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# A study of the relationship between syllable rate and fluency

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A STUDY OF THE RELATIONSHIP BETWEEN

SYLLABLE RATE AND FLUENCY

By

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Chapter 1

# INTRODUCTION

> From a scientific standpoint the problem of defining a phenomenon is intimately bound up with the question of the operations we use to measure it. Consequently, it will be useful to explore the measurable dimensions of stuttering. How does one express quantitatively such a concept as the degree, amount or severity of stuttering behavior? In investigations of this problem so far essentially five ways have been found for doing this.

Bloodstein (1969) makes this statement in his book A Handbook on Stuttering. He then goes on to name these five ways: frequency of stuttering, mean duration of stuttering, frequency of specified dysfluencies, ratings of severity, and speech rate. The relationship between two of these, speech rate and frequency of specified dysfluencies, was the concern of this study.

The purpose of this study was to investigate the relationship between syllable rate and frequency of dysfluencies. A few studies have previously investigated the rate-dysfluency relationship. These studies used over-all rate, whereas syllable rate was used in this study. Speech consists of the motoric sequencing of syllables and words. Each speaker articulates these motor sequences at different rates. It would seem that this specific articulation rate rather than over-all rate might most directly relate to dysfluencies. This author felt that the use of the syllable rate would approximate this articulation rate.

Kelly and Steer's (1949) study supports the validity of using syllable rate since they found that over-all rate of speech was not descriptive of the actual sentence rates employed by the speaker. The results indicate that speech is very variable in rate and over-all rate fails to reveal these true speaking rates. Sentence-by-sentence analysis and syllable rate came closer to revealing the true speaking rate as well as the true variability of rate.

Johnson and Rosen (1937) did one of the first studies on the relationship between rate and fluency. It was designed to ascertain whether specific changes in the stutterer's speech pattern would affect changes in the frequencies of stuttering. One set of changes studied was very slow, normal, and fast oral reading rates. The results showed that in the slow reading, stuttering occurred on an average of 1.3 percent of the words compared with three successive "normal" readings in which stuttering was recorded on 7.6 percent, 3.8 percent, and 3.5 percent of the words, respectively. "Fast" reading contained the highest frequency of stuttering, 7.7 percent.

Several years after this study, Bloodstein (1944) specifically looked at the relationship between oral reading rate and frequency of stuttering. Oral reading rate was defined as word rate and varied as the result of using three differently constructed passages: monosyllabic only, average (monosyllabic and polysyllabic), and polysyllabic only. He found the stutterers' mean rate to be 122.7 words per minute, with a high negative correlation between over-all reading rate and frequency of stuttering. These results seem to contradict Johnson and Rosen's (1937) results showing the faster the rate, the greater the number of dysfluencies.

There may be several reasons for the discrepancy between Johnson and Rosen's results and those of Bloodstein. Bloodstein allowed each subject to read the passage silently before reading aloud; Johnson and Rosen did not. Bloodstein's stutterers had fewest dysfluencies on the monosyllabic passage, more on the average passage, and most dysfluencies on the polysyllabic passage. The subjects reading fastest on the monosyllabic passage, slower on the average passage, and slowest on the polysyllabic passage according to over-all rate lead Bloodstein to his conclusions. However, considering the mean word length of the polysyllabic passage was 2.2 syllables, the average passage 1.5, and the monosyllabic passage 1.0, and their respective word rates were 85, 122, and 150 words per minute, the syllabic rate was the reverse of their word rates: polysyllabic 187 syllables per minute, average 183 syllables per minute, and monosyllabic 150 syllables per minute. Therefore, using syllable rate, the results obtained by Bloodstein would be similar to those obtained by Johnson and Rosen: the faster the rate, the greater the number of dysfluencies.

Fransella and Beech (1965) did a study of the effect of rhythm on the speech of stutterers, which also included an examination of stuttering behavior under varying speed of the metronomic beat. They found that the speed of the metronome beat significantly influenced the amount of stuttering. Under all conditions of rhythm (rhythmic metronome, no metronome, arhythmic metronome), there were fewer dysfluencies at slow speeds than at usual speeds.

Further research by Johnson (1961) was undertaken "to obtain normative and comparative data respecting rate and dysfluency in the speech and oral reading of adult male and female stutterers in words per minute." The results showed that the difference between stutterers and nonstutterers was highly significant, with the nonstutterers showing the higher speaking and reading rates. In general, the nonstutterers were considerably less dysfluent than the stutterers. However, rates were over-all rates, not syllable rates, and, since it is very plausible that the speech of the stutterers contained many "extra syllables," these results may not be inconsistent with previously cited findings.

