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ANALYSIS OF THE AIRFLOW PROGRAM RELATIVE TO THE
BEHAVIORAL DIMENSIONS OF STUTTERING

Submitted in partial fulfillment of the requirements
for graduation with honors to the Department of
Communication Arts at Carroll College,
Helena, Montana

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Dimensions of Stuttering

Stuttering is generally considered to consist of three major components: (1) cognitive, (2) emotional, and (3) behavioral (Gronhovd, 1976). Each of these areas appears to be a somewhat specific and independent aspect of stuttering, and, as a consequence, each requires somewhat different strategies for assessment and management.

The cognitive aspect deals with the stutterer's information and attitudes regarding normal speech, normal speakers, fluency, stuttering, and how to deal with communication situations (Gronhovd, 1976). This area also includes the person's awareness of his disfluencies and his consequent conclusions about his adequacy as a speaker and a person. Discussion, counseling, and education comprise the primary strategies for remediation in this area.

The emotional aspect of stuttering includes both the individual's level of general anxiety and the nature and extent of speech-related anxieties. It is important to determine if there is an abnormal amount of general anxiety or if the person feels anxiety primarily in relation to disfluency, words, sounds, and/or speech situations (Brutten
and Shoemaker, 1967, pp. 30-31). Generalized high anxiety suggests a need for the services of a trained psychologist. However, the more common speech-related anxieties can usually be managed by speech pathologists through one of several methods of systematic desensitization.

The behavioral aspect has been traditionally viewed in terms of primary behaviors (repetitions and prolongations) and secondary behaviors (instrumentally-learned escape and avoidance behaviors). However, recent research suggests that a more molecular view of stuttering behavior is necessary (Shames & Sherrick, 1965, pp. 55-56), including specific analysis and management of airflow (Adams, 1974, p. 36), phonetic transition and co-articulation (M. Wingate, 1969, pp. 107-108), and tension (Gronhovd, 1975, p. 6), in addition to the usual elimination of the secondary behaviors. This view suggests that remedial programs aimed at modification of stuttering behavior need to be somewhat more complex and thorough than the currently popular approach of simply reinforcing fluent speech.

**Purpose**

Current research suggests the need for a more detailed approach to the clinical management of stuttering. Thus, it would appear that a correspondingly detailed description of speech processes pertinent to stuttering is essential to the intelligent utilization and understanding of some of the new
and complex stuttering management programs. It is therefore the purpose of this paper to analyze and describe the behaviors typical of stuttering in terms of airflow, phonetic transition, tension, instrumental escape and avoidance behaviors. Secondly, to analyze the limited ability of the airflow therapy program developed by Martin Schwartz (1976) and how it deals with these previously identified problems. And finally, I would like to compare the program developed by Schwartz with other approaches involving linguistic and motor awareness.

Components of Stuttering Behavior

A detailed view of stuttering behavior may include the following categories and subcategories: airflow (subglottic air pressure, glottal resistance, and supraglottic air pressure), phonetic transition, tension, and secondary (instrumental escape and avoidance) behaviors.

Airflow in Normal Speech

**Subglottic air pressure** (respiratory pressure). The source of energy for speech production is the steady stream of air that is forced from the lungs by the muscles of exhalation. Contractions of the intercostal muscles pull the ribs downward, while contractions of the abdominal muscles force the diaphragm upward (Silverstein, 1980, p. 540). Because of this increased pressure, air travels from the tiny alveoli to
the bronchioles of the lungs. Air leaves the lungs through the bronchi which join to form the trachea or "windpipe." The trachea extends up to the larynx which holds the vocal folds. During breathing the vocal folds are kept apart so air can move freely into and out of the lungs. From the larynx the air moves through a muscular tube called the pharynx. The oralpharynx and nasopharynx divide the oral and the nasal cavities. Sound energy can then travel through each cavity independently or both orifices simultaneously. The direction of sound is determined by the position of the velum, or soft palate, which is also referred to as the velopharyngeal closure. When the velum is raised, it closes off the nasal cavity, causing air to pass through the mouth. When the velum is lowered, air passes through the nose, creating nasal sounds (Silverstein, 1980, p. 534).

The approximation of the vocal folds for the production of the vocal tone and the articulation of pressure consonants provides resistance to the flow of air. The manner of articulation tells how the sound is formed and voice describes whether or not the vocal folds are vibrating (Shriberg and Kent, 1982, p. 85).

