THE EFFECT OF MOTOR SPEECH AWARENESS ON STUTTERING

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ABSTRACT

Four adult stutterers underwent five treatment conditions individually in the same order. After average stuttering frequency during spontaneous speech was established in baserate, two control conditions followed. The first showed the effects of interrupting the subject at frequent, unpredictable, five-second intervals. The second showed the effects of training the subject to analyze the initial phonemes of words according to three "motor" features. In the experimental or motor awareness condition, the subject was interrupted as before, but was required to analyze the initial phoneme of the **next** *word he was about to say by pressing buttons on a panel before he could resume talking. Finally, an extinction condition was run to determine the permanence of any experimentally-produced effects. Two of the four stutterers reduced in percent words stuttered during the motor awareness condition and one when simply being trained to do so. Experimental procedures had little or no effect on the speech of one subject.*

In the past, many speech clinicans have reported the efficacy of techniques designed to focus the stutterer's awareness on the act of speaking. In these treatments, the stutterer is supposed to become consciously aware of how his articulators move normally, of what his speech attempt should produce in terms of sensory feedback, or of some other aspects of speech production (e.g. Gifford, 1956; Swift, 1943; Agnello, 1972; Neely, 1972). As early as 1937, Van Riper advanced the concept that the stuttering block is determined in large part by the stutterer's "preparatory set [1]" to stutter. As a result of abnormal preparatory sets, the stutterer speaks in an abnormal way. In much of his writing on stuttering therapy, Van Riper argues that when the stutterer is taught to modify his preparatory set — that is, to rehearse for less tense and less abnormal stuttering — the stuttering which follows will be so modified.

Recently, several new approaches to stuttering therapy have been advanced which require motor speech awareness. Most prominent among these approaches are: precision fluency shaping (Webster, 1974), personalized fluency control therapy (Cooper, 1976), practice in prosodic patterns (Wingate, 1976), and muscle biofeedback (Hanna, Wilfling, and McNeill, 1975; Guitar, 1975; Lanyon, Barrington, and Newman, 1976; Cross, 1977; and Moore, 1977).

The only research which compared motor awareness treatments with other stuttering therapy techniques was done by Frick in 1965. He compared one group of stutterers treated with "motor planning" techniques and conventional techniques with a control group treated by conventional means alone. In spite of the fact that both groups began and ended with similar, nonsignificant severity ratings, Frick concluded that motor planning techniques were superior to conventional techniques. Owing to problems such as these in experimental design, statistical analysis, and interpretation of the results, Frick's conclusion cannot be unequivocally accepted.

In light of the continued prevalance of clinical techniques advocating motor speech awareness and the relative pausity of definitive data regarding its efficacy, the need exists for further objective data relating to the awareness question. Therefore, the present study was undertaken to test the hypothesis that stuttering frequency will be reduced when stutterers are obliged to become aware of motor aspects of speaking. For the present investigation, requiring stutterers to analyze word-initial phonemes according to "motor" features of voice, manner, and place of articulation at frequent, unpredictable intervals prior to saying the words was the operational definition of motor speech awareness. Under these conditions, it was hypothesized that stuttering frequency would be reduced.

[1]Van Riper's original use of the term "preparatory set" is considerably different than his present clinical technique of preparatory set used in conjunction with cancellation and pull-out (Van Riper, 1973).

METHOD

The subjects used in this study were four male adult stutterers. All four were 18 to 20 year old college students who were paid for each session completed. For inclusion in the study, each subject was required to emit stutterings on at least five percent of the total words uttered in the first three baserate sessions. The four stutterers were run individually for 17 to 24 fifty-minute sessions. They underwent five experimental treatments in the same order.

The experimental environment was identical for all sessions. Each subject was seated at a table in the experimental room. He faced a one-way mirror through which the experimenter could observe him from the adjacent control room. Before each session began, the subject was instructed to talk about any topic he pleased and to continue talking until told to stop. A stack of cards, each containing a single printed noun, was provided to remind him of speaking topics.

A panel containing three pairs of buttons with adjacent printed labels and a small red light was always located in front of the subject. From top to bottom, the buttons were labeled; VOICING: Present, Absent; INITIATION: Explosive, Smooth; and TONGUE-TIP CONTACT: Present, Absent. A microphone was suspended in front of the subject to tape record sessions.

