Reading Ability and Disfluency in Stuttering and Nonstuttering Elementary School Children

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This study was aimed at comparing the reading abilities of elementary school children who stutter with their nonstuttering peers. Forty-four stuttering children from four grade levels were matched with a group of normally fluent controls on the basis of age, sex, and grade level. Reading ability was assessed by means of three Dutch standardized tests yielding a total of six scores. Disfluency scores during oral reading were also obtained for each subject. Results indicated significant differences between the two groups on reading rate and reading errors, but not on reading comprehension. Analysis of reading errors did not show qualitative differences among subjects: stuttering and nonstuttering children made the same kinds of reading errors. Similarly, the two groups did not differ with respect to performances at different grade levels. Among both groups of subjects performances became better with increasing grade on four of the six measures. Corrrelational analyses indicated that the measures of reading ability used in this study were significantly associated with frequency of disfluency for the nonstuttering children. In contrast, no significant relationship was found between reading ability and disfluency in the stuttering group, except for reading rate. Results are discussed with respect to the possible interaction between verbal performance and linguistic competence in reading ability measures, particularly for the stuttering child.

INTRODUCTION

Several authors have suggested that some stuttering children demonstrate some degree of retardation in the acquisition and use of certain language skills (cf. Van Riper, 1971; Bloodstein, 1975). Most of the research concerning this contention has been focused on comparing the language development in stuttering and nonstuttering children. Relatively little attention has been directed to differences between stutterers and nonstutterers in the acquisition of reading skills. Reading is one form of linguistic

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behavior that requires competence in the understanding and formulating of oral language. Children who do not acquire a good knowledge of semantics and syntax and other skills requisite to the process of language formulation will encounter difficulties in learning to read.

To date, little is known regarding a possible relation of the occurrence of reading problems and the incidence of stuttering in children. There is some evidence which suggests that greater linguistic demands result in larger amounts of disfluencies. Cecconi et al. (1977), for example, found that the frequency of disfluencies, and more specifically the stuttering-like disfluency types, increases in normally fluent children with increasing difficulty of the reading material. These findings were confirmed by Blood and Hood (1978) for stuttering children from different grade levels. The results of both studies apparently support the contention that a relationship exists between oral reading difficulty and abnormal disfluency.

If, as has been hypothesized, stuttering children are slower in all forms of linguistic behavior, one might expect differences to be found between stuttering and nonstuttering children with respect to reading ability. However, no information is available indicating that stuttering children are inferior to nonstuttering children in reading abilities. On the contrary, the evidence so far suggests that the reading abilities of school age stutterers are within normal limits. Using a standardized reading test, Conture and Van Naerssen (1977) found no differences in the performances of stuttering and nonstuttering children. Unfortunately, Conture and Van Naerssen did not report on the performances of stuttering children from chronologically different age groups. The possibility should be considered that children who have had a weakness in language skills may have overcome their potential deficit through the training at school by the time they reach the more advanced grades. Any weakness in reading skills would, therefore, be most apparent in the early stages of learning to read, but less manifest in the later stages as in grades 4 and 5.

The present study was undertaken to further investigate whether or not elementary school children from different grade levels who stutter differ from their nonstuttering peers in terms of reading ability. A second purpose of the study was to determine the relationship between reading ability and speech disfluency.

METHOD

Subjects

The experimental subjects in this study were 44 elementary school children who had been diagnosed by independent speech pathologists as having a stuttering problem. The matched control group consisted of 44 normal-speaking children. None of the normal-speaking children had a history of stuttering. Matching was performed on the basis of sex, chronological age, and school-grade placement.

In both groups 11 of the children were female, 33 were male. Mean age of the stuttering group was 9 yr, 9 mo with a range of 7 yr, 9 mo to 11 yr, 8 mo. Mean age of the control group was 9 yr, 7 mo with a range of 7 yr, 8 mo to 11 yr, 6 mo. Table 1 shows the distribution of the stuttering and nonstuttering children according to school-grade placement.

Prior to the experiment a questionnaire was filled out by the parents of each child requesting information about speech development, school performances, and the presence of any learning disability. A subject was excluded from the study if any learning disorder was reported.

