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## Comparison of Three Measures of Stuttering Severity

By DOROTHY SHERMAN, MARTIN YOUNG, and KENNETH GOUGH

Various measures of severity of stuttering are available and are used both clinically and experimentally. Information concerning the relationships among these various measures thus should be useful in planning effective therapy or in designing experiments.

In a previous study Sherman and Trotter (4) evaluated the relationship between two measures of the severity of stuttering. One measure was the mean scale value of severity of individual moments of stuttering derived from listeners' responses; the other measure was frequency of stuttering. Measures were taken on tape-recorded readings of a 500-word passage. The obtained estimate of the strength of relationship was a Pearson  $r$  of .61.

### PROCEDURE

The present study was designed to extend correlational analysis to some additional measures of severity of stuttering. Data suitable for this purpose were available from an experiment by Gough (2). There were three different severity measures for each of 24 different tape-recorded 200-word samples of oral reading by each of 10 stutterers, 240 samples in all. The three measures were reading time, frequency of moments of stuttering, and scale values of over-all severity derived from listener ratings. The ratings were made by one trained listener, a procedure previously shown to yield reliable results (3). A nine-point equal-appearing intervals scale was employed. Ratings were made at 10-second intervals. A mean severity rating was computed for each of the 24 speech samples as read by each of the 10 stutterers. Satisfactory reliability of these mean values was established.

### RESULTS AND DISCUSSION

For each of the 24 readings, three Pearson  $r$ 's were computed to estimate the strengths of the relationships between reading time and frequency of stuttering, between reading time and rated severity, and between frequency of stuttering and rated severity. Thus there were three sets of correlation coefficients, 24 per set. To test for significant differences among the  $r$ 's of each set, a readings-by-subjects analysis of variance was employed. The criterion measure for

any one analysis was the product of corresponding standard scores for the two variables being compared. The measures were computed separately for each reading. The advantage of using this criterion measure is that the mean of the measures for any one reading is a Pearson  $r$ . The  $F$ -test for differences among 24 means, then, is actually a test of the significance of the differences among related correlation coefficients.

Table 1

Summaries of analyses of variance, testing differences among readings with respect to relationships between (1) reading time and frequency of stuttering, (2) reading time and rated severity, and (3) frequency of stuttering and rated severity. The measures were the products of corresponding standard scores computed for each of 10 subjects for each reading separately.

Source	df	ss	ms	F	F <sub>.05</sub>
<i>Reading time and frequency</i>					
Readings (R)	23	2.99	.13	.23	1.62
Subjects (S)	9	77.49	8.61		
RS	207	117.78	.57		
Total	239	198.26			
<i>Reading time and rated severity</i>					
Readings (R)	23	2.95	.13	.27	1.62
Subjects (S)	9	92.11	10.23		
RS	207	98.63	.48		
Total	239	193.70			
<i>Frequency and rated severity</i>					
Readings (R)	23	.69	.03	.10	1.62
Subjects (S)	9	76.86	8.54		
RS	207	64.34	.31		
Total	239	141.89			

The results of the  $F$ -test are non-significant for all three analyses (see Table 1). An estimate of the correlation between the two severity measures of any one analysis is thus the mean<sup>1</sup> of the 24 obtained coefficients.

The mean of the 24 obtained correlation coefficients estimating the strength of the relationship between reading time and frequency of stuttering is .76. The corresponding mean for reading time and rated severity is also .76. A somewhat higher mean of .87 was obtained for frequency of stuttering and rated severity. All three mean coefficients are statistically significant. It thus may be assumed that there is some relationship between reading time and frequency of stuttering, between reading time and rated severity, and between frequency of stuttering and rated severity. Generalizations concerning the strengths of these relationships, however, must be made with caution. The number of subjects is small and the confidence intervals are thus wide.

<sup>1</sup>Employing the mean as the average value of the 24  $r$ 's provides a reasonable estimate of the population value because the  $N$ 's are the same and the various values of  $r$  do not, in general, differ greatly (1, p. 134).

At the same time it should be noted that all of the obtained  $r$ 's, 24 for each analysis, 72 in all, fall well above the lower limit of the 95 per cent confidence intervals (see Table 2) for the respective means. At least for the subjects of the present study it seems safe to assume that the obtained mean  $r$ 's are fairly reliable estimates and that the relationships are fairly strong, particularly between frequency of stuttering and rated severity.

**Table 2**

Means and their 95% confidence interval limits for three sets of 24 Pearson  $r$ 's measuring the relationships among three sets of measures of stuttering severity: (1) reading time, (2) frequency of stuttering, and (3) rated severity.

<i>Variables</i>	<i>N</i>	<i>Mean of r's*</i>	<i>Range</i>	<i>Confidence Interval**</i>
1 & 2	10	.76	.50 to .99	.24 to .94
1 & 3	10	.76	.54 to .93	.24 to .94
2 & 3	10	.87	.73 to .95	.53 to .97

\*An  $r$  of .63 is required for significance at the 5% level with  $df=8$ .

\*\*Confidence interval limits were computed by employing Fisher's  $z$  transform of  $r$ .

Multiple correlation procedures have been suggested (4) as a tool for evaluating variables which might influence listener reactions to stuttering. Since the completion of the present study, Young (5) has done an experiment utilizing multiple  $r$ . Scale values of severity derived from listener responses to 50 200-word speech samples constituted the dependent variable. There were three independent variables: time required to speak 200 words; frequency of syllable repetitions; and frequency of sound prolongations. A multiple correlation coefficient of .90 was obtained. Zero order correlations were .68 for rated severity and speaking time, .83 for rated severity and frequency of syllable repetitions, and .75 for rated severity of stuttering and frequency of sound prolongations. No pair of variables is directly and specifically comparable to any pair of the present study. However, in both studies the frequency of stuttering measures correlate more closely with the rated severity measures than with the time measures.

#### SUMMARY

A comparison was made of three measures of stuttering severity: reading time, frequency of moments of stuttering, and scale values derived from listener ratings. Measures were taken on 24 tape-recorded, 200-word readings by each of 10 stutterers. Each measure was compared to the other two measures by means of Pearson's correlation procedure. All interrelationships were statistically significant. The strength of relationship, as estimated by obtained  $r$ 's, was highest between frequency of stuttering and rated severity of stuttering.

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