THE EFFECT OF DYSFLUENCIES ON ATTENTION IN STUTTERERS AND NON-STUTTERERS

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ABSTRACT

Stutterers and non-stutterers were presented two dichotic shadowing tasks. In the first task subjects shadowed a fluent message while a non-shadowed fluent message was presented in the opposite ear. In the second task, the subjects shadowed a fluent message while a non-shadowed dysfluent message was presented to the opposite ear. Stutterers made significantly more errors in shadowing when the non-shadowed message was dysfluent compared to the fluent non-shadowed message task. Non-stutterers exhibited no significant difference in their performance on the two tasks.

Bloodstein (1975) described several theoretical models which stressed the stutterer's anticipation of, or attention and reaction to his dysfluencies. The premise is implicit in the models of Sheehan (1953); Williams (1957); Johnson (1959); and Burtten and Shoemaker (1967). The hypothesis has been supported by findings that dysfluencies decrease when auditory stimuli are: masked (Mariat and Hutton, 1957); disrupted (Burke, 1969); or delayed (Chase, 1958; Lotzman, 1961; Bohr, 1963; and Soderberg, 1968, 1969).

Despite the therapeutic success most learning theory models enjoy, a common lament of the clinician is the reduction or total disappearance of improved behaviour when the stutterer returns to his environment. Tharp and Wetzel (1969) regard the environment as, "the principle source of recidivism." Withdrawing from therapy too soon, incomplete program of therapy, or difficulty of maintaining motivation on one's own, have been traditionally offered as explanations for relapse (Starbuck 1974). One logical explanation for recidivism, in reference to learning theory, is that of stimulus generalization. It is conceivable that the stutterer's initial sensitivity and reaction to his dysfluencies generalize to dysfluencies heard in the environment. Williams (1976), confirmed the clinical impression that adult stutterers routinely display or express concern over an increase in stuttering upon joining a therapy group. The increase in stuttering may be due to (1) increased self-awareness, or (2) the individual's response to the other stutterers' dysfluencies as if they were his own. If the increase is due to the stutterer attending and reacting to other individuals' stuttering, then it would follow that the stutterer's reaction might come to generalize to "normal" dysfluencies as well. The latter position readily lends itself to investigation.

Broadbent (1958) reported a number of techniques that have been used to investigate the capacity of man's attention. One such procedure used by Cherry (1953) consisted of speech shadowing under dichotic listening conditions, in which subjects were asked to repeat ongoing prose presented in one ear in competition with prose being presented in the contralateral ear. The results indicated that the subjects could do this task easily and with very little interjection of information from the non-shadowed ear. In addition, the study by Triesman and Geffen (1968) suggested that, "ear asymmetry can disappear completely, even with competing simultaneous messages, provided that the subject's attention is sufficiently focused on the task" (p. 147). The shadowing procedure of Cherry (1953) avoids the ear difference and cerebral dominance controversy between stutterers and non-stutterers (Tomatis, 1954 and 1963; Curry and Gregory, 1969; Quinn, 1972; and Cerf and Prins, 1974; Walle, 1971; Andrews and Quinn, 1972; Andrews, Quinn and Sorby, 1972).

A hypothetical explanation, not generally offered for recidivism in stuttering, is based on a type of stimulus generalization: the original stimuli being the stutterers' unique dysfluencies. This generalization may develop in three phases: (1) a stutterer attending and reacting to his speech dysfluencies (Johnson and Knott 1936); (2) his sensitivity generalizing to the stutter-like dysfluencies of others and finally, (3) a sensitivity to "dysfluencies in general." This study was designed to investigate the second phase of the hypothesis: the stutterer's reaction to stutter-like dysfluencies of others.

METHOD

Using a dichotic listening technique, stutterers and non-stutterers were asked to shadow a message in one ear to the exclusion of a competing message in the contralateral ear. In Task A, the messages in the shadowed and non-shadowed ear were fluent while in Task B, the message in the shadowed ear was fluent, while the message in the non-shadowed ear was dysfluent. It was expected that any difference in attention, as a consequence of the tasks, would be reflected in the error rates. If dysfluencies affected attention, then errors, judged as the number of words omitted or added, would be greater for Task B.