Procedure

Each subject was individually tested by one of the investigators in a quiet room. Reading ability was measured by means of the following three standardized Dutch reading achievement tests:

1. *One-minute Word Test* (Brus and Voeten, 1972). The test contains 100 words of increasing difficulty level and requires the child to read as many words as possible in 1 min.

TABLE 1

School-Grade Placement of Stuttering and Nonstuttering Subjects

	2nd grade	3rd grade	4th grade	5th grade
stuttering subjects	4	17	13	10
nonstuttering subjects	4	17	13	10

The test yielded two scores: total number of words produced in one minute, and total number of reading errors.

2. *Differential Sentence Test* (Dommerholt, 1970). The test consists of 30 sentences of increasing length which the child is required to read within 3 min. The test delivered a score for reading errors and a score for the percentage of errors that were revised. Two parallel forms were used: the first containing 355 syllables and the second 372 syllables.
3. *Reading Comprehension Test* (Brus and Van Bergen, 1973). The test consists of32 written instructions of increasing syntactic complexity. The children are required to read each instruction silently and to carry it out. The test measures the ability to understand the meaning of words and the syntactic structure of a sentence. It has three forms: one for 2nd graders, one for 3rd graders and one for 4th and 5th graders. Two scores were determined: total number of correct responses (maximum score is 32) and time needed to complete the test (working time).

Analysis of Reading Errors

All responses on the One-minute Word Test and the Differential Sentence Test were tape recorded for subsequent analysis. Identification of reading errors was made according to the criteria listed by Dommerholt (1970) and included the following categories:

1. Wrong emphasis
2. Spelling a word
3. Breaking up a word into syllables (e.g., zo-o-lo-gi-cal garden instead of zoological garden)
4. Redoubling of sounds in open syllables (e.g., smokking instead of smoking)
5. Pluralization of nouns
6. Omission of a word
7. Adding of a word
8. Replacement of a word by a new synonymous word
9. Replacement of a word by a new not synonymous word

10. Replacement of an article (e.g. 'the' is replaced by 'a')
11. Inversion of words (e.g. 'was it' instead of 'it was')
12. Inversion of a sound
13. Replacement of a sound
14. Omission of a sound
15. Addition of a sound
16. Anticipation of a sound (i.e. anticipating a sound that occurs in a part of the word not yet read or in the word immediately following the misread word)
17. Miscellaneous errors (i.e. words that are unrecognizable).

In the Differential Sentence Test instances of spontaneous revisions of reading errors were also counted and a percent reading errors revised was determined for each child.

Analysis of Disfluencies

The Word Test and the Differential Sentence Test were also analyzed for the occurrence of ten types of disfluencies (Janssen and Kraaimaat, 1980): fast repetition of a sound, syllable, or monosyllabic word, prolongation of a sound, tense block, interjection of a sound, and slow repetition of a sound, syllable, word or phrase. In the Sentence Test total disfluency and individual disfluency types were calculated per number of syllables read to compensate for differences in sample length.

Reliability Measures

Reliability checks for judgment of reading errors and disfluency were conducted by an independent observer from the tape recorded sample of 40 randomly selected subjects.

Interexaminer reliability in judging total number of disfluency was estimated by utilizing a product–moment correlation coefficient. Interexaminer agreement on the One-minute Word Test was 0.96, and on the Differential Sentence Test, 0.98. A product–moment correlation coefficient was also used to calculate the reliability for detecting the total number of reading errors in the One-minute Word Test. This coefficient was 0.95. Reliability in identifying specific types of reading errors in the

differential Sentence Test was assessed by computing a percentage of agreement for each reading type error (Sander, 1961). Nonoccurrences were not considered in the formula. Interjudge reliability scores were: 1.00 for wrong emphasis, 0.43 for breaking up a word, 0.83 for omission of a word, 0.93 for addition of a word, 0.95 for replacement by a new word, 0.93 for replacement of an article, 1.00 for inversion of words, 0.93 for replacement of a sound, 0.96 for omission of a sound, 0.90 for addition of sound, and 0.89 for anticipation of a sound, yielding a mean interjudge reliability value of 0.90.