Figure 1. Experimental apparatus.

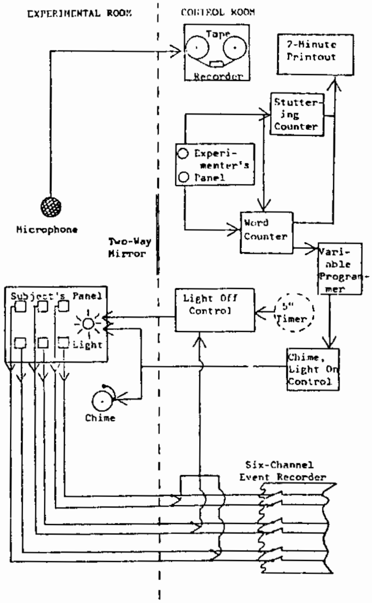

Figure 1 presents a schematic diagram of the experimental apparatus. As the subject spoke, the experimenter counted each word by pressing one of two buttons on a counting panel. Similarly, he counted each "moment of stuttering" by pressing the other button. Counts on the word button were tallied automatically by means of a Grason-Stadler 1200 series logic system. Counts on the stuttering button were tallied on a "word counter" and a separate "stuttering counter". Both counters were automatically printed and reset to zero after each two-minute interval.

The first condition was Baserate (BR) in which the subject was simply instructed to talk. The purpose of baserate was to obtain a measure of the subject's average frequency of stuttering in the experimental environment.

In the second condition, Light Alone Before Training (LABT), the light on the subject's panel was intermittently switched on for five second intervals according to a frequent, unpredictable schedule. The subject was instructed to stop talking immediately whenever the light and a simultaneous door chime were activated and to remain silent for the sive seconds the light was illuminated. Immediately after the light was switched off, he was told to resume talking just where he was interrupted without repeating any previous words.

After the last session of this condition, and before the first session of the next condition, each subject was trained to analyze word-initial phonemes according to three motor features, which were labeled on the response panel: presence or absence of VOICING, explosive or smooth sound INITIATION, and presence or absence of TONGUE-TIP CONTACT. For example, correct responses for the initial phoneme /t/ of the word "time" would be VOICING: absent, INITIATION: explosive, and TONGUE-TIP CONTACT: Present. Training was continued until the subject analyzed phonemes with at least 80% accuracy for each feature.

The Light Alone After Training Condition (LAAT) was identical to: LABT. Its purpose was to assess the effects of the initial training period on stuttering frequency which had otherwise become stable.

The experimental apparatus in LABT and LAAT operated in the following manner. Each pulse to the "word counter" simultaneously delivered a pulse to a variable-ratio programmer. This device was programmed to activate simultaneously switches that illuminated the red light on the subject's response panel and sounded a chime also located in the experimental room. The variable-ratio programmer was itself activated, on the average, after every fifteen words. That is, it switched on the light and chime after 7, 11, 15, 19, or 23 words were counted. One of these five totals was randomly generated before each word count began. The subject's red light remained illuminated until it was turned off automatically by a five-second timer. During the Motor Awareness Condition (MA) which followed LAAT, the light was activated exactly as in the previous condition but was switched off by the subject's third button press. After being interrupted by the light and chime, he was instructed to analyze the first sound of the **next** word he was about to say and to say it immediately after he analyzed the sound. In this condition, three button-presses comprised one complete response, and the first button-press in the third row extinguished the light. Also, each time any button was pressed, an impulse was delivered to that button's corresponding pen on a six-channel event recorder located in the control room. From the output of the event recorder, all of the subject's button responses could be monitored for accuracy. This procedure comprised the operational definition of motor speech awareness used in this study. For any session in which the subject's accuracy of responding dropped below 80% for any feature, he was retrained prior to entering the next motor awareness session.

Each session was tape recorded on an Ampex AG 440 tape deck. A pure-tone of short duration was recorded at the end of each two-minute interval. These tones were later used to dub and score tape samples for reliability purposes.

