCOs
17. Lower ranking personnel
18. Females
19. Males
20. Strangers
21. Acquaintances
22. Friends
23. Big people
24. Little people
25. Police, military Police (Army), Security Police (Air Force), Shore Patrol (Navy)
26. Someone who acts like he/she knows more than you do
27. Husband/Wife

1 Hasbrouck and Lowry-Romero (1983)
APPENDIX III.I
RECEIVING A CALL ON THE TELEPHONE\(^1\)

1. Hearing the phone ring with no one around.
2. Hearing the phone ring with others present (family, co-workers, strangers).
3. Answering the phone with no one around.
4. Answering the phone with others present (family, co-workers, strangers).
5. Receiving a call from mother or father.
6. Receiving a call from grandmother or grandfather.
7. Receiving a call from brother or sister.
8. Receiving a call from aunt or uncle.
9. Receiving a call from a son or daughter.
10. Receiving a call from mother-in-law or father-in-law.
11. Receiving a call from a sister or brother-in-law.
12. Receiving a call from a friend.
13. Receiving a call from an acquaintance.
14. Receiving a long distance call.
15. Receiving a call from your bank.
16. Receiving a call from your insurance company.
17. Receiving a call from a car dealer.
18. Receiving a call from an auto parts store.
19. Receiving a call from a doctor/dentist's office.
20. Receiving a call from your supervisor.
21. Receiving a call from a higher ranking officer.
22. Receiving a call from a higher ranking NCO.
23. Receiving a call from a lower ranking person.
24. Receiving a call from someone requiring you to read something out loud.
25. Receiving a call from someone asking questions.
26. Hearing someone say something like, "Do you know your name?"
27. Hearing someone say something like, "Have someone pick up the other phone."
28. Using rhythmic motor movements to speak on the phone.
29. Talking too fast when receiving a call.

\(^1\)Hasbrouck and Lowry-Romero (1983)
APPENDIX IV

DIRECTIONS: Avoidance and Escape Devices

Have the patient describe the types of devises he/she uses in each listed category (if appropriate), describe how the device is used, describe when the device is used, describe how he/she feels about having had to use them, and discuss how it feels to talk without using them now that he/she is fluent.

Begin with Item Number 1 and work up to the highest numbered item.

QUESTIONS:

1. Describe how _________________________affects your stuttering.
2. Describe when you used ________________________.
3. How did you feel about doing this?
4. How does it feel not having to do this?

SITUATION GRADIENTS:

1. How does the thought of ______________________affect your stuttering?
2. How does the thought of ______________________ in one hour affect your stuttering?
3. Same as -b, that afternoon.
4. Same as -b, the next day.
5. Same as -b, the next week.

^Hasbrouck and Lowry-Romero (1983)
## APPENDIX V

Comparison of Pre- and Post-Test (30 minute pre-/post-test)

<table>
<thead>
<tr>
<th>Client</th>
<th>Age/Sex</th>
<th># Stat.Wds.</th>
<th>% Stat.Wds.</th>
<th># Dysflu.</th>
<th>% Dysflu.</th>
<th># of Words</th>
<th>Wds.perMin.</th>
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<td>Pre- Post-</td>
<td>Pre- Post-</td>
<td>Pre- Post-</td>
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<td>M.Q.</td>
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## APPENDIX VI

**Follow-up Data (15 Minute Conversation)**

### Follow-up data during first 6 months post-treatment

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### Follow-up data 6-12 months post-treatment

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### Summary
- **Mean #Stutt.** for first 6 months: 2.75
- **Mean #Stutt.** for 6-12 months: 7.85
- **Mean %Stutt.** for first 6 months: 20.75
- **Mean %Stutt.** for 6-12 months: 48.57
- **Mean %Dysfl.** for first 6 months: 1.35
- **Mean %Dysfl.** for 6-12 months: 1.26
APPENDIX VII
Pre- and Post-treatment EMG Readings, Reflective of Tension Levels at the Larynx and Forehead during Three Different Situations

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Each number equals the mean EMG tension level in microvolts for a one-minute recording period. Conversion = spontaneous; reading = Towne Heyer Passage; quiet = quiet, silence.
## APPENDIX VII—Continued

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<th>Conversation</th>
<th>Reading</th>
<th>Quiet</th>
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<td>Pre-test</td>
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<td>Forehead Larynx</td>
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