RESULTS

Differences in Reading Ability Between Stutterers and Nonstutterers

The means and standard deviations of all reading ability measures for the stuttering and nonstuttering children in each grade group are presented in Table 2.

The data were analyzed by means of separate analyses of variance for each of the reading ability measures. A 2 × 4 factorial design for unequal cells was used (Winer, 1971). A summary of the analyses of variance is given in Table 3.

Results indicated that grade constituted a significant main effect for the number of reading errors in both tests, the number of words produced and the number of correct responses on the Reading Comprehension Test. Inspection of Figure 1 shows that with the increase in grade children performed better on these reading ability measures. No influence of grade was found on the percentage of reading errors that were revised and on the working time of the Reading Comprehension Test.

The analyses of variance further revealed significant differences between stuttering and nonstuttering children on four of the six reading ability measures. Stuttering children produced fewer words, made more errors in the Differential Sentence Test, revised a lower percentage of their errors, and needed more time to complete the Reading Comprehension Test. No significant interactions between group and the grade level of the subjects were found, except for the test scores on the Reading Comprehension Test. To gain a better understanding of the nature of this

TABLE 2

Means and Standard Deviations (in parenthesis) of Reading Ability Measures for Stuttering and Nonstuttering Children in Each Grade Group

Subjects	Grade 2	Grade 3	Grade 4	Grade 5
Stutterers				
Reading errors WT[a]	3.00	4.18	4.15	2.90
	(2.45)	(2.46)	(4.12)	(1.85)
Number of words WT	34.50	47.76	54.23	66.20
	(21.61)	(13.93)	(13.27)	(12.01)
Reading errors DST (%)[b]	12.02	6.11	4.77	3.28
	(8.80)	(1.87)	(3.01)	(1.78)
Errors revised DST (%)	9.34	22.27	22.87	22.03
	(11.37)	(15.10)	(12.37)	(9.38)
Correct responses RCT[c]	15.25	23.35	21.62	26.10
	(8.66)	(5.98)	(7.15)	(4.07)
Working time RCT	26.13	25.85	21.72	18.98
	(6.20)	(4.57)	(4.63)	(5.02)
Nonstutterers				
Reading errors WT	7.25	3.24	2.92	3.40
	(2.99)	(1.68)	(2.14)	(1.58)
Number of words WT	46.50	64.41	71.92	79.00
	(19.16)	(8.69)	(11.66)	(16.47)
Reading errors DST (%)	7.01	4.83	3.64	3.18
	(2.65)	(1.74)	(2.02)	(1.90)
Errors revised DST (%)	27.08	25.95	35.16	24.33
	(12.08)	(16.77)	(20.85)	(20.75)
Correct responses RCT	24.50	27.53	20.54	22.70
	(6.03)	(2.90)	(7.38)	(5.58)
Working time RCT	20.20	19.03	20.49	18.41
	(1.73)	(5.21)	(5.38)	(5.60)

[a]WT = One-minute word test.
[b]DST = Differential sentence test.
[c]RCT = Reading comprehension test.

TABLE 3

Results of Analyses of Variance Testing for Reading Ability Measures

Source		Group	Grade	Group × Grade	Error
Reading errors WT	MS	1.20	24.81	13.62	7.01
	F	0.17	3.54*	1.94	
Number of words WT	MS	3600.09	3012.94	32.41	178.70
	F	20.15**	16.86**	0.18	
Reading errors DST (%)	MS	58.42	125.53	19.07	7.44
	F	7.85**	16.87**	2.56	
Errors revised DST (%)	MS	1335.33	322.59	220.04	258.64
	F	5.16*	1.25	0.85	
Correct responses RCT	MS	82.44	115.39	131.35	34.19
	F	2.41	3.37*	3.84*	
Working time RCT	MS	13077.89	3811.93	2517.66	1504.50
	F	8.69**	2.53	1.67	

Note: $df = 1$ for group; $df = 3$ for grade; $df = 3$ for group × grade; $df = 80$ for error.
* $p < 0.05$.
** $p < 0.01$.