All of the above studies in some way looked at the over-all rate and its relationship to dysfluencies. Both Johnson and Rosen and Fransella and Beech found that with faster speech there were more dysfluencies. Bloodstein found just the opposite when using over-all rate, but if syllable rate is computed his results are consistent with the other two studies. These three studies were based on intrasubject measurement. Johnson, in another study using intersubject measurements, did not specifically try to change rate, but found that stutterers had slower over-all rates, but syllable rate was not considered.

In the previously cited intrasubject studies, stutterers were used as subjects. The present study involved "nonstuttering" subjects as an appropriate population for investigating the basic intrasubject relationship between rate and frequency of dysfluencies.

## STATEMENT OF PROBLEM

The present study used syllable rate and frequency of dysfluencies to study the relationship between rate and fluency in both oral reading and spontaneous speaking.

If the total amount of dysfluencies changed with the rate (fast vs. normal), of secondary interest was a general examination of the relationship between syllable rate and specific types of dysfluencies. No previous studies have looked at the relationship between rate and specific type of dysfluencies.

It was hypothesized that the amount of dysfluencies would increase with an increase in syllable rate, both on the spontaneous speaking and reading tasks.

## DEFINITION OF THE EXPERIMENTAL VARIABLES

The experimental variables were:

1. independent variables:
   a. speaking tasks:
      spontaneous speaking and oral reading
   b. rates: "normal" and "fast" syllable rates
2. dependent variable: the total number of dysfluencies per 100 words produced in the subjects' speech.

The spontaneous speaking task involved 10 30-second talks on 10 different words: flower, honesty, cup, ring, trustworthy, mild, map, plain, happiness, and individuality. Five words were used for the "normal" rate task and five for the "fast" rate task. The words were independently randomized to these tasks for each subject respectively.

The reading task required reading a 300-word passage (Appendix A), beginning at the subject's "normal" rate and increasing this rate as the subject continued to read.

"Normal" syllable rate was defined as the rate at which the subjects spoke or read when asked to speak or read at their normal rate.

"Fast" syllable rate was defined a priori as at least a 70 percent increase over the "normal" rate based on the limited intrasubject data available (Kelly and Steer, 1949). It was later redefined as at least a 23 percent increase over the "normal" rate, as 70 percent was unattained by all but two subjects. The final definition of "fast" rate seemed appropriate using intersubject normative data presented by Fairbanks (1960) which indicated the 100th percentile to be 23 percent above the median of this group.

Subject's dysfluencies were any aspect of speech which could be classified according to Johnson, Darley, and Spriesterbach's classification of dysfluencies (Appendix B).

# Chapter 2

# PROCEDURE

## SUBJECTS

A group of 20 male volunteers who considered themselves to be normally fluent participated in the experiment. These 20 males, ages 16 to 18, were from the sophomore, junior, and senior classes at Sentinel High School, Missoula, Montana. Name, age, year in school, and normality of speech for the subjects were determined by the experimenter's questioning of the subjects before the procedure began. The first 20 subjects were used for the experiment, as none reported any speech defects, nor were they considered by the experimenter to have defective speech. Therefore, it was not necessary to reject a single volunteer. The students were told that they were participating in a thesis experiment, and that no information regarding the experiment could be revealed until the experiment had been completed on all subjects.

## APPARATUS

The apparatus consisted of an office-sized room which contained a tape recorder (Uher Model 400 Report L) for recording the subjects' speaking samples, a table and two chairs. The microphone of the tape recorder was placed on the table, approximately two feet from the subject.

## EXPERIMENTAL PROCEDURE

In this investigation "normal" and "fast" speaking samples were collected from 20 male subjects while they were reading orally and speaking spontaneously. The subjects were assigned numbers according to their order of appearance for the experiment. All subjects participated in the reading task first. Odd-numbered subjects performed the "normal" rate spontaneous speaking tasks second followed by the "fast" rate spontaneous speaking tasks. Even-numbered subjects performed the "fast" rate spontaneous speaking tasks followed by the "normal" rate spontaneous speaking tasks.

During the reading task each subject read aloud a 300-word passage. The subject was asked to begin reading at his "normal" rate, and then was asked to read faster and faster each time the experiment said "Faster!" (See Appendix C for instructions to subject.) The reading task occurred first so that the subjects had some understanding of their "fast" rate before they were asked to perform the "fast" spontaneous speaking task.