A stop consonant is formed when the vocal tract is completely closed, so air ceases to flow temporarily, and pressure is built up. When the air is released, there is a short bursting noise called a stop burst (Shriberg and Kent, 1982, pp. 86-87).
Figure 1. Muscles involved in respiration. The left side depicts the rib cage and related muscles. The rib cage is partially removed from the right side to show a lung.

Figure 2. Organs involved in speech.
A fricative is a manner of articulation that is produced when air continuously escapes through a narrow constriction. An affricate is a combination of sounds involving a stop followed by a fricative. Here the velopharynx is completely closed (Shriberg and Kent, 1982, pp. 88-90).

A nasal consonant is produced with an open velopharynx and a complete oral closure as in a stop. The sound energy radiates through the nasal cavities (Shriberg and Kent, 1982, p. 90).

The final manner of articulation I will discuss here is a glide. A glide sound has a slightly narrower vocal tract constriction than for vowels, but not completely closed, as in stops. The articulators glide from a partially constricted state to a more open state (Shriberg and Kent, 1982, p. 90).

The terms voiced and voiceless refer to the vibration of the vocal folds. During a voiced consonant the vocal folds vibrate, whereas production of voiceless consonants causes no vibration. It is possible to feel the folds vibrating during a voiced sound by placing your fingers above your adam's apple.

The respiratory process must involve the generation of adequate pressure below the level of the vocal folds (sub-glottic air pressure) to overcome the glottal resistance provided by the closed vocal folds and exceed the supraglottic air pressure generated by the articulation of pressure consonants (Adams, 1974, p. 37). Prerequisites to the generation
of this pressure include coordination of inspiratory and expiratory activities and adequate breath capacity.

The moving parts which form phones are called articulators. The major articulators humans use are: velum, jaw, tongue, lips, teeth and pharyngeal walls (Shriberg and Kent, 1982, p. 26).

The velum, as stated before, acts like a hinge door directing the flow of air. It is also considered to be an extension of the bony hard palate (Shriberg and Kent, 1982, p. 26).

The jaw or mandible aids the movements of the tongue and lower lip. The jaw can be elevated or lowered depending upon the sound being produced (Shriberg and Kent, 1982, p. 26).

The tongue is a muscular organ which can be divided into five different parts. The body of the tongue is the main bulk. The tip, or apex, is the part you can see protruding between your lips. The blade is located right behind the tip. This is the part that plays a major role in constricting the tongue for such sounds as "sh" in "ship." The dorsum, or back of the tongue, makes contact with the roof of the mouth. It is elevated during such words as "key" and "go." Finally, the root of the tongue extends down, forming the front wall of the pharynx (Shriberg and Kent, 1982, pp. 26-28).

**Glottal resistance** (laryngeal valving). The valving action of the larynx is a function of the adduction and abduction of the vocal folds. Adduction occurs when the folds are
1. Lips (labial)  
2. Teeth (jaw) (dental)  
3. Alveolar ridge (alveolar)  
4. Tongue (lingual)  
5. Hard palate (palatal)  
6. Soft palate (velar)  
7. Uvula (uvular)  
8. Pharynx (pharyngeal)

Figure 3. A schematic sagittal section of the head showing the articulators and places of articulation.

Figure 4. Functional divisions of the tongue: (1) body, (2) tip or apex, (3) blade, (4) dorsum, (5) root.
brought together, whereas they are separated during abduction. During phonation the primary adductive forces are provided by the lateral cricoarytenoid and interarytenoid muscles. Abduction of the vocal folds is primarily a function of the posterior cricoarytenoid muscles. According to Adams (1974, p. 36), during the production of voice the vocal folds must be sufficiently adducted to produce vibration, but not so great as to terminate airflow altogether. In addition, adduction must be properly timed to coincide with breathing patterns and the voicing demands of the individual phonemes being produced.

Supraglottic air pressure (intraoral breath pressure). The production of stops, plosives, fricatives, and affricates requires that the airstream be sufficiently restricted in the oral cavity to produce audible friction. The velopharynx is also closed during production of these sounds so the air within the oral pressure chamber will not escape into the nose (Shriberg and Kent, 1982, p. 87). This restriction results in the buildup of pressure in the oral and pharyngeal cavities (supraglottic area). Although these pressures must be adequate to produce the required sounds, the articulatory contacts must not be so tight that the pressure equals or exceeds subglottic air pressure, resulting in termination of airflow. Adams (1974) summarizes by saying:
Figure 5. Schematic drawing of the larynx - posterior view.
Figure 6. Views of the Cricothyroid Muscle

Posterior Cricothyroid Muscle (adduction)

Lateral Cricothyroid Muscle (adduction)

Interior Cricothyroid Muscle (adduction)
Figure 7. Structures of the supralaryngeal (pharyngeal-oral-nasal) system.
speech fluency depends, at least in part, upon the correct timing and the prompt smooth initiation and maintenance of airflow and glottal vibration. These effects result from the harmonious integrations of subglottic pressure, glottal resistance, and supraglottic pressure. Consequently, any muscle activities that affect these variables in ways that support their coordinations, can be listed among the motor determinants of fluent speech production (pp. 37-38).