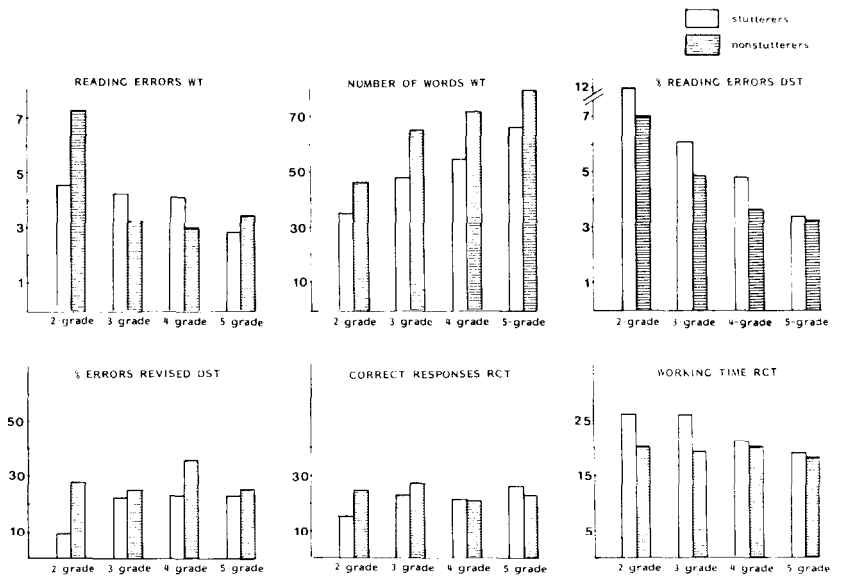

Figure 1: Mean frequency of reading ability measures for each of the four grade levels for stuttering and nonstuttering children.

interaction, the data were subjected to a Newman–Keuls simple main effects test (Winer, 1971). The results showed no significant differences among the grade means of the nonstuttering subjects. As to the stuttering subjects, the mean group performances were significantly lower ($p < 0.05$) for the second grade children than for the third, fourth and fifth grade children, indicating that reading comprehension is dependent upon grade level for the stuttering subjects only.

Since the stuttering and nonstuttering children proved to be significantly different in the frequency of reading errors made in the Differential Sentence Test, it was of interest to investigate whether they would differ in specific types of reading errors. Toward this end, error types were converted into proportions of the total number of errors made on the Test and differences between the two groups were evaluated by means of a series of independent *t*-tests.

It can be seen from Table 4 that the replacement of an article and the replacement, omission, or addition of a sound were the most frequent categories of reading errors for both groups of subjects. The only significant difference ($p < 0.05$) between the mean scores for the two groups was on the category "addition of a sound." This type of error occurred with a higher frequency in the nonstuttering group. For the remaining types of reading errors the differences were not statistically significant and the direction of the differences was inconsistent, indicating that stuttering children are not characterized by an increase in specific types of reading errors.

Relationship Between Reading Ability and Speech Disfluency

The second part of the study was designed to examine the relationship between reading ability and the frequency of speech disfluency during oral reading. For this purpose disfluency analyses were conducted for both the One-minute Word Test and the Differential Sentence Test. Frequency of disfluency in the Sentence Test was expressed as percent of disfluency per number of syllables read. Mean disfluency scores for the stuttering children were 5.18 (SD 4.79) in the One-minute Word Test, and 12.76 (SD 11.65) in the Differential Sentence Test. For the nonstuttering group these values were 2.70 (SD 2.66) and 3.36 (SD 2.30), respectively.