Spontaneous speaking tasks were obtained by flashing a word to the subject and asking him to talk for 30 seconds on this word. For the "normal" rate tasks the subject was under no time pressure, but, in order to get a "fast" rate, the subject was asked to begin speaking as soon as he saw the word and to think and speak as quickly as possible. (See Appendix C for instructions.) Each subject spoke five 30-second tasks at "normal" rate and five 30-second tasks at "fast" rate. The rates were counterbalanced for order of presentation among subjects.

When all subjects had completed the procedure, the "normal" and "fast" spontaneous speaking task responses were placed in random order; the syllable rates were measured and a count of the number and type of dysfluencies in the taped responses took place. The reading task was then similarly analyzed without regard to "normal" or "fast" portions. In all, 60 speech samples were analyzed: 20 reading tasks, 20 "normal" rate spontaneous speaking tasks, and 20 "fast" rate spontaneous speaking tasks.

To measure syllabic rate, the phrase was used as a minimal unit. The phrases from each trial were timed with a stop watch, and a rate was computed by dividing the number of syllables by the number of seconds. The mean of these rates was used as the rate for that trial for each subject. The mean phrase rate, based on the first reading trial, was used as the rate for the "normal" reading task. The mean phrase rate for the remaining reading trials after instructions to read faster were given was used as the rate for the "fast" reading task. The phrase rate for "normal" and "fast" spontaneous speaking tasks was the average within each respective spontaneous task.

The experimenter analyzed independently each speaking sample, and computed the dysfluencies per 100 words for each of the tasks. The formula for computing this index was (ND/NW)100, in which ND represented the total number of dysfluencies in the speech sample and NW represented the number of words of the subject for the sample. This procedure for computing dysfluencies was similar to that used by Johnson (1961).

The number of dysfluencies was computed for each trial. The total number of dysfluencies based on the first reading trial was used as the number of dysfluencies for the "normal" reading task. Each subject's "dysfluency score" for the "fast" reading task consisted of the mean for the "fast" reading trials. The "dysfluency score" for "normal" and "fast" spontaneous speaking tasks was the average within each respective spontaneous speaking task.

To establish the experimenter's reliability, another graduate student in speech pathology and audiology, with an equal interest and background in stuttering as the experimenter, also evaluated the responses. She independently analyzed half of the speech samples using the criteria listed in Appendix B. The interjudge correlation using a Pearson product-moment correlation coefficient was 0.99, indicating very high agreement between judges.

A coefficient of risk of .10 was used for analyzing the data.

## Chapter 3

## RESULTS

It was hypothesized that a group of normally fluent male speakers would exhibit more dysfluencies at fast rates than at their normal rates on both spontaneous speaking and reading tasks.

Data which was calculated on the subjects' rates and dysfluencies included the following:

### SPONTANEOUS SPEAKING TASK

#### Rate

In order to establish the validity of the "fast" and "normal" trials, a comparison was made between the rates of the two conditions for the 20 subjects. The "normal" trials were those five on which the subject was asked to speak at his normal rate, while the "fast" trials were those five on which the subject was pushed to go as fast as he was able. Of 20 subjects, 19 went faster on at least three "fast" trials over their "normal" trials. Of these 19, four had an increased rate on three of five "fast" trials over their fastest "normal" rate. Seven more had an increased rate on four of the five "fast" trials over their fastest "normal" rate. Eight subjects had an increased rate on all five "fast" trials over their fastest "normal" rate. The "fast" trials and "normal" trials as defined by the instructions were considered to be sufficiently valid to test the relationship between rate and dysfluencies since the mean percentage of increase between these two tasks was at least 23 percent for 19 subjects. However, one subject reversed this pattern by generally speaking faster on the "normal" trials and slower on the "fast" trials. The experimenter chose to use his fastest trials as "fast" trials regardless of instruction and retain him as a subject.

The initial comparison of the number of dysfluencies on the "normal" and "fast" trials was then made.

Dysfluencies

Ten dysfluency counts were made for each subject on the spontaneous speaking tasks: five for the five "normal" rate trials and five for the five "fast" rate trials. The number of dysfluencies per subject was the mean number of dysfluencies per 100 words for the five "normal" trials and the mean number of dysfluencies per 100 words for the five "fast" trials. The differences between the averages of the "normal" trials and the averages of the "fast" trials were calculated for each of the 20 subjects. The mean difference of 0.1802 was obtained. Using the t-test for correlated observations, the "t" ratio was .1198, which is not significantly different from zero (df = 19; $p < .10$). Thus, the change in dysfluencies from "normal" to "fast" rates does not support rejection of the null hypothesis.