Criteria for stability

A minimum number of sessions for each condition was established prior to running Subject 1. Further criteria were not specified in numerical terms; rather, the stability criterion outlined by Martin, Haroldson, and Starr (1971) with respect to single-subject research in stuttering was adopted. So long as the number of words, number of stutterings, or percent of words stuttered was not systematically increasing or decreasing, the next condition was introduced. For the remaining three subjects, the minimum number of sessions remained the same as for Subject 1. However, stability criteria were more objectively specified. When the minimum number of sessions for any condition was completed, that condition was terminated if two stability criteria were met. First, in all conditions requiring three or more sessions (all except LAAT) the mean percent stuttering for each of the last three sessions could not be progressively increasing or decreasing. Second, the first criterion being met, the mean of the last session could not be 15% larger or 15% smaller than the mean of all previous sessions within that condition. In LAAT, the second session could not be larger or smaller than the first session by 15%. In the event that both additional criteria were not met for the last session of any condition, additional sessions were run until the criteria were met.

RESULTS

Subject 1

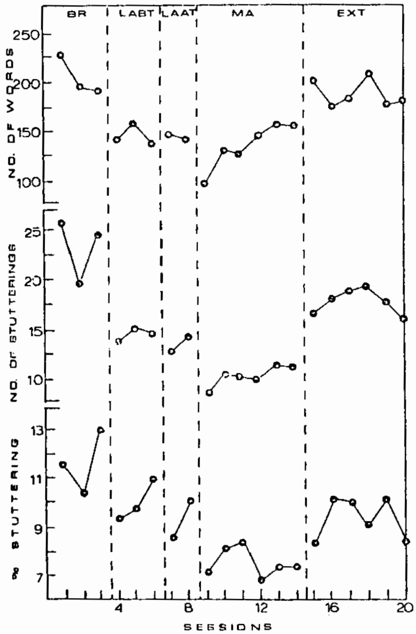

Figure 2. Average number of words, stutterings, and percent words stuttered each two minutes by Subject 1 in Baserate (BR), Light Alone Before Training (LABT), Light Alone After Training (LAAT), Motor Awareness (MA), and Extinction (EXT) sessions.

Figure 2 shows the data for Subject 1. The horizontal axis indicates the number of sessions. The vertical axis is divided into three parts. The upper and middle sections show the mean numbers of words and stutterings for each session; the lower section represents the mean number of words. This measure permits the comparison of stuttering frequencies across sessions on which the number of words varies.

In BR for Subject 1, the number of words decreased and the number of stutterings decreased, then increased. Percent stuttering did not appear to change in any systematic way for the three sessions in this condition.

As can be noted in Figure 2, Subject 1 emitted fewer words and stutterings in LABT than in BR. Obviously, total speaking time must be reduced in this condition as a result of the frequent five-second intervals of silence. Nevertheless, percent stuttering also decreased for Subject 1. After training to analyze motor features was completed, words, stutterings, and percent stuttering changed very little in LAAT; hence, the training had little or no effect.

Words and stutterings for Subject 1 reduced markedly in the MA session. Both measures recovered by the last MA session, but words recovered more than stutterings. The result of this interaction was that percent stuttering remained at low levels throughout the condition.

The last condition, EXT, was identical to BR. Its purpose was to test the permanence of any experimentally-produced effects.

As can be seen for Subject 1, words and stutterings increased such that percent stuttering reached approximately the level observed in LAAT.

Subject 2

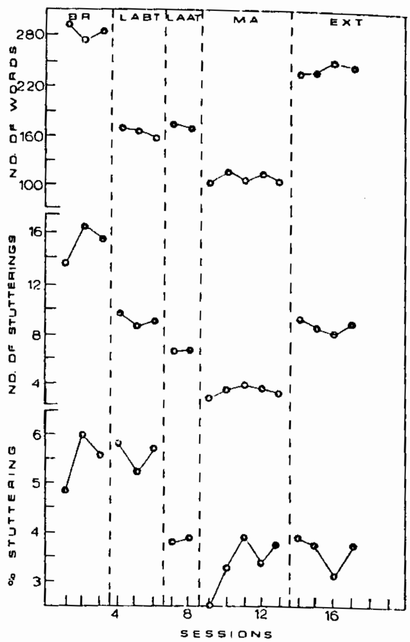

Figure 3. Averge number of words, stutterings, and percent words stuttered each two minutes by Subject 2 in Baserate (BR), Light Alone Before Training (LABT), Light Alone After Training (LAAT), Motor Awareness (MA), and Extinction (EXT) sessions.

