Attention and Stuttering: Do Stutterers Think Too Much About Speech?

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In this investigation the ability of stutterers and nonstutterers to simultaneously perform speech and nonspeech tasks was compared. Subjects were 10 stutterers and 10 nonstutterers. Two experiments were conducted. In the first, subjects performed a non-attention-demanding gross-motor task while they read aloud. In the second, subjects performed an attention-demanding task (reading comprehension) during speech. Results indicated that there was no significant change in the disfluency values of stutterers during the motor activity or as a result of the reading comprehension task. However, stutterers were found to perform significantly poorer than nonstutterers on the reading comprehension task. This finding was taken as evidence that stutterers devote more attention to speech than do nonstutterers.

INTRODUCTION

It has often been said about stuttering that its frequency varies with the amount of attention stutterers give to their speech (see, for example, Bloodstein, 1981). Anecdotal reports from stutterers invariably include comments about how stuttering decreases when the stutterer is not thinking about or attending to speech. In light of the important role that attention might play in stuttering, there has been surprisingly little research investigating the relationship between attention and stuttering. One way to evaluate this relationship is to determine the ability of stutterers to simultaneously perform a nonspeech task during speech. If stutterers devote a disproportionate amount of attention to speech, such studies should find that stutterers are poorer than nonstutterers performing a nonspeech task during speech.

The previous research in this area for the most part supports this

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view. For example, an early study by Herren (1931) found that stutterers had difficulty voluntarily extending and flexing their hands during speech. A correlation was noted between the duration and severity of stuttering and stutterers' ability to perform this motor action. Some years later, Froeschels and Rieber (1963) noted that stutterers had significantly more trouble perceiving both visual and auditory stimuli during speech than normal speakers. These findings suggested that stuttering adversely affected perceptual functioning. Bloodstein (1981), however, cites two studies (Perkins, 1969; Hugo, 1972) which did not confirm these findings and suggested that perceptual difficulties might be an extreme symptom of stuttering.

A study by Ringel and Minifie (1966) investigated the effects of productive and receptive communication activities on stutterers' abilities to estimate the passage of time, i.e., "protensity" judgments. Ringel and Minifie found that the severity of stuttering significantly influenced protensity judgments and suggested that it was stutterers' preoccupation with speech that caused their poorer performance. Finally, Fransella (1967) found that writing down a series of tape-recorded numbers while reading aloud had no effect on stuttering.

The literature in this area suggests that stutterers are often poorer than nonstutterers performing speech and nonspeech tasks simultaneously. In these instances, stutterers apparently are not able to attend to the nonspeech task as well as nonstutterers. It is known (Kinsbourne and Hicks, 1978) that humans possess only a limited amount of functional attention and that efficiency on an attention-demanding task is often lost when this task is performed simultaneously with another attention-demanding task. Quite possibly, stutterers devote an abnormally high amount of attention towards speech, resulting in a reduction of the amount of attention that can be directed towards the nonspeech task. Alternatively, attention towards speech might be excessive only during moments of stuttering.

We are not entirely comfortable with the profile of stutterers that emerges from these studies and the implications this profile has for the relationship between attention and stuttering. Although there might exist a group of stutterers who have difficulty coordinating speech and nonspeech activities and, therefore, probably are preoccupied attentively towards speech, we would like to believe that this difficulty and preoccupation are not representative of the entire stuttering population.

To substantiate this belief, two experiments were conducted that compared the ability of stutterers and nonstutterers to simultaneously perform speech and nonspeech tasks. In the first experiment, subjects performed a simple, repetitive gross-motor activity while readling aloud. It was hypothesized that the speech of stutterers and nonstutterers would not be adversely affected by the motor activity because the activity did not require higher-level mental processes. Although to carry out even the most simple gross-motor activities some attention is required, the motor-activity in this experiment was assumed to be a non-attention-demanding task since it did not involve higher-level mental processes. In the second experiment, the same subjects, while also reading aloud, performed a task (reading comprehension) that required higher-level mental processes. It was predicted that this task, an attention-demanding one, would either adversely affect stutterers' speech or itself be adversely affected by the speech task. In other words, we hypothesized that stutterers would either experience a decrease in fluency or perform poorer than nonstutterers on the reading comprehension task.