Since the subjects were generally following directions as shown by the rate data above, there is no evidence to assume that an increase in rate generally results in an increase in dysfluencies. To double check the general relationship between rate and dysfluencies, the dysfluencies of the five slowest trials were compared to the dysfluencies of the five fastest trials regardless of instruction for all 20 subjects. The number of dysfluencies per subject was the mean number of dysfluencies per 100 words for the five slowest trials and the mean number of dysfluencies per 100 words for the five fastest trials. Using each subject's mean, the differences between the average of the slowest trials and the average of the fastest trials were calculated for each of the 20 subjects. A mean difference of .8569 was obtained. Using a t-test for correlated observations, the "t" ratio was .5383, which is not significantly greater than zero (df = 19; $p < .10$), further supporting the lack of demonstrated relationship between rate and dysfluency in general.

However, further examination of the data revealed a tendency for subjects who had a slower rate on the "normal" trials to have an increase in dysfluencies on the "fast" trials over those who had a faster rate on the "normal" trials. The subjects were divided then into two subgroups: the 10 "slower speakers" versus the 10 "faster speakers." Using the same individual dysfluency data as originally calculated, a difference in mean number of dysfluencies between the "normal" and the "fast" trials per instructions was 1.25 for the "slower speakers" and -.89 for the "faster speakers." Since the variances of these two groups varied by a factor of 10, a Chi square was used to compare the differences between these two groups.

The Chi square of independence compared the 10 "slower speakers" and the 10 "faster speakers" against an increase or decrease in dysfluencies between "normal" and "fast" trials as presented in Table 1 below. The result from this test was a "$x^2$" equal to 1.87, which was not significant at the .10 level of confidence (df = 1).[1]

To further check for any fluency differences between "slower speakers" and "faster speakers," the data was also analyzed using the five slowest trials without regard to the instructions given the subjects vs. the five fastest trials regardless of instructions. The number of dysfluencies per subject was computed, as that calculated above, using the five slowest trials and the five fastest trials.

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[1]The Chi Square formula employed the Yates correction for continuity due to small hypothetical values (Siegel, 1956).

Comparing these two groups, the mean difference in dysfluencies from the slowest to the fastest trials was 3.21 for the slower group and -1.504 for the faster group. A "t" ratio of 1.580 was significant at the .10 level of confidence (df = 18).

Table 1. The Change in Dysfluencies from "Normal" to "Fast" Rates for "Slower Speakers" vs. "Faster Speakers"

| | Increase in dysfluencies | Decrease in dysfluencies |
|---|---|---|
| "Slower speakers" | 6 | 4 |
| "Faster speakers" | 2 | 8 |

The Chi square test was also used on this data to compare those who began slower and those who began faster on the "normal" trials against an increase or decrease in dysfluencies between slowest and fastest trials, as presented in Table 2 below. The result was a "$x^2$" equal to 5.0, which was significant at the .05 level of confidence (df = 1).

Thus, the data seems to suggest that an increase in rate results in an increase in dysfluencies if the rate of "normal" speaking is considered. In order to assess the exact relationship between rate and dysfluency, the percentage of increase of the "slower speakers" was compared to the percentage of increase of the "faster speakers." The percentage of increase was calculated for each subject and then the mean of the "slower speakers" was compared to the mean of the "faster speakers." The mean rate increase of the "slower speakers" was 138.38 percent, while the mean rate increase for the "faster speakers" was 71.21 percent. A "t" ratio of 2.3050 was significant at the .025 level of confidence (df = 18).

Table 2. The Change in Dysfluencies from Slowest to Fastest Rates for "Slower Speakers" vs. "Faster Speakers"

| | Increase in dysfluencies | Decrease in dysfluencies |
|---|---|---|
| "Slower speakers" | 8 | 2 |
| "Faster speakers" | 2 | 8 |

Thus, it seems that the significantly greater increase in dysfluencies in the "slower speakers" can be attributed to a significantly greater increase in rate over the "faster speakers." Thus, there is no evidence to support the assumption that an increase in rate is singly related to an increase in dysfluencies, but there is some evidence to support the contention that increased rate is related to an increase in dysfluencies during spontaneous speaking if the percentage of increase is taken into consideration. There are, however, notable exceptions to this tendency among subjects.