Airflow in Stuttered Speech

Subglottic air pressure, glottal resistance, and supraglottic air pressure are variables that must be properly integrated for fluent speech. Conversely, any muscle activities that decrease subglottic pressure, increase glottal resistance, and/or increase supraglottic pressure, may prevent the correct timing and quick initiation and maintenance of airflow (Adams, 1974, p. 38).

Subglottic air pressure (respiratory pressure). If sufficient air pressure builds up in the subglottic area to overcome glottal resistance and supraglottic pressure, airflow will be normal. However, if subglottic pressure is not adequate to overcome glottal resistance and supraglottic pressure, airflow will be limited or nonexistent. Adams (1974, p. 38) suggests five possible respiratory problems observed in stutterers which could result in limited or nonexistent airflow:

1. Fixations, where the passive and active inspiratory and expiratory forces are simultaneously operative and in balance;
2. Mis-timings, where expiration is interrupted by what might be referred to as an inspiratory gasp;

3. Insufficient respiratory activity, which consists of shallow breathing;

4. Asynchronous respiratory movements, where the thorax and abdomen are in opposition to one another;

5. Respiratory tremors, consisting mainly of what could be termed a diaphragmatic flutter (pp. 38-39).

Charles Van Riper (1971) cites several studies which have found that many stutterers show breathing abnormalities. Among them, Schilling (1960, pp. 147-148) found that tremors and irregular clonic movements of the diaphragm occur during both speech and silence periods.

**Glottal resistance** (laryngeal valving). In addition to subglottic air pressure, glottal resistance is a second major factor in airflow for speech production. If excessive glottal resistance exists, a correspondingly sufficient amount of tension must exist in the respiratory system to generate sufficient subglottic pressure to move the air past the point of resistance.

Three laryngeal muscles are of primary importance in laryngeal valving. One abductor muscle (the posterior cricoarytenoid) opens the vocal folds and is opposed to adductor muscles (the lateral cricoarytenoid and the interarytenoids) which close the vocal folds for purposes of phonation. When these adductor muscles tense, they close the vocal folds and resistance to airflow is generated at the glottis. Excessively
tense closure of the vocal folds may cause resistance at the glottis which is sufficient to impede airflow.

Schwartz (1974, pp. 169-172) referred to the core of the stuttering block as an inappropriate vigorous contraction of the posterior cricoarytenoid muscle in response to the subglottal air pressure required for speech. This abduction of the posterior cricoarytenoid requires that the lateral cricoarytenoid and interarytenoid muscles be excessively tensed in order to force the vocal folds together again for purposes of phonation, thus increasing glottal resistance. Freeman and Ushijima (1975, pp. 37-38), using electromyography, found that during disfluency the abductor and adductor laryngeal muscles do not respond in mutual coordination with each other, and that the lateral cricoarytenoid muscle becomes abnormally tense during the moment of stuttering. The electromyograph gives evidence of a defect in transmission at the neuromuscular junction and helps to determine primary muscle disorders. Here the adductor muscle action potential is higher than the abductor muscle potential. This imbalance causes the cricoarytenoid muscle to tense up with the result of stuttering (Luckman and Sorenson, 1980, p. 513). Finally, Conture, McCall, and Brewer (1977, pp. 661-662) demonstrated numerous abnormal laryngeal behaviors during stuttering through the use of fiberoptics and videotape for direct laryngeal observation. To do this, a fiberoptic bronchoscope is inserted into the trachea and broncial tree. This flexible
instrument can be used for diagnostic purposes by visualizing obstructions in the tracheobronchial tree, to obtain a tissue specimen, or to remove a foreign body. Conture, McCall, and Brewer (1977) speculated that the larynx behaves differently during various stutterings with, for example, one type of laryngeal behavior characterizing part-word repetitions and another type typifying sound prolongations (pp. 663-665).