METHOD

Subjects

Subjects were ten stutterers, eight males and two females, with a mean age of 31.9 yr (range 18–66 yr) and ten nonstutterers, six males and four females, who had a mean age of 27.3 yr (range 19–45 yr). None of the stutterers had any history of neurological problems or chronic hearing loss. At the time of testing, these subjects had just begun an intensive therapy program at the Cleveland Hearing and Speech Center. All testing was conducted during the first week of the program to control for the possible effects of therapy. Severity of stuttering ranged in these subjects from mild (4) to severe (2), based on frequency measures of stuttering in oral reading and spontaneous speech. Finally, none of the nonstutterers evidenced any history of speech, language, or hearing problems.

Experiment 1

In this experiment subjects read portions of the Rainbow Passage before, during, and after performing a simple gross-motor activity. For all

but four subjects, two stutterers and two nonstutterers, the activity was stepping up and down a 10-in high, 4-ft square table. The other four subjects performed less strenuous "toe-raisers" either because they were in poor physical condition or because of their age.

Subjects, seated, were first asked to read the first third of the Rainbow Passage aloud. Baseline fluency data were obtained from this reading. Subjects then familiarized themselves with the motor activity for one minute. Next, subjects were handed the Rainbow Passage and instructed to read the second third of the passage while continuing to perform the motor activity. The experiment concluded with subjects reading the final portion of the Rainbow Passage. Each portion of the Rainbow Passage contained approximately 110 words.

Disfluencies were noted during the actual testing by two scorers, in most cases the two authors. In some instances, however, a graduate student in speech pathology served as the second scorer. Since we were interested in measuring the increase in "stuttering," only disfluencies that have been shown to be characteristic of stutterers were scored (Williams et al., 1968; Curran and Hood, 1977). These included sound and syllable repetitions, prolongations, inaudible and audible fixations, agrammatical pauses, and disrhythmic phonations (e.g., broken words and tense interjections). Differences in the initial scoring of disfluencies were resolved by listening to audio recordings of the testing sessions. All inaudible fixations were initially marked as such and were not subject to validation involving the audio recordings.

Experiment 2

In this experiment, subjects were asked to respond to questions about the content of four reading passages after having read these passages aloud. An attempt was made to determine the effects of attention on reading comprehension by experimentally manipulating the attention variable. This was done by not forewarning subjects that reading comprehension questions would be asked. Instead, subjects were told that the experiment was investigating the effects of multiple readings on speech. After the first reading of the first passage, six reading comprehension questions were asked, much to the surprise of both the stutterers and nonstutterers. When the reading comprehension questions were asked

after the subsequent passages, subjects were of course no longer surprised. The knowledge that reading comprehension was going to be evaluated presumably affected a subject's attention to the content of the subsequent passages read. Whereas attention to the reading content might be minimal for the first passage, it should be increased during the reading of the subsequent passages. The design of this experiment thus made it possible to determine the effects that attention to a nonspeech task (reading comprehension) had not only on the performance of the nonspeech task but on speech as well. If stutterers are in fact inferior to nonstutterers on tasks performed during speech, then there should be an inverse relationship between their reading comprehension scores and a measure of fluency. As fluency improves, reading comprehension should become poorer and vice versa.

As part of another study which examined the phonetic factor in stuttering, all subjects read four phonetically weighted passages at least three times each. Only the first readings were analyzed in the current study. The reading comprehension questions were always presented after the first reading. The presentation of the passages was counterbalanced for the two groups of subjects. Whether or not the phonetic factor affected subjects' speech or reading comprehension scores was considered in the analyses of the data for this experiment.

RESULTS

Experiment 1

Data in the form of number of disfluencies were calculated for stutterers and nonstutterers for each portion of the Rainbow Passage. Recall that the first portion of the Rainbow Passage was read before the subjects began the motor activity, the second portion, during the motor activity, and the third portion, with subjects again seated. The data for this experiment are presented in Table 1. In examining these data, it is evident that performing the motor activity had little effect on the speech of nonstutterers, as no nonstutterer had more than two disfluencies. In contrast, performing the motor activity appeared to have some effect on the speech of several stutterers, though group differences in disfluency values across the three conditions proved to be insignificant [Wilcoxon

TABLE 1

Data for Experiment 1

Subject	Age	Sex		Disfluencies		
				Before	During	After
Stutterers						
1.	18	M		0	4	4
2.	19	M		5	28	18
3.	20	M		11	14	19
4.	24	M		1	0	0
5.	25	M		1	1	2
6.	25	F		0	0	1
7.	30	M		6	4	6
8.[a]	33	F		24	35	46
9.	60	M		9	6	16
10.[a]	66	M		12	17	15
			Mean	6.9	10.9	12.7
			SD	7.5	12.4	13.8
Nonstutterers						
1.	19	M		0	0	0
2.	19	M		0	2	0
3.	21	M		0	2	0
4.	22	F		0	2	0
5.	24	F		0	0	0
6.	29	M		0	0	0
7.	30	F		0	0	0
8.	31	M		0	2	0
9.[a]	33	F		0	0	0
10.[a]	45	M		1	0	0
			Mean	0.1	0.8	0.0
			SD	0.3	1.0	0.0

[a]Performed "toe-raisers."