# READING TASK

## Rate

On the reading task the subjects were asked to begin reading at their normal rate and to increase their rate after they heard the experimenter say "Faster!" Those sentences before the first "Faster!" were considered the "normal" task and those sentences after the third "Faster!" were considered the "fast" task.

Of 20 subjects, 19 had an increase in rate after they heard the first "Faster!" All 20 subjects were going faster than "normal" after the third "Faster!" was spoken by the experimenter. Thus, all subjects had a "normal" task and at least one "fast" task between which a difference in dysfluencies could be compared.

## Dysfluencies

There were two dysfluency counts for each subject on the reading task: the number of dysfluencies per 100 words on the "normal" task and the number of dysfluencies per 100 words on the "fast" task, which was the mean number of dysfluencies from those tasks which came after the third "Faster!" Using each subject's mean number of dysfluencies, the mean difference between the "normal" and "fast" tasks was calculated for the 20 subjects. A mean difference of 2.15 was obtained. Using a t-test for correlated observations, the "t" ratio was 4.188, which is significantly greater than zero at the .005 level of confidence (df = 19), and indicates that an increase in rate on the reading task generally resulted in an increase in dysfluencies.

A comparison similar to that made on the spontaneous speaking task was made between dysfluencies on the "normal" and "fast" tasks for the 10 slower subjects versus the 10 faster subjects. The number of dysfluencies per subject was the same as those calculated above. The mean difference in dysfluencies from the "normal" to the "fast" tasks was 2.14 for the slower group and 2.17 for the faster group. The difference of .03 indicated that no significant difference exists between the slower and faster group during oral reading. Thus, the general trend for increased dysfluency during "fast" oral reading was true of both slow and fast readers. Such a general trend was not obtained for spontaneous speech except for the "slower speakers" who also tended to have a greater percentage increase in rate. There were notable individual exceptions to this trend during spontaneous speech with only minor individual exceptions during reading.

## TYPES OF DYSFLUENCIES

As stated previously, of secondary interest in this study was a general examination of the relationship between syllable rate and specific types of dysfluencies.

For this analysis the dysfluencies were categorized into types as they were counted by the experimenter. For each subject a mean of the types was computed for the "normal" and "fast" spontaneous speaking tasks and the "fast" reading task. Since there was only one "normal" reading trial, the number of each type of dysfluency was the total number per 100 words for that trial. The differences from "normal" to "fast" trials were computed for each type of dysfluency for each subject. The mean difference was computed for the 20 subjects on both the reading and spontaneous speaking tasks for each type of dysfluency.

On the reading task, part-word repetitions and revisions increased the most with an increase in rate. This increase was not only the largest difference noted, but specifically occurred in the readings of at least half of the subjects while the other types showed little change or changed in fewer than half of the subjects.

For analysis of types of dysfluencies on the spontaneous speaking task, the subjects were divided into two groups used previously--"slower speakers" and "faster speakers." The "slower speakers" had an increase in word repetitions and incomplete phrases, while a change was noted in interjections; five subjects increased and five decreased from "normal" to "fast" rate. The "faster speakers" had an increase in word repetitions, while interjections increased in five subjects and decreased in five;

incomplete phrases increased in five subjects and decreased in four.

Change in types of dysfluencies with change in rate was diffuse and inconsistent in spontaneous speech, but quite clearly involved part-word repetitions and revisions during oral reading.

## Chapter 4

## DISCUSSION

The purpose of this study was to examine the relationship between syllable rate and fluency. It was hypothesized that the number of dysfluencies would increase with an increase in syllable rate, both during spontaneous speaking and oral reading tasks. A group of subjects read and spoke at both their "normal" rates and at "fast" rates. The relationship between fluency and rate was based on the number of syllables per second and the number of dysfluencies per 100 words. Of secondary interest was the relationship between rate and types of dysfluencies.

While the subjects had an increase in rate on the spontaneous speaking task, the change in fluency was not statistically significant. There was, however, a statistically significant increase in mean number of dysfluencies with increase in rate in "slower speakers" in contrast to "faster speakers."

On the reading task, the subjects had an increase in rate and a statistically significant increase in dysfluencies from the "normal" to "fast" tasks, with no exceptions between subgroups.

There appear to be several factors involved in the change in dysfluencies from "normal" to "fast" syllable rates. On the spontaneous speaking task, the "slower speakers'" mean percentage of increase in rate was significantly greater than the "faster speakers'" mean percentage of increase, and, thus, percentage of rate increase was probably an important variable involved in the dysfluency increase in "slower speakers." There were several notable individual exceptions to the trend of increased dysfluencies in the "slower speakers." These notable exceptions included several subjects whose dysfluencies did not increase although they had the greatest percentage of increase in rate.