**Supraglottic air pressure** (tight articulatory contacts). The third major factor in the establishment and maintenance of airflow is supraglottic air pressure. Supraglottic air pressure is that which builds up in the oral-pharyngeal cavities due to restriction of the airstream by some of the articulators. The muscles of the head and neck work to move the jaw, tongue, lips, and pharyngeal walls. Some articulators, like the tongue, change in both shape and position; others, like the jaw, change only in position (Shriberg and Kent, 1982, pp. 62-68). However, when articulatory contacts are excessively tight, supraglottic pressure may rise near the level of subglottic pressure, stopping airflow and phonation (Adams, 1974, p. 40). Van Riper (1971) also suggests that this is a frequent occurrence in stutterers which in turn leads to struggle behavior in order to re-establish airflow (pp. 25-26).

In summary, disruptions of respiratory-laryngeal-articulatory functioning may result in difficulty initiating and maintaining airflow for production of speech. Initiation
and maintenance of normal airflow is dependent on subglottic pressure that is more forceful than the glottal resistance and supraglottic pressure that must be overcome.

Phonetic Transition

Wingate (1969) refers to stuttering as a phonetic transition defect. He states, "The term defect is intended at this time to be descriptive rather than necessarily implying some inherent disability. That is, the fluency is defective since it lacks normal transition" (p. 107). Van Riper illustrates this phonetic transition problem as follows:

During prolongation of the /s/ in the words "see" or "Sue" the stutterer may not show the usual preparatory lip postures of the vowels that follow the /s/, as he does when speaking these words normally. Instead he uses the lip posture for the schwa vowel. He produces the natural, isolated /s/, not the allophone for the word he is trying to say. This is doubtless due to the manner in which he perceives the feared word. He may be fearing its initial sound, the isolated /s/, the "suh" or "sss" sound. Or some of his difficulty may occur because he begins his utterance with a totally inappropriate sound. The prevalence of the schwa vowel in the repetitive abortive releases is another indication of this behavior. The advanced stutterer seldom says "mmmo... mmno... motor." He says "mmuh... mmuh..." And when he says "vvvvvvvvvvery" or "aaaaaaaaapple" the /v/ or the /ae/ are produced differently and have a different spectrographic pattern than when he says the /v/ or /ae/ of "very" or "apple" normally. He seems to be searching and hunting for the appropriate transitions he needs (Van Riper, 1971, pp. 136-137).
Tension

Tension, although widely recognized as a problem in stuttering, is rarely described in detail and only occasionally dealt with directly in therapy (Gronhovd, 1976). The previously mentioned breathing problems (especially shallow clavical breathing) cause considerable tension in the muscles of exhalation. Because the breath supply is small, the exhalatory muscles must contract abnormally hard to raise subglottic pressure, especially if the latter two are abnormally high. These latter two factors are also tension-related in that excessive glottal resistance is a result of highly-tensed laryngeal adductors, and excessive supraglottic pressure results from tight or tense articulatory contacts. In summary, much of the airflow problem can be described in terms of one single variable: tension.

It is also noteworthy that the major target of the therapy program developed by Schwartz (1976) emphasizes teaching relaxed initiation of phonation rather than the hard or tense glottal attack that is frequently noted in stutterers.

Secondary (Instrumental Escape and Avoidance) Behaviors

As the stutterer experiences a moment of stuttering, he may use particular escape and/or avoidance behaviors such as facial grimaces, body contortions, or other abnormal behaviors. These are voluntary behaviors used as distraction devices to terminate the moment of stuttering, and are learned by the
stutterer because they have coincided with release from a block. Van Riper (1971) states:

If, for example, a stutterer jerked his head and if, just as he did so, he also said the word on which he had been stuttering, the utterance itself would reinforce the head jerk. At that moment, there would be some relief from specific anxiety or at least from frustration. What is more important, the head jerk would be followed by communication. He could continue. The head jerk also terminates any phonemic, word, or situation fear. All these events are powerfully rewarding. These behaviors are difficult to unlearn and become more so as they are practiced (p. 130).

One of the primary problems encountered by the stutterer is the short-term usefulness of these escape and avoidance behaviors. After only a few instances of use, each of these behaviors becomes automatic, losing its distraction (and therefore fluency-generating) qualities, and the stutterer has then habituated a bizarre behavior that no longer helps him stay fluent.