The data for Subject 2 are shown in figure 3. Percent stuttering levels for BR are about equal to percent stuttering levels in LABT. This suggests that the reductions on words and stutterings from BR to LABT were the result of the imposed intervals of silence.

After initial training to respond to motor features, however, percent stuttering for Subject 2 decreased markedly, the joint effects of increased words and decreased stutterings. This result was unexpected since the training only involved responding to word-initial phonemes of words presented auditorily for analysis. No indication was given that the subject should apply the training to his own speech.

Except for an additional further reduction in the first MA session, precent stuttering did not change consistently for Subject 2 throughout the remainder of the experiment.

Subject 3

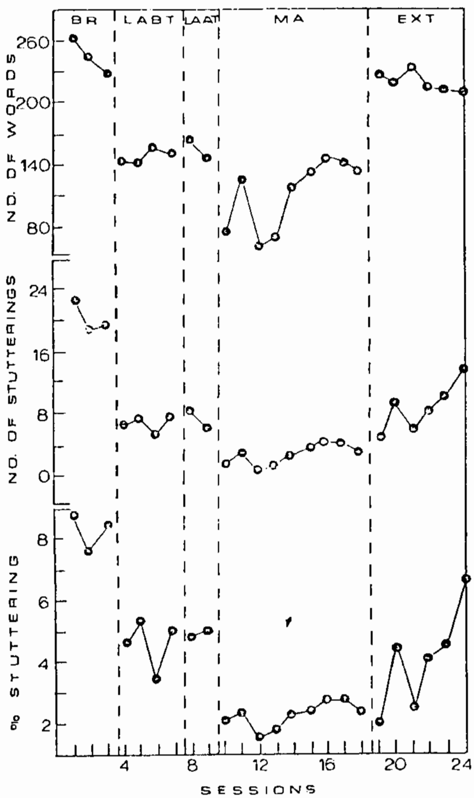

Figure 4. Averge number of words, stutterings, and percent words stuttered each two minutes by Subject 3 in Baserate (BR), Light Alone Before Training (LABT), Light Alone After Training (LAAT), Motor Awareness (MA), and Extinction (EXT) sessions.

Figure 4 shows the data for Subject 3 and is quite similar to the profile observed for Subject 1. Words, stutterings, and, notably, percent stuttering, decreased in both LABT and LAAT compared with BR levels. Furthermore, little difference between LABT and LAAT indicates that initial training alone had no significant effect on stuttering frequency. In MA, percent stuttering reduced further. This was the result of a proportionally greater reduction in stutterings than in words.

In EXT, stutterings and percent stuttering progressively recovered to near BR levels. Subject 3 withdrew from the study after Session 24; thus, percent stuttering was not operationally stable.

Subject 4

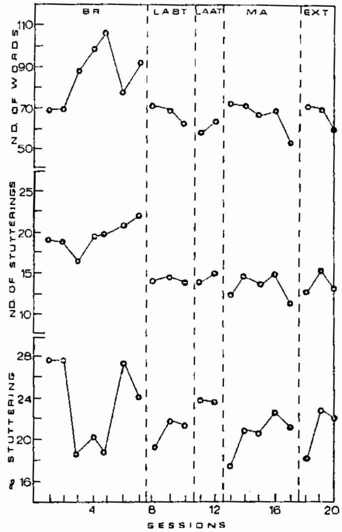

Figure 5. Average number of words, stutterings, and percent words stuttered each two minutes by Subject 4 in Baserate (BR), Light Alone Before Training (LABT), Light Alone After Training (LAAT), Motor Awareness (MA), and Extinction (EXT) sessions.

Figure 5 shows the data for Subject 4. Percent stuttering was extremely variable for this subject during BR. He subsequently made no consistent changes in percent stuttering throughout the experiment.