Subjects:

Six male stutterers, ranging in age from 18 to 36 years, mean age 22.8; and seven male non-stutterers, ranging in age from 18 to 29 years, mean age 22.1, were selected from the University population. None of the subjects had prior experience with speech shadowing. The subjects were given training in the task until their error rate was less than 10%. All subjects had normal hearing bilaterally.

Procedure:

Four emotionally neutral paragraphs of 150 words each, recorded by a non-stuttering female speech pathologist in order that pitch differences would help the subjects discriminate their voices from the message (Moray, 1972), were randomly assigned to the different trials. For the competing message of Task B, the non-stuttering female speech pathologist injected frequent tense pauses, part word repetitions, prolongations and broken words at the rate of 25 dysfluent words per minute (overall verbal output 80 words per minute). In Task A verbal output was 150 words per minute. The passages were recorded on a Crown 700 tape recorder and presented to the subjects at 50 dB SL through Koss ESP - 6 earphones. Subjects' shadowing responses were recorded on a Sony cassette tape recorder.

Subjects were instructed that they would hear two different passages, one presented to each ear. Their task was to shadow only the message in the right ear, and to continue the best they could in the event they made errors. Both groups were presented Task A, followed by Task B. Counter-balancing was not used so as to prevent a possible confounding effect of learning. If stutterers were sensitive to the dysfluencies in the non-shadowed message, then subjects presented Task B first might learn to attend to the non-shadowing ear in the subsequent task, confounding the results. Presenting Task A first gave all subjects the opportunity to improve shadowing ability under an ''optimum'' competing situation.

RESULTS

Scoring agreement was assessed using Pearson's correlation coefficient. An $r = 0.94$ was found which was significant ($t = 13.49$, $df = 24$, $P < .01$).

Statistical analysis utilized a square root transformation of the error score and a split-plot repeated measures design (Kirk, 1968). Due to the unequal size of the two groups, an unweighted-means solution was used in the analysis of variance. The results are presented in tables 1 and 2. Table 1 shows that fluency difference

Table 1. Analysis of Variance for Unweighted-Means Solution.

SOURCE	SS	df	MS	F
Between Subjects				
G (Fluency of Subject)	0.058	1	0.058	0.019
Subject within groups	33.622	11	3.057	
Within Subjects				
T (Message Type)	6.494	1	6.494	35.646*
GT	5.191	1	5.191	28.494*
T x subject within groups	2.004	11	0.182	

*p < .01

Table 2. Analysis of Variance Using Unweighted-Means Solution for Simple Effects.

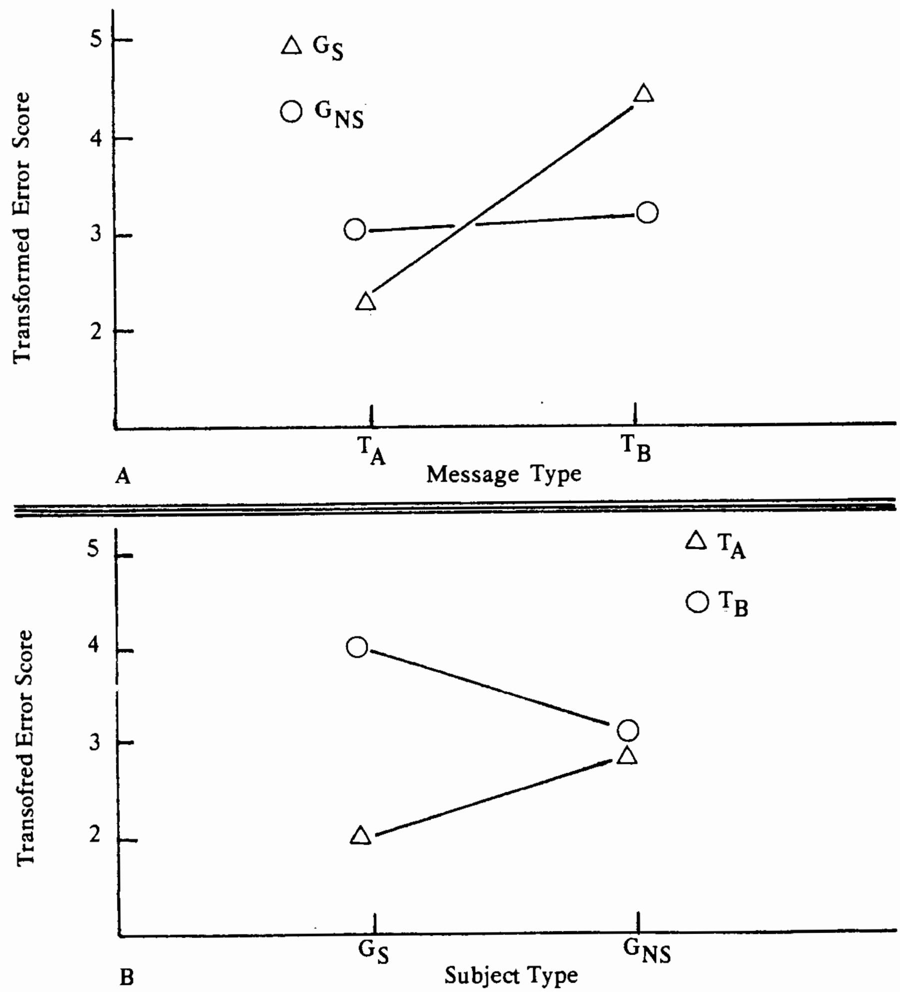
SOURCE	SS	df	MS	F
Between Subjects				
Between G at T_A	2.085	1	2.085	1.288
between G at T_B	3.195	1	3.195	1.973
within cell	35.626	22	1.619	
Within Subjects				
between T at G_S	10.840	1	10.840	59.560*
between T at G_{NS}	0.037	1	0.037	0.203
T x subject within groups	2.004	11	0.182	