Another factor which seemed to be involved in dysfluency change was the "fastest rate" achieved by the subjects. In comparing the "slower speakers'" mean "fastest rate" to the "faster speakers'" mean "fastest rate," there was little difference. So, the "fastest rates" were similar for many of the subjects, but the "faster speakers" had fewer breakdowns and a smaller change in dysfluencies from "normal" to "fast" rates. Thus, it seemed that "faster speakers" managed fast rates better than "slower speakers." Physiological limits for rate beyond which breakdowns occur in the speech of the individual may exist and vary between "slower" and "faster" speakers and provide a plausible explanation for this finding. The data collected for this study seemed to suggest that "slower speakers" were pushed to these limits while "faster speakers" were not. The data also seemed to suggest that physiological limits vary among subjects with notable exceptions to the trends by individuals within a subgroup. Therefore, one would want to be cautious in predicting any increase in dysfluencies with a "fast" rate for any individual. Information on his physiological skill for articulatory behavior would seem to aid in such a prediction.

The reading results were unlike those of the spontaneous speaking task in that the mean difference in dysfluencies from "normal" to "fast" rate was significant using all 20 subjects; there was no significant difference between the slower and faster readers. The percentage of rate increase, however, was no greater, and even less in most cases, than that of the speaking task. One possible reason for the dysfluency change on the reading task was not the percentage of rate increase, but the fastest rate achieved by the subjects. The "slower speakers'" fastest rates for the spontaneous task were no different than their fastest rates for the spontaneous speaking task. However, the "faster speakers'" fastest rate for the reading task was significantly greater than their fastest rates on the speaking task, and they became more dysfluent at "fast" rate on the reading task. Therefore, it seems probable that the "faster speakers" were pushed to their physiological limits on the reading task, but not during spontaneous speaking. Thus, they had a significant increase in dysfluencies in their "fast" oral reading but not during "fast" spontaneous speaking. Therefore, it would seem that the fastest rate achieved by the subjects in relation to their speaking rate skills is more important than the percentage of increase in rate per se.

Besides the percentage of increase in rate and the consideration of the fastest rate, there are probably other reasons for the differences in reading and spontaneous speaking task dysfluencies. The increase in rate on the speaking task generally resulted in changes in interjections, word repetitions, and incomplete phrases, while the increase in rate on the reading task generally resulted in an increase in part-word repetitions and revisions. In comparing these two tasks, one must consider the differences between reading and spontaneous speaking. Both involve motoric sequencing of sounds and syllables, but spontaneous speaking requires a language formulation process also. Because of this language formulation process, there may have been a tendency for the subjects to monitor their rate on the spontaneous speaking task. They may have increased their rate to a certain extent, when pushed to do so, but went no faster due to the need for time to formulate their thoughts. Therefore, the change in dysfluencies from "normal" to "fast" rates included more of those related to language formulation--interjections, word repetitions and incomplete phrases--rather than those which are more likely due to breakdowns in the motoric sequencing process--part-word repetitions and revisions. On the reading task, since no language formulation time was necessary, the increase in rate probably resulted in breakdowns of the motoric sequencing process as part-word repetitions and revisions.

This data, although collected from "nonstuttering" individuals, would seem applicable to individual "stuttering" cases as they too have physiological limits. Therefore, it would seem that this data has some clinical applications for that stuttering therapy which deals with reducing rate either directly or indirectly. Many times therapy for the "stutterer" includes rate reduction as a way to reduce dysfluencies. The results of this study would support the idea that with slower rates there are fewer dysfluencies for some cases. The data further suggests that some physiological limits are probably involved in an increase of dysfluencies with a "fast" rate. Therefore, just because a person talks "fast" doesn't mean his dysfluencies will increase. The results would validate to some extent the use of rate reduction therapy as a means of reducing dysfluencies, but it would appear that one's individual physiological limits would also need to be considered. Also, further research is needed to determine the diagnostic procedures by which to identify those subjects for whom rate reduction therapy is applicable. Perhaps "stutterers" are dissimilar to the "nonstuttering" population, and perhaps the results of such a study would validate even further the use of rate reduction therapy to decrease dysfluencies.