Matched Pairs Signed-Rank Test, $p>0.10$ (Siegel, 1956)]. The high standard deviations indicated considerable variability in this group of stutterers. The type of action performed (stepping up and down the table or toe-raisers) appeared not to contribute to this variability as the subjects who performed toe-raisers had disfluency values resembling other subjects in the study.

The individual subject data indicated that six stutterers had more disfluencies in the reading following the motor activity than in the reading during the motor activity. Only one stutterer (No. 2) clearly was affected adversely by the motor activity, his frequency of stuttering increasing by more than five times during the motor action. When the motor activity was terminated, however, his frequency of disfluencies decreased by almost half. In contrast to this subject, three subjects (Nos. 3,8,9) had substantially more disfluencies after the motor activity than during it, indicating that their speech was influenced not only by the motor activity but by some indeterminable factor as well (e.g., increased blood pressure or pulse rate, fatigue, relaxation of speech controls, etc.).

Experiment 2

Within- and between-group comparisons were possible in this experiment. First examined was the effect knowledge of the reading comprehension task had on each group's comprehension scores. Neither the stutterers nor the nonstutterers were found to significantly increase their reading comprehension scores with knowledge of the task (Wilcoxon Matched Pairs Signed-Rank Test, $p>0.10$). Nevertheless, all but one of the nonstutterers' reading comprehension scores improved with knowledge of the comprehension task (see Table 2). In contrast, only two stutterers' reading comprehension scores improved with knowledge of the task. Clearly, most of the stutterers were not affected in the same way as nonstutterers by knowledge of the reading comprehension task.

Our next analyses compared the two groups' performance on the reading comprehension task. No significant difference was found between stutterers and nonstutterers' initial reading comprehension scores (i.e., without knowledge of the task). The fact that there was no difference between these scores can be taken as evidence that the two groups had comparable reading comprehension abilities. This initial comparability of the two groups' reading comprehension abilities is important because significant differences between the two groups were found once subjects had knowledge of the task (Mann-Whitney U Test, $p<0.001$). These differences were maintained throughout the remainder of the experiment, such that the overall reading comprehension scores of nonstutterers were significantly better than those of stutterers (Mann-Whitney U Test, $p<0.01$).

TABLE 2

Data for Experiment 2

	Reading Comprehension			Disfluencies		
Subjects	Passage 1	Passage 2	All Passages	Passage 1	Passage 2	All Passages
Stutterers						
1.	4	6	3.0	0	3	1.75
2.	3	2	3.25	15	12	11.38
3.	4	3	3.5	10	8	13.0
4.	3	3	3.75	1	0	0.25
5.	3	2	2.55	3	2	4.0
6.	4	3	3.5	2	1	0.63
7.	4	3	4.75	6	5	4.25
8.	4	4	3.5	26	23	29.75
9.	3	3	3.75	5	5	7.25
10.	2	3	2.5	16	7	7.0
Mean	3.4	3.2	3.4	8.4	6.8	7.9
SD	0.7	1.13	0.67	8.3	7.6	8.8

Nonstutterers						
1.	3	4	4.25	0	0	0
2.	3	4	4.0	0	0	0
3.	5	6	4.5	0	0	0.25
4.	3	4	4.5	1	0	0.25
5.	1	4	3.0	0	0	0
6.	6	4	5.5	0	0	0
7.	2	4	4.0	1	0	0.25
8.	5	6	5.75	1	0	0.5
9.	4	5	5.0	0	0	0
10.	3	4	4.25	0	0	0.25
Mean	3.5	4.5	4.48	0.3	0	0.15
SD	1.5	0.85	0.79	0.48	0	0.17

Our final analyses examined the relationship between fluency and reading comprehension proficiency in stutterers, since it was possible for some of the phonetically-weighted reading passages to cause more reading difficulty than others. For this reason, the presentation of the four passages was counterbalanced. A Wilcoxon Matched Pairs Signed-Rank Test indicated that no significant differences existed either in reading comprehension scores or in the frequency of disfluency associated with the four passages.