Examples of secondary behaviors commonly used by the stutterer are: finger snapping, head jerking, eye blinking, and toe tapping. Termination of these and other secondary behaviors is usually an early goal in the remediation program and can be accomplished in most cases through operant conditioning.
Summary

The foregoing information suggests that breathing, laryngeal valving, articulation of pressure consonants (stops and fricatives), phonetic transition, tension level in the speech mechanism, and escape and avoidance behaviors are all potential problem areas for the stutterer. Therefore, it would seem that remedial programs ought to account for all of these variables in their goals and/or procedures. It is the intent of the following chapter to determine to what extent the program of Schwartz (1976) accounts for these variables.
CHAPTER 2
AIRWAY PROGRAM

Introduction and Purpose

The previous chapter identified a number of specific problems in the areas of airflow, phonetic transition, tension, and escape and avoidance behaviors which current research strongly suggests are characteristic of most stutterers. It would therefore seem that therapy programs ought to incorporate specific procedures designed to cope with as many of these problems as possible. It is the intent of this chapter to analyze the ability of a currently popular program developed by Schwartz in 1976.

Overview of the Airway Program

Airway Dilation Reflex (ADR)

Schwartz's airflow program is based on the assumption that stuttering is due to abnormal vigorous dilation of the airway which interrupts airflow during exhalation for speech (Schwartz, 1974). The complete reflex consists of "...flaring nostrils, opening of the mouth, straightening of the spine, contractions of part of the genioglossal muscle bringing the body of the tongue forward, dilation of the pharynx, and abduction of the vocal folds" (p. 171). The
genioglossus is one of the intrinsic muscles of the tongue. It spreads out to insert along the entire upper surface of the tongue. When it is constricted, the entire length of the tongue is pulled downward and forward, producing a concave channel in the center (Silverstein, 1980, p. 192). The reflex straightens and opens the airway as a central nervous system response to increased subglottic pressure, a condition that the nervous system interprets as life-threatening (chooking).

The ADR is triggered when certain children attempt to speak under stressful conditions. Speech requires subglottic pressure. Thus, when a child is under stress, his reflex centers may misinterpret the buildup of air pressure as a life-threatening situation. The reflex is triggered, the vocal folds open wide, and the child becomes temporarily speechless. In response to the ADR, the child learns to bring the vocal folds tightly back together, which is called a conditioned laryngospasm. This laryngospasm is considered by Schwartz to be the primary or core behavior in stuttering.

Stress

Stuttering, according to Schwartz, in adults is a physical response that occurs as a result of learned emotional responses to stress. Schwartz (1976) refers to what he considers to be the stutterer's seven basic stresses:
1. **Situation stress:** anxiety associated with certain situations (example: speaking on the telephone);

2. **Word or sound stress:** anxiety associated with sounds or words;

3. **Authority figure stress:** anxiety associated with particularly significant people;

4. **Stress of uncertainty:** anxiety associated with uncertainty about the proper way to behave in unfamiliar situations (example: new job, meeting new friends);

5. **Physical stress:** speaking when tired or ill;

6. **External stress:** anxiety stemming from immediate problems (example: fired from job, terminal illness);

7. **Speed stress:** situations in which the stutterer feels compelled to communicate quickly and efficiently (example: ordering in a restaurant) (pp. 48-55).

In addition, he refers to baseline stress as the amount of tension in the muscles of the body at any one moment. When baseline stress is high, the vocal folds show a high level of tension. Fluctuations in baseline stress may account for fluctuations in fluency and nonfluency. The greater the stress, the tighter the vocal folds will tend to close during the conditioned laryngospasm (Schwartz, 1976, pp. 56-58).

**Treatment**

The following overview of Schwartz's airflow program involves two adult stutterers involved in a five-day, forty-hour intensive therapy program. The program began in a structured setting with a preview of what the next five days would include. The clinician explained to the patients that
they would learn about the speaking mechanism, what causes stuttering, and how to use the airflow technique to speak fluently (Schwartz, 1976, p. 92).

The first day of therapy consisted of obtaining a case history from both patients, a brief explanation of the speaking mechanism (supplemented by a handout illustrating the parts contributing to the speaking process), and how the vocal folds lock together when stuttering occurs. The explanation was followed by an introduction to the key technique (airflow) for the management of the laryngospasm. The clinician explained that the airflow is begun as an audible sigh which releases the vocal folds from the laryngospasm. The isolated airflow was modeled by the clinician several times before the patients were instructed to try an audible sigh. Each patient was instructed to try taking a deep breath and slowly exhale the air in an audible manner. The flow was practiced by each patient until the clinician subjectively perceived adequacy of production (Schwartz, 1976, p. 97).