Pearson product–moment correlations were then computed between reading ability measures and disfluency scores. Since grade level

TABLE 4

Group Mean Proportions and Standard Deviations for Each Type of Reading Error for Stuttering and Nonstuttering Children

	Stutterers		Nonstutterers		
Type of reading error	Mean	SD	Mean	SD	*t*-value
Wrong emphasis	0.018	0.035	0.015	0.034	0.46
Word spelling[a]	0.001	0.006	—	—	—
Breaking up a word	0.023	0.049	0.031	0.049	−0.72
Redoubling of sounds[a]	0.002	0.010	—	—	—
Plural form[a]	—	—	0.013	0.037	—
Omission of a word	0.052	0.064	0.063	0.061	−0.84
Addition of a word	0.049	0.063	0.051	0.063	−0.14
Replacement by a new (synonymous) word[a]	—	—	0.002	0.010	—
Replacement by a new (not synonymous) word	0.079	0.085	0.065	0.079	0.55
Replacement of an article	0.153	0.104	0.150	0.118	0.19
Inversion of words	0.005	0.026	0.001	0.006	0.95
Inversion of a sound	0.015	0.033	0.027	0.045	−1.34
Replacement of a sound	0.197	0.126	0.159	0.106	1.53
Omission of a sound	0.274	0.161	0.213	0.133	1.96
Addition of a sound	0.114	0.104	0.182	0.162	−2.36*
Anticipation of a sound	0.020	0.047	0.020	0.036	0.00
Miscellaneous errors	0.001	0.009	0.007	0.025	−1.43

[a]No *t*-value calculated due to the nonoccurrence of this error type in one of the two groups.

*$p < 0.05$.

may be a factor influencing the possible relationship between these measures, first-order partial correlation coefficients were generated with the influence of grade level upon the data ruled out. Table 5 shows the zero-order correlation coefficients between reading ability measures and grade, and the first-order correlation coefficients with the disfluency scores for both groups.

It is evident from this table that grade is an influencing factor on reading ability in both groups. In the stuttering group grade correlated significantly with the number of words produced in the One-minute

TABLE 5

Correlations Between Reading Ability and Grade, and Partial Correlations Between Reading Ability and Disfluency

	Stutterers			Nonstutterers		
	Grade	Disfluency		Grade	Disfluency	
Reading ability		WT	DST		WT	DST
Reading Errors WT	−0.15	−0.14	−0.18	−0.29	0.62**	0.48**
Number of words WT	0.54**	−0.33*	−0.54**	0.54**	−0.26	−0.62**
Reading errors DST (%)	−0.53**	−0.10	−0.02	−0.46**	0.34*	0.63**
Errors revised DST (%)	0.16	−0.02	−0.17	0.02	−0.20	−0.13
Correct responses RCT	0.31*	0.07	−0.07	−0.31*	−0.37*	−0.62**
Working time RCT	−0.51**	0.06	0.27	−0.03	0.36*	0.48**

* $p < 0.05$.
** $p < 0.01$.

Word Test, with percent reading errors in the Sentence Test, and with both reading comprehension measures. Thus, as has been noted earlier, stuttering children in the higher grades performed better on all three reading ability tests. For the nonstuttering group a significant negative correlation was found between grade level and number of correct responses in the Reading Comprehension Test. This indicates that in this group the children in the lower grades performed better than those in the more advanced grades.

With grade held constant, there appears to be large differences between the two groups in the relationships of reading ability and disfluency. For the nonstuttering group significant correlations were found between reading errors and disfluency. Clearly, nonstutterers' inability to produce words correctly is closely related to their being disfluent during oral reading. For the stutterer, on the other hand, there seems to be no relation at all between reading errors and disfluency. Comparing the two groups with regard to the correlations between reading comprehension and disfluent behavior, it can be noted that such a relation is also present in the nonstuttering group only. For this group significant correlations were found between disfluency and the two reading comprehension scores. In the stuttering group these correlations

were nonsignificant, suggesting that for stuttering children their degree of disfluency is independent of reading comprehension. The only significant correlation in the stuttering group was with the number of words produced in the One-minute Word Test.

One might ask, however, whether for the stuttering group the use of the global disfluency measures masks differences in specific types of disfluency. To analyse this possibility the specific types of disfluency which are traditionally referred to as "stuttering" (i.e. fast part-word repetitions, sound prolongations and tense blocks) were separated from the other specific disfluency types that are generally labeled "normal disfluency" (i.e. slow repetitions of words and phrases and interjections). The computed first-order correlation coefficients, however, indicated no significant relation between any of the reading ability measures and the stuttering types of disfluency. Only the correlation between number of words produced in the one-minute Word Test and the "normal" disfluency score was significant at the 0.01 level, as was already apparent with the global disfluency score. Thus, it may be concluded that for the nonstuttering child his degree of disfluency during oral reading is closely related to his reading achievement, while for the stuttering child disfluency and reading ability seem to be separate functions.