DISCUSSION

In order to better understand the relationship between attention and stuttering this study examined the ability of stutterers and nonstutterers to simultaneously perform a non-attention-demanding task during speech and an attention-demanding task during speech. Consistent with our initial hypothesis, the data in the first experiment indicated that, in general, the speech of stutterers and nonstutterers was not affected adversely by the simultaneously performed gross-motor activity. Apparently, the majority of stutterers in this study were not so preoccupied or attentive to their speech that they could not perform a simple, repetitive gross-motor action during speech without a concomitant increase in disfluencies.

The findings from the second experiment were also consistent with our initial predictions. In this experiment, stutterers were found to perform significantly poorer than nonstutterers on the attention-demanding reading comprehension task, given knowledge of the task. A quite remarkable finding from this experiment was that half of the stutterers actually obtained lower reading comprehension scores with knowledge of the task, while three others obtained the same scores. In contrast, all but one nonstutterer increased his or her reading comprehension score with knowledge of the task. It was as if the stutterers knew that they would not be able to attend both to the speaking task and the reading comprehension task. Deciding that the speech task was the more important one of the two, attention was not reapportioned from the speech task to the reading comprehension task. As a result, there was no significant change either in frequency of disfluencies or reading comprehension scores. Some postexperiment probing revealed that some of

the stutterers had preconceived notions regarding their ability (in this case, inability) to read aloud while attending to reading content.

Let us summarize at this point the findings from the two experiments. First neither the non-attention-demanding task nor an attention-demanding task had an effect on the speech of stutterers. That is, there was no significant change in the disfluency values of stutterers during the motor activity or as a result of the reading comprehension task. Second, the findings from the second experiment indicated that most stutterers devoted more attention to the speech production process than did nonstutterers. Given that humans possess only a limited amount of functional attention, stutterers who devote an increased amount of attention to speech necessarily have less attention to devote to another attention-demanding task that accompanies speech. Thus, the third major finding: stutterers performed significantly poorer than nonstutterers on the attention-demanding reading comprehension task.

The relatively poor performance of stutterers on the reading comprehension task supports previous research (Herren, 1931; Froeschels and Rieber, 1963; Ringel and Minifie, 1966) showing that stutterers typically perform poorer than nonstutterers on attention-demanding tasks accompanying speech. The findings in this study also are consistent with stutterers' reports that they attend too much to speech. What has not been answered in this study or in previous ones is why stutterers often devote a disproportionate amount of attention to the speech production process. In the remainder of this paper, we offer some speculative thoughts on this subject.

The traditional answer given to this question is that stutterers pay too much attention to speech because they stutter. Conversely, we sometimes hear that stutterers stutter because they devote too much attention to speech or speech-related phenomena. Both of these reasons, though somewhat contradictory, are in part correct. They are both correct because of developmental changes that occur in the relationship between stuttering and attention. It is our view that initially stutterers devote a disproportionate amount of attention to their speech because they stutter. Just as language-disordered, reading-disordered, and other handicapped individuals must devote additional attention to their deficiencies, incipient stutterers must devote increased attention to the speech production process because they are simply not as good as nonstutterers in tempo-

rally coordinating these processes (cf. Van Riper, 1971). When the young stutterer apportions more attention to speech, he is doing so to increase the efficiency of the speech production mechanism. In many young stutterers, devoting more attention towards the coordination of speech movements often diminishes or eliminates the stuttering problem. For some stutterers, however, devoting more attention to the speech production process does not permanently eliminate the problem. In these instances, the amount of attention devoted to speech production probably decreases as the stutterer begins to devote more and more attention to planning and executing avoidance and escape behaviors that have been developed to cope with the negative aversive stimuli associated with stuttering. What begins, then, in the incipient stutterer as an apportionment of attention to improve an inefficient speech production mechanism ends up in the mature stutterer as an apportionment of attention focused as much on the various learned escape and avoidance behaviors as on the processes of speech production. In light of these points, it is not surprising that the most successful therapies, through various means, have eliminated the attention stutterers direct towards the planning and execution of escape and avoidance behaviors, thus allowing stutterers to focus the majority of their attention on coordinating the speech production processes.

In conclusion, the experiments reported in this paper have compared the ability of stutterers and nonstutterers to simultaneously perform nonspeech tasks during speech. Stutterers were found to perform poorer than nonstutterers on an attention-demanding task which accompanied speech. This finding was taken as evidence that stutterers devote more attention to speech than nonstutterers. It was speculated that the relationship between attention and stuttering appears to be contradictory at times because of developmental changes that affect the nature of this relationship.

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