The patients were then instructed to use the airflow prior to production of one-syllable words. The practice of the airflow progressed from this isolated sound-syllable production to reading and conversation. Each new level of difficulty consisted of the clinician first modeling the airflow, followed by the patient's attempted production. Following practice using the airflow in various word patterns, the clinician described problems that may follow the week of
intensive therapy. The seven basic stresses (previously listed) and the five misuses of airflow (characteristics which provoke the reappearance of stuttering) were explained. Schwartz (1976, pp. 86-88) describes these misuses as follows:

1. Pushing the flow. Under conditions of stress, patients tended to push the flow, which frequently led to a laryngospasm and a subsequent stutter.

2. A failure of transition. Another source of trouble was the lack of a smooth flow into the first sounds the patients wished to say. The flow stopped short, with a slight pause between the end of the flow and the beginning of the sound. This pause provided all the time necessary for the occurrence of a laryngospasm.

3. A failure of intent. Patients often are so preoccupied with the upcoming sound that their mouths are formed into position for that sound at the beginning of the airflow. Thus, the flow of air is affected by the anticipated sound, and one of the effects can be a tensing of the vocal cords, a tensing that leads to laryngospasm.

4. Holding the flow. One patient, in an effort to time the flows properly, would inhale and hold the air by closing his vocal cords, and then start the airflow at the appropriate time by releasing his cords. If he attempted to do this under conditions of stress, the hold would be transformed into a locking of his vocal cords and he would stutter.

5. Omitting the flow. This usually occurs because of distraction and rarely because of stress, and becomes less and less of a problem as the patient continues to practice and gets into what I call a "flow groove." Omitting the flow, while quite common at the very beginning of therapy, is relatively rare after the first week.

The first day of therapy ended with assignments for the patients to say fifty phrases using the airflow technique.
The second, third, and fourth days of therapy included practicing the airflow technique in conversation and reading. Telephone situations, debates, and role playing were set up by the clinician to enable the patients to practice the airflow under various stress conditions. Unlike so many other skills, in which practice improves performance, thus sustaining motivation, practice for stutterers serves to strengthen already-developed fluency, decreasing the chance of its disintegrating under stress (Schwartz, 1976, p. 104).

On the final day of therapy, a new clinician worked with the patients on spontaneous speaking situations such as telephone conversations and word games. The airflow technique continued to receive primary emphasis and the clinician subjectively monitored the patients' speech. The last few hours of treatment in the afternoon consisted of "pep" talks by the clinician who had previously worked with the patients. The "pep" talks included a discussion of motivation methods that may be used to encourage consistent airflow usage after returning home. In addition, the clinician explained the importance of altering self-concept on the conscious and subconscious levels. The patients were told that most stutterers have a subconscious self-concept as that of being a stutterer, and until the subconscious intent is altered, the conscious attempts at behavior change cannot effectively alter the stuttering habit. Finally, the clinician explained that each week the patients were to record ten minutes of their speech
on a cassette tape and send it to the Hearing and Speech Center. The clinician would listen to the tape, record any comments or instructions, and send the tape back to the patient. The clinician encouraged the patients to call the center any time a problem occurred in using the airflow (Schwartz, 1976, pp. 118-119).

Schwartz stresses that the presence of fluency does not imply a cure: "A cure exists only in the mind of the speaker, not in the ears of a listener. . . . A patient was cured, not when he didn't stutter, but when he remembered that he used to think of himself as a stutterer" (Schwartz, 1976, p. 104). A total cure will take years of practice and work because fears die slowly. Very often, though, by the end of the one week of intensive therapy, the patients are virtually symptom-free. The data show that out of 185 patients, 89 percent of them were completely symptom-free (Schwartz, 1976, p. 93).

Analysis of the Airflow Program Relative to Airflow, Phonetic Transition, Tension, and Secondary Behaviors

The four previously discussed major components of stuttering behavior include airflow (subglottic air pressure, glottal resistance, and supraglottic air pressure), phonetic transition, tension, and secondary (instrumental escape and avoidance) behaviors. It would seem important that any stuttering management program should include methods of treatment
designed to deal with as many of these components of stuttering behavior as possible. The following is an attempt to determine the degree to which Schwartz's airflow program attempts to deal with each of these components.

Airflow

Sufficient subglottic air pressure (respiratory pressure) must be generated below the level of the vocal folds to overcome glottal resistance and supraglottic air pressure. The airflow program attempts to deal with subglottic air pressure only in that a full breath is a specific target along with sigh production prior to speaking. This presumably would eliminate shallow breathing in most stutterers. However, the other potential breathing problems as mentioned in the first chapter are not dealt with (fixations, mistimings, asynchronous respiratory movements, respiratory tremors) (Schwartz, 1976, pp. 84-85).