DISCUSSION

The results of the present study indicate that in terms of reading ability stuttering children from all four grade levels performed less well than their nonstuttering peers on four of the six measures. In general, performances were better with increasing grade level among both groups of subjects. However, with the exception of the number of correct responses on the Reading Comprehension Test, there were no significant group–grade interactions suggesting no differences between the two groups in beginning and more advanced readers. These findings are not consistent with the idea of a developmental lag for stuttering children in the acquisition of reading skills.

The overall poorer performances on the part of the stuttering children appears to warrant some discussion. The reading tests used in this study tapped several components of the reading process: rate, accuracy, and reading comprehension. Of the four measures that signifi-

cantly differentiated between stutterers and nonstutterers, one measure, number of words produced, may be regarded as a rate measure, and two, reading errors and number of errors revised, as accuracy measures. The fourth measure, working time on the Reading Comprehension Test, may be classified as a rate measure including the time needed to read the instructions silently and the time needed to carry them out.

Rate and accuracy are important factors in the reading process reflecting a child's skill in the decoding and comprehension of the written material. Both components, however, may also have other functions. Oral reading rate, for example, may also be seen in connection with the child's struggle with the verbal output, and may therefore also reflect an inadequacy in the execution of speech. Lower scores on this measure may, therefore, be indicative of poor reading skills as well as the result of the stuttering problem. Likewise, accuracy may be a function of inadequate skills in the execution of speech. Clearly, there was a tendency for the stuttering children to make more errors. Analysis of the type of reading errors, however, did not show qualitative differences: stuttering and nonstuttering children make the same type of reading errors. In addition, it was found that stuttering children do not revise their reading errors as frequently as nonstutterers, which is in agreement with the findings of Silverman and Williams (1973), although they also found that both groups make comparable amounts of reading errors. Silverman and Williams did not offer an explanation for this phenomenon, but it might be reasonable to speculate that some stuttering children avoid revising their errors from fear of stuttering. Anyhow, factors associated with the stuttering problem may be likely to interact with accuracy in reading.

While the results on the rate and accuracy measures must be considered with some reservation, the findings on reading comprehension are less equivocal. The Reading Comprehension Test is a silent task. The child is required to read the written instructions silently. To carry out the instructions correctly the child must be able to interpret lexical and syntactic information. Thus, the scores on this test are not contaminated by oral performance and may be viewed as a better estimate of the child's linguistic competence, particularly the stuttering child. This interpretation is consistent with the conclusion of Conture and Van Naerssen (1977) who from a different point of view suggested that "passage comprehension is probably the best single indicator of both normally fluent speakers'

and stutterers' total reading ability." Our findings did not indicate any difference between the two groups on this measure. Although the stuttering children were slower in reading and carrying out the instructions, their degree of comprehension was not inferior to the nonstuttering children. This is further illustrated by comparing the individual test profiles in terms of the norms suggested by Brus and Van Bergen (1973) in their test manual. This comparison revealed that four subjects in the stuttering group performed below their own grade level, against four of the nonstuttering subjects.

Perhaps the most striking and suggestive of the differences between stutterers and nonstutterers in this study is to be observed in the relation of the reading test performances to the frequency of disfluencies during oral reading. In the nonstuttering group the less-skilled readers are also the most disfluent ones. No relations could be observed, however, between disfluency and reading ability for the stuttering child, except for reading rate. This finding does not support the contention that reading, and therefore language, problems are important determinants of stuttering.

In conclusion, then, the most reasonable interpretation of the results of this study is that the observed differences between the two groups are more a reflection of differences in the execution of speech than that they are indicative of differences in the decoding and comprehension of written material. More evidence will be needed to show how precisely oral performance and linguistic competence interact in the stuttering child during oral reading. However, the apparent differences in the performances on the silent and oral reading tests demonstrate the importance of using both forms of tests in assessing the reading abilities of the stutterer.

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