Accuracy of Analyzing Motor Features

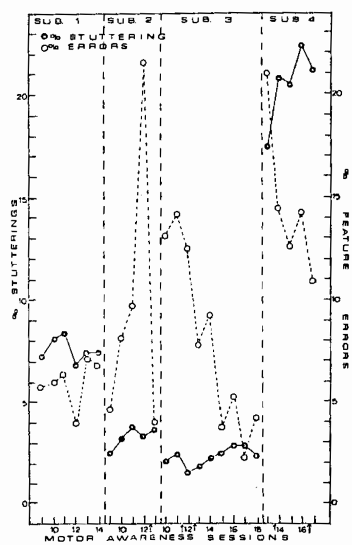

Figure 6. Comparison of percent stuttering (left ordinate) and percent errors in responses to the three motor features (right ordinate) for Motor Awareness (MA) sessions of four stutterers.

To determine the extent to which stuttering and motor feature errors covaried, percent stuttering and percent feature errors for each MA session were plotted on the same coordinates in Figure 6 for all four stutterers Accuracy of responding and stuttering behavior appear to be related to a limited degree for Subject 1. The apparent correspondence of the curves suggests that the effects of motor awareness on stuttering for Subject 1 were enhanced by accuracy of such awareness. On the contrary, no relationship between response accuracy and stuttering is evident for the other three subjects.

Reliability

An independent observer counted words and stutterings of 20 speech samples taken from the tape recorded sessions in order to assess the accuracy of the experimenter's counts. The reliability samples consisted of randomly selected, 10-minute segments at the beginning or end of BR and EXT sessions. These segments were dubbed onto separate reliabiltity tapes in the random order selected.

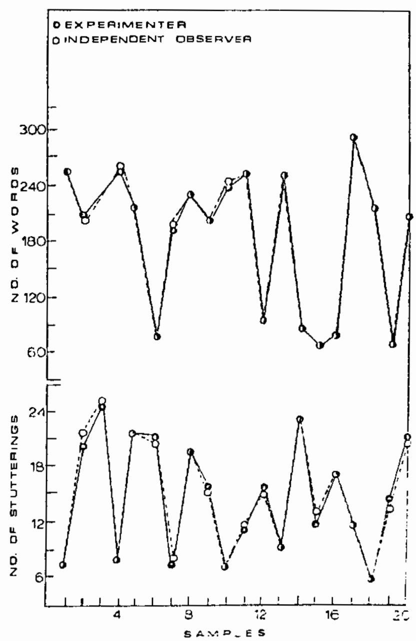

Figure 7. Comparison of word and stuttering counts for the experimenter and an independent observer.

The word and stuttering counts of the experimenter and the independent observer are shown graphically in Figure 7. The points plotted on the two curves are the mean numbers of words and stutterings for each ten-minute speech sample. The two curves are virtually identical, indicating that the experimenter's reliability of counting words and stutterings was satisfactory.

DISCUSSION

Light Alone

Subjects 1 and 3 decreased in percent stuttering during LABT; Subjects 2 and 4 did not change significantly. The design of the study does not allow further explication of this effect because LABT was a control condition.

Training to Respond to Motor Features

Only one subject, Subject 2, showed an unexpected reduction in stuttering after merely being trained to analyze word initial phonemes according to three motor features. The fact that percent stuttering for Subject 2 remained at about the same level throughout the rest of the experiment indicates that motor awareness training caused this decrease in stuttering. It is possible that Subject 2 was the type of stutterer who in Van Riper's (1963) words is ". . . able to sum up his powers and just refuse to stutter" (p. 410). Initial training may have tapped such potential abilities to inhibit stuttering.

Motor Awareness as Operationally Defined

Subjects 1 and 3 showed reductions in percent stuttering when required to analyze word-initial phonemes during spontaneous speech at frequent, unpredictable intervals. For Subject 1, it appeared that relative decreases in stuttering were related to the accuracy of analyzing motor-features. On the other hand, no such relationship was evident for Subject 3. Therefore, the mechanism whereby motor awareness produces an effect on stuttering frequency is difficult to ascertain by this study.

It had been shown that motor speech awareness procedures, or the training to do so, was associated with reductions in the frequency of stuttering in three of four subjects. Caution must be exercised, however, in generalizing from these results. It seems clear that motor speech awareness, as operationally defined in this study, can reduce the frequency of stuttering in some stutterers. Nevertheless, the same effect in a larger sample of subjects would be required to justify the conclusion that motor speech awareness is an effective therapeutic procedure with stutterers.

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