Glottal resistance (laryngeal valving) during the production of voice must be sufficient to produce the vocal fold vibration, but not so great as to terminate airflow altogether. The sigh production in the airflow program encourages both soft glottal attack and relaxed phonation on the first syllable of each breath group. Since most stuttering occurs on the first sound of a breath group, it would appear that this aspect of the program would probably eliminate most moments of stuttering. However, glottal resistance problems occurring
beyond the first syllable must be dealt with on a chance basis by the stutterer, since no measures are incorporated to insure relaxed phonation beyond the first syllable.

Supraglottic air pressure (tight articulatory contacts) is the air pressure that builds up in the oral and pharyngeal cavities due to restriction of the airstream by the articulators. If articulatory contacts are excessively tight, supraglottic pressure may equal or exceed subglottic pressure and stop airflow. The airflow program does not attempt to deal with any of these contacts above the level of the larynx.

Phonetic Transition

Normal movement from phoneme to phoneme is an essential aspect of fluent speech, and it is frequently seen to be defective in stutterers. Perkins (1973) suggests that syllable prolongation may be the most effective method for dealing with these phonetic transition problems. Since the airflow program requires syllable prolongation only on the first syllable, and since Schwartz advocates no other techniques (such as syllable prolongation throughout the utterance) for phonetic transition problems, it must be assumed that the program makes no real attempt to deal with this aspect of the problem (p. 286).
Tension

Tension is inherent in some of the previously described problems, airflow in particular. Breathing problems (especially shallow clavical breathing) generate thoracic and abdominal tension. Excessive glottal resistance is the direct result of tense vocal fold adduction, and excessive supra-glottic pressure is a function of tense articulatory contacts. Since the airflow program involves a full breath target and relaxed initiation of phonation, tension in the breathing mechanism is reduced and laryngeal relaxation on the first phoneme is encouraged. Beyond this, no substantial attempt is made to deal with tension.

Secondary Behaviors

Secondary (instrumental escape and avoidance) behaviors are used as distractional devices to terminate the moment of stuttering. Schwartz makes no attempt to deal directly with secondary behaviors, since he is of the opinion that the correct use of the airflow technique will eliminate stuttering and therefore there will be no reason for secondary behaviors.

Summary

Schwartz's airflow program has been analyzed in terms of airflow, phonetic transition, tension, and secondary behaviors which appear to be the behavioral problems that typically exist in stuttering. Schwartz's airflow program is based on the
assumption that stuttering is a conditioned laryngospasm in response to the airway dilation reflex. This assumption generates therapy dealing primarily with problems involving laryngeal valving and processes fundamental to adequate breath pressure. However, as previously discussed, glottal resistance problems occurring after the first syllable are not directly dealt with. Furthermore, the program attempts to deal with only one of the potential breathing problems (shallow breathing) that stutterers may experience. No attempts are made to deal with tight articulatory contacts, phonetic transition problems, tension (beyond that encouraged by the use of a full breath target and relaxed initiation of phonation), or secondary behaviors. On this basis it seems to be appropriate to view this approach as a limited program for stutterers with only those problems that the program can deal with, or as a useful technique that may be profitably incorporated into broader-based therapy programs. It should probably not, however, be considered a primary, comprehensive approach to the remediation of stuttering that is appropriate for all or most stutterers.
CHAPTER 3
A COMBINED APPROACH TO STUTTERING THERAPY

Schwartz's model of stuttering as a learned extricatory response to a laryngeal abductor reflex has focused important attention on laryngeal behavior prior to speaking. Moreover, it leads one to suspect that voicing is the speech activity most likely to go awry in stuttering. In this chapter I hope to show that the airflow program developed by Martin Schwartz is extremely limited yet when accompanied with other related programs can be valuable.

**Stuttering Therapy Approaches Involving Linguistic and Motor Awareness**

The following is a brief overview of some of the current therapy programs in which the stutterer becomes aware of the linguistic and motor aspects of speaking. The chosen programs do not involve the addition of unusual stimulation such as rhythm during speech.