* p .01

between subjects (G) was not significant, however message type (T) (within subjects) and the interaction, subject type X by message type (GXT) were both significant. The significant inteaction ($F = 28.494$, $P < .01$) suggests that different subject types behave differently under different levels of Task type. An analysis of simple main effects (Table 2) revealed a significant difference ($F = 59.560$, P .01) between Task A and Task B for stutterers (G_S) wereas difference in performance between the two tasks non-stutterers (G_{NS}) was not significant ($F = 0.203$). On the basis of these results (Fig. 1A) it was concluded that the performance of stutterers, on a speech shadowing task, is affected by the dysfluency of the non-shadowed message whereas the performance of non-stutterers was not.

One unexpected result (Table 2) was that of no difference in performance between non-stutterers and stutterers when the competing message was dysfluent ($F = 1.973$). It is felt that with a larger "N" in both groups a significant difference might be observed (Fig. 1B).

Fig. 1. Interaction between Message Type and Subject Type.



DISCUSSION

When subjects shadowed a fluent prose passage in competition with another message presented to the opposite ear, stutterers performed significantly poorer when the competing message contained stutter-like speech. This performance was in contrast to the non-stutterers who did not differ significantly in shadowing ability between the two tasks. This result appears to support the stated hypothesis. Additional support was found during post-experiment interviews. The stutterers reported being aware of the dysfluencies in the non-shadowed ear but were unable to recall the message content. Non-stutterers were aware of peculiar occurrences in the non-shadowed ear, however, only one subject labelled it stuttering.

The finding of Curry & Gregory (1969) that a significant number of stutterers in their group had a left ear preference was not supported by this study. If there was a difference in ear preferences for the two groups, shadowing with the right ear should have resulted in higher error scores for the stutterers than with non-stutterers on Task A. Fig. 1 shows that the opporsite was true, with stutterers having a lower score on Task A than did the non-stutterers.

In order to maximize differences in performance due to dysfluencies, a high percentage of stutter-like utterances (32.5%) was used in the non-shadowed ear. The dysfluencies consisted of, tense pauses, prolongations, part word repetitions and broken words. The results suggest that there is an interaction between the dysfluency behaviour of the subject and the dysfluency types used in the competing message. In other words, the subject may have responded to the stuttering as he would to his name (Moray 1969). The method used in the experiment avoided counter-balancing, which increased the probability of rejecting significant results (type II error) during analysis (Gaito 1961). It is felt therefore, that by not counter-balancing resulted in a more conservative analysis of the data, further supporting our findings.