Since this study was exploratory in nature, it was hoped that one result would be more research in this area. Since the experimenter did not predict a difference between "slower speakers" and "faster speakers," it would seem best to design a study to look more specifically at these two groups and the differences between them.

Another study could be a normative one on stutterers and nonstutterers regarding syllable rate versus frequency of dysfluencies as the literature is lacking in this area.

A normative study is also needed on intrasubject differences in rate. Several studies have looked at this as intersubject studies, but there is little intrasubject data on the range of "normal" for a subject and what is a "fast" rate for that subject.

Future research could also be concerned with the relationship between syllable rate and dysfluencies in different age groups and between the sexes.

Chapter 5

# SUMMARY AND CONCLUSIONS

The purpose of this study was to assess the relationship between syllable rate and fluency. A group of 20 male subjects spoke at a "normal" rate and a "fast" rate on both oral reading and spontaneous speaking tasks. For the reading task the subjects read a 300-word passage beginning at "normal" rate and increasing this rate when the experimenter said "Faster!" During the spontaneous speaking task, which followed the reading task, the subjects spoke on 10 different words, five at "normal" rate and five at "fast" rate. The stimulus words were independently presented in random order for each subject to minimize any word effect; the order of the "normal" and "fast" rates within the spontaneous speaking task was counterbalanced. All oral responses were tape recorded and analyzed for syllable rates and for total number and type of dysfluencies.

In general, the subjects followed instructions to speak faster with one notable exception on the spontaneous speaking task. The average number of dysfluencies for the "fast" tasks versus the "normal" tasks was based on the instructions except for the one subject. The reverse was used for him since he completely reversed his response.

The statistical analysis of the results indicated that there was a general trend for both slow and fast readers to become more dysfluent when they increased their rate. Such a general trend was not obtained for spontaneous speaking tasks except for the "slower speakers" who also tended to have a greater percentage increase in rate. There were notable exceptions to this trend during spontaneous speech with only minor exceptions during reading. Reasons for the difference in dysfluency change between "faster speakers" and "slower speakers" were discussed as due to percentage of increase in rate, the fastest rate achieved by the subjects, and respective subject's physiological limitations.

The change in types of dysfluencies with a faster rate was diffuse and inconsistent in spontaneous speech, but quite clearly involved part-word repetitions and revisions during oral reading. The reasons for these differences were discussed as due to the main differences between speaking and reading: motoric sequencing of sound and syllables is required in both, while spontaneous speaking also requires a language formulation process.

Clinical implications were discussed and future research was indicated on: (1) normative studies on syllable rate; (2) intrasubject studies on the range of "normal" rate; and (3) further research on the differences between "slower" and "faster speakers."

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# APPENDIX A

# READING PASSAGE

People talk with each other by means of acoustic signals. The signals are produced by the speaker and received by the listener. They pass from the one to the other in many different ways. In the most common situation, the speaker and listener are linked directly by the air between them. This air is the natural path that the speech signals follow. Often, however, we can improve upon this arrangement by using equipment between speaker and listener. We convert the speaker's acoustic signals into electrical signals, control them in some way, and then change them back into the acoustic form for the listener to hear. In other words, we give the signals a new path through the equipment.

The fact that we can change the path in this way means we can serve a number of purposes. For one thing, we can amplify the speech signals, or increase their power. As we all know from experience, the power of the human voice is limited. Am amplifier can raise the limit. In a harbor, for example, or a football statium it can be used to make speech audible at a distance. A man who wears a hearing aid carries a small amplifier with him. He needs more power than the average speaker produces, and the hearing aid supplies it.

In their electrical form the speech signals can be sent over very long distances. The radio and the telephone thus allow the speaker to ignore the space that separates him from his listener. If we put a recorder in the system, he can also ignore time. The listener can listen whenever he wants, and repeat the speech as often as he likes. These are only a few of the ways in which equipment can extend speech far beyond the simple, direct situation.

# APPENDIX B

# CLASSIFICATION OF DYSFLUENCIES

1. Interjections of sounds, syllables, or words. This includes extraneous sounds such as "uh," "er," and "um"; or extraneous words such as "well" and "you know," which are distinct from sounds and words associated with the fluent pattern of speech.

2. Part-word repetitions. Repetition of parts of words, i.e., syllables and sounds, are placed in this category.

3. Word repetitions. Repetition of whole words, including words of one syllable, are included in this category.

4. Phrase repetitions. Repetitions of two or more words are included in this category.

5. Revisions. Instances in which the content of a phrase is modified, or in which there is grammatical modification. This includes changes in the pronunciation of a word.