**Proprioceptive Awareness** (Van Riper)

Van Riper's well known approach to stuttering therapy involves four stages: identification, desensitization, modification, and stabilization. His goal is "fluent stuttering" (Van Riper, 1973, p. 231).
The aspect of his treatment singled out most is "proprioceptive awareness." Proprioceptive awareness is primarily involved in his modification stage and to a small extent in his stabilization stage. After the stutterer is able to understand and describe his stuttering (identification), and is able to stutter openly (desensitization), then he must work on modifying it. Through "cancellation," the stutterer is taught to modify his stuttering after it occurs. In cancellation, he learns to feel the excessive tension, abnormal postures, and inappropriate movements and then try the word again while concentrating on these motor features. Next, the stutterer learns to modify his stuttering as it occurs with the "pull-out." The pull-out involves changing the stuttering response in gradual approximation to the appropriate speech targets, then consciously and deliberately pulling out of the stuttering response to fluent speech. Finally, the "preparatory set" is taught in order to modify stuttering before it occurs. Here, the stutterer learns to identify subtle tactile and proprioceptive cues prior to stuttering and to modify them before attempting the feared word. The speech which results is deliberate, slightly slowed, and limited in stress and intonation variations. It is critical that the stutterer keep the "motor model" of what he intends to say in mind while utilizing a high degree of proprioceptive awareness during his ongoing speech as he uses the preparatory set (Van Riper, 1937, pp. 149-151).
During stabilization, the stutterer is taught consciously to shift his attention to fluency instead of stuttering. This can only be attained through a great deal of oral speaking. The stutterer will soon notice his speech has "smoothed out" (Van Riper, 1973, p. 351).

**BRAT (Gronhovd)**

BRAT stands for breathing, rate, airflow, and tension. These are the four main target areas in Gronhovd's "molecular approach." The BRAT technique works along with anxiety desensitization techniques with the addition of transfer and maintenance programs. The most predominant areas stutterers have difficulties with are respiratory patterns, pauses, rate, voice onset, intraoral air pressure, and tension.

In the initial step of this program, the stutterer is taught deep muscle relaxation in a supine position. Following this he makes unvocalized, then vocalized sighs. He then counts up to four digits trying to maintain (1) smooth, easy exhalations; (2) a slow rate; (3) uninterrupted airflow; (4) no excessive tension; (5) a soft glottal attack with a breathy voice; and (6) automatic production (Gronhovd, 1977, pp. 1-3).

Using the same or similar techniques, the stutterer then answers simple questions and speaks in short, then longer, monologues, still lying in the supine position. Propositional speech activities are next repeated in a semi-reclined position
and subsequently in a sitting position. Speaking rate is increased from one to two syllables per second as the stutterer orally paraphrases silently-read material and engages in conversation. Finally, rate, voice quality, intensity, intonation, rhythm, and phrasing are "normalized" to produce "an easy, relaxed, expressive, unmonotonous vocal quality and rate" (Gronhovd, 1977, p. 2).

Summary

In Schwartz's book, Stuttering Solved, he describes his airflow therapy as "a revolutionary new treatment." He reported successful treatment rates of 89 percent of his patients. This airflow technique is based on the assumption that passive airflow is incompatible with the conditions which evoke laryngospasm, such as increased subglottal air pressure. The stutterer is taught to inhale, to relax, to begin to exhale passively, and, only when passive airflow is established, to begin to speak.

This therapy program is limited to stutterers having airflow disruptions only in the initial syllable. I feel that by combining Gronhovd's technique along with Schwartz's the stutterer would be taught to relax his entire utterance—not just his first word.

I also feel that an additional improvement to Schwartz's airflow program would be to include Van Riper's Proprioceptive Awareness approach. By doing this, the stutterer is learning
a more overall approach to monitoring his behavior. He not only will learn to identify and accept his stuttering, but he also learns to monitor excessive glottal tension within himself. He then, with the proper motivation, will be able to overcome the tension and partake in an overall, relaxed speaking situation.

The following table compares these three approaches according to various linguistic and motor targets of awareness. Each approach taken in isolation is limited and neglects an average of four target areas. When combined, all areas are covered, giving the patient an overall therapy program.
CONCLUSION

In this paper I have attempted to give an overview of the typical behaviors of stuttering in terms of airflow, phonetic transition, tension, instrumental escape and avoidance behaviors. I have also analyzed the limited ability of the airflow therapy developed by Martin Schwartz. Finally, I have attempted to review an overall, combined treatment program for stutterers by showing how the linguistic and motor determinants should be considered together.

I feel that research in the area of stuttering in the next several years will focus heavily on linguistic and motor variables. But, regardless of what therapy program(s) is used, the ultimate goal is fluency; and as Schwartz stresses: "A cure exists only in the mind of the speaker, not in the ears of a listener. . . . A patient was cured, not when he didn't stutter, but when he remembered that he used to think of himself as a stutterer" (Schwartz, 1976, p. 104).
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