In conclusion, there is a differential effect of stutter-like dysfluencies on stutterers and non-stutterers. Dysfluencies in the non-shadowed ear for stutterers produced an involuntary shift in attention away from shadowing the message in one ear to the dysfluencies in the other ear. The stutterer may react the same way to dysfluencies perceived in the environment. The shift in attention would cause the stutterer either to, 1) produce content errors in his speech because of competition and subsequent decrease in self-monitoring or, 2) react to the stutter-like behaviour as if it were his own, precipitating behaviour geared to stop the perceived stuttering: the reaction would lead to struggle behaviour in either case.

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ERRORS IN SHADOWING AS ASSESSED BY THE TWO JUDGES ... RAW DATA.

Task A	Subject	Judge 1	Judge 2	X
	1	8	7	7.5
	2	1	1	1.0
Stutterers	3	8	6	7.0
	4	6	6	6.0
	5	3	3	3.0
	6	6	6	6.0
				$\bar{X}$=5.08
				s^2= 6.442
	7	30	29	29.5
	8	2	2	2.0
Non-stutterers	9	10	10	10.0
	10	19	18	18.5
	11	3	3	3.0
	12	3	3	3.0
	13	6	6	6.0
				$\bar{X}$=10.30
				s^2=104.998
Task B				
	1	31	30	30.5
	2	3	3	3.0
Stutterers	3	17	17	17.0
	4	17	16	16.5
	5	13	12	12.5
	6	30	30	30.0
				$\bar{X}$=18.25
				s^2=111.675
	7	30	29	29.5
	2	4	4	4.0
Non-stutterers	9	9	9	9.0
	10	21	20	20.5
	11	4	4	4.0
	12	5	4	4.5
	13	6	6	6.0
				$\bar{X}$=11.07
				s^2=100.286

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Appendix to Yovetich, Booth & Tyler

"The effects of dysfluencies on attention in stutterers and non-stutterers."

EDITORIAL STAFF COMMENTS BASED ON REVIEWER CRITICISMS

The preceding article was selected for publication, over the objections of some of the editorial consultants and it is for that reason that this appendix was prepared. Although the data are of interest, the article deserves critical evaluation of its experimental methodology, method of reporting results, and treatment of data. The article is weak in a number of areas, but it is not unrepresentative of the **mss** received by any journal. The concerns noted in the Yovetich et al. article are not unique, and all readers should attend carefully to these comments when considering submission to this or other scientific journals.

Any experiment must be described in sufficient detail so that an experienced investigator would be able to replicate the study, and so that he may evaluate the appropriateness of the methodology. There must be an adequate description of the experimental materials and apparatus, the subjects who participated, and the experimental procedure. Yovetich et al. fail to provide sufficient detail in their description of the materials (save that each was 150 words in length and "emotionally neutral"), or the experimental subjects. One may question whether the material employed and the data collected are sufficient to answer the questions regarding the effects of "normal" dysfluencies upon relapse following therapy for stuttering. Although the groups employed in the study were equated for mean age, the reader is left to question their education level, IQ and how they compared on other variables that may account for the differences in performance. Since characteristics of the samples used in an experiment greatly affect the kinds of inferences that may be drawn from the results, great care must be taken in describing the participants.

Pretraining may be required in certain circumstances, but it is necessary to know on what materials, in what manner and for what length of time the subjects received the training. Preexperimental training may have effects upon performance that are beyond those of the independent variables of an experiment.

In experiments involving multiple observations on the same experimental unit, particular attention must be paid to sequence or "carry-over" effects. These include fatigue, "warm-up", learning-to-learn, transfer of training, and other consequences of familiarity with the experimental task that may be expected to carry-over to subsequent tasks. If carry-over effects are assumed to be "great", the repeated measure or multiple observation experiment is inappropriate. If the effects are assumed to be small, and a simple additive model appears realistic, there is some chance that carry-over effects may be balanced out of the experiment. Yovetich et al, however, appear to assume that counterbalancing **controls** carry-over effects in the data. If such effects exist, counterbalancing does not remove them, but rather spreads the sequence effects among the treatments, confounding treatment with sequence effects. Under certain statistical assumptions, it is possible to partial effects due to the order of presentation from those due to the treatments, but counterbalancing does not guarantee that the effects of the treatments are free of the effects of the order of the testing. Yovetich et al chose not to counterbalance the order of testing among the subjects. While this is defensible in certain circumstances, the authors are wrong in assuming that failing to counterbalance somehow prevents the carry-over effect of 'learning' from appearing in their data.

Apparently, Yovetich et al. employed the same materials in Task A and B (Trials 1 and 2) of the experiment, with the two tasks differing only in the rate and dysfluency of the passage presented to the "non-shadowed" (left) ear. If this is true, one would expect substantial carry-over effects, and due to the design and procedure these effects are completely confounded with subjects. There is no way in which sequence effects may be partialled from the experimental manipulations, and the probable effects of prior experience on performance in Task B are difficult to estimate. One possibility, however, is that the effects of the dysfluent passage were masked by practice with the fluent ("attended") passage in Task A. If sequence efforts could be eliminated from the data, the results may have shown increased errors for both groups!

The techniques used to analyze the data, and the statistics are not the principal findings of the experiment, although many authors write their Results section as if they were. The data should be carefully and thoroughly described, and preliminary data handling should be justified. Apparently, two raters judged the subjects' shadowing performance and recorded production errors. Apparently, the mean number of errors across judges was taken as the dependent measure. Authors and readers can not afford these vague references to the treatment of experimental data, since how the data are handled may influence the outcome and interpretation of the results. Any transformations of the original data must be justified. Yovetich et al. never state the rationale for a square root transformation of the original error measures, nor the type of square root transformation employed. The means and variances of the data are not proportional, nor are they highly correlated. Although there may be other reasons for the transformation, one is left wondering why it was performed in this study.

Authors often confuse the operationalisms of their experiments with the data collected. For example, "fluency" is not the dependent measure in Yovetich et al's experiment. Errors of omission and intrusion, which have been operationally defined as measuring fluency, are the data of interest.

Failure to attend to the **data** of this experiment is emphasized in two parts of the results section. First, the square root transformation of the errors are not the data of the experiment, and should not be reported in Figure 1. Second, the outcome of the experiment is masked by the authors' attention to the statistical analysis rather than the data. Simply, the results of the experiment showed that there was a significant interaction between the frequency of shadowing errors produced by the two groups and the type of passage presented to the "non-shadowed" ear. The analysis of simple main effects confirmed the source of the interaction as due to the increase in errors for the stuttering group between conditions in which the "non-shadowed" passage was fluent and dysfluent. The analysis of simple main effects also revealed that performance of the stuttering group, although significantly different between the two tasks, did not differ from that of the non-stuttering group on either Task A or Task B. Put another way, although the stuttering group committed more errors when the dysfluent passage was presented to the "non-shadowed" ear, their performance was not significantly better than the non-stuttering group of Task A nor worse than that group on Task B.

These results may have arisen from the differences in the variances between the groups, but the authors have the responsibility to provide possible interpretations of the effects, and to account for the factors that may have influenced the results. The suggestion that a greater number of subjects may have influenced the results is theoretically weak, and the 'predictions' offered by the authors are only one of many possible outcomes of increasing the sample size.

Results should be summarized in a concise manner, and in a way that is not open to confusion. Yovetich et al's summary in the first sentence of the Discussion section is a case in point, since the "significantly poorer" performance of the stuttering group is open to qualification. That group did not perform more poorly than the normals, but did have more errors when the "non-shadowed" passage was dysfluent than when it was fluent. The discussion of "left ear preference" is out of place in this article. Although it is a tenable hypothesis, the issues of laterality and cerebral dominance are not addressed by the experimental design. The experimental procedure and analysis of the data are not sufficient to conclude that the effect of the dysfluent passage is due to the "dysfluency types used in the competing message." A reasonable way to proceed to address this question would be to vary the types of dysfluencies and to have assessed the types of errors produced by the subjects. Evidence of "an involuntary shift in attention away from shadowing the message in one ear to the dysfluencies in the other ear" is not obvious from the results although it is one possible interpretation of the effect of the dysfluent passage. Support of this conclusion would require some analysis of the kinds of errors produced by the subjects; e.g., intrusions from the "non-shadowed" passage.

The authors have demonstrated that dysfluency in the competing message of the dichotic listening task may influence the shadowing performance of stutterers, but other variables in the experiment may have had an effect on performance. It is not clear that the effects of dysfluency are due to 'stimulus generalization' as described by the authors, nor do the data support the conclusion that the stutterers are dividing their attention between the shadowed and non-shadowed channels.

Whether "normal" dysfluencies precipitate relapse among persons having received therapy for stuttering is open to debate. None of these proposals is within the scope of the present research.