6. Incomplete phrases. An incomplete phrase is one in which the thought or content is not completed and which is not an instance of a phrase repetition.

7. Broken words. This category is typified by words which are not completely pronounced, and which are not classifiable in any other category, or in which the normal rhythm of the word is broken in a way that definitely interferes with the smooth flow of speech. "I was g- (pause) -oing home" is an example of a broken word.

8. Prolonged sounds. Sounds or parts of words which are judged to be unduly prolonged are included in this category (Johnson, Darley, and Spriestersbach, 1963).

# APPENDIX C

## INTRODUCTORY STATEMENTS AND DIRECTIONS MADE BY THE EXPERIMENTER TO THE SUBJECT

My name is ____________________. Please come in and be seated. When the subject had been seated and identifying information had been obtained, the following statement was made:

> You are about to participate in an experiment. Please do not speak to anyone about the experiment until it has been concluded. You are going to read a short passage and speak on several words. The reading task will be first.

Reading Task Directions

> I am going to ask you to read several paragraphs aloud. Please begin reading aloud at your normal rate and every time I say "Faster!" please increase your rate. Try to read as fast as you can, but still keep it distinct and not run together like this: [Experimenter's example].

When the subject had completed the reading task, the following instructions were given:

> Now, you will be asked to speak about 10 words individually for 30 seconds, five at your normal rate and five at fast rate.

Directions for "Normal" Spontaneous Speaking Task

> I am going to present five words to you, one at a time. Would you please talk about the word and what it means for 30 seconds at your normal rate. Are there any questions?

Directions for "Fast" Spontaneous Speaking Task

> I am going to present five words to you, one at a time. Would you please talk about the word and what it means for 30 seconds. Please think and talk as fast as you can. Being talking as soon as you see the word. Are there any questions?

# APPENDIX D

# TABLES

Table 3. Syllables Per Second for the Five "Normal" and the Five "Fast" Trials for the Spontaneous Speaking Task

| Subject No. | "Normal" syllable rates | | | | | "Fast" syllable rates | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.25 | 3.59 | 3.63 | 4.11 | 4.28 | 3.51 | 3.62 | 5.03 | 5.52 | 5.72 |
| 2 | 3.50 | 3.66 | 4.13 | 4.13 | 4.35 | 4.43 | 4.90 | 4.91 | 6.36 | 7.13 |
| 3 | 4.21 | 4.27 | 4.46 | 5.12 | 8.07 | 3.69 | 5.01 | 6.93 | 7.35 | 9.38 |
| 4 | 3.39 | 4.01 | 4.17 | 4.12 | 5.78 | 4.15 | 5.04 | 5.26 | 5.27 | 6.21 |
| 5 | 1.91 | 3.75 | 3.82 | 3.94 | 4.86 | 5.15 | 5.40 | 6.32 | 6.57 | 8.56 |
| 6 | 4.17 | 4.46 | 4.71 | 5.21 | 5.48 | 4.56 | 5.05 | 5.98 | 6.56 | 8.94 |
| 7 | 4.12 | 4.55 | 4.65 | 4.69 | 6.16 | 5.35 | 6.31 | 6.47 | 7.22 | 7.42 |
| 8 | 3.98 | 4.20 | 4.67 | 4.83 | 7.98 | 4.75 | 6.66 | 7.56 | 8.40 | 8.90 |
| 9 | 3.51 | 5.16 | 5.52 | 6.00 | 6.11 | 6.49 | 6.55 | 7.12 | 7.21 | 8.81 |
| 10 | 4.94 | 5.01 | 5.13 | 6.02 | 6.10 | 6.81 | 7.93 | 8.02 | 8.08 | 8.53 |
| 11 | 5.58 | 5.85 | 6.16 | 6.30 | 6.70 | 6.77 | 6.93 | 7.51 | 7.97 | 8.48 |
| 12 | 4.58 | 5.07 | 5.34 | 5.72 | 6.22 | 6.00 | 6.50 | 6.53 | 7.40 | 7.52 |
| 13 | 4.65 | 5.01 | 5.12 | 6.37 | 6.43 | 6.02 | 6.23 | 7.14 | 7.20 | 7.55 |
| 14 | 4.57 | 5.02 | 5.16 | 5.54 | 6.24 | 5.97 | 6.23 | 6.70 | 6.80 | 7.56 |
| 15 | 4.50 | 4.85 | 5.12 | 5.53 | 5.43 | 5.94 | 6.00 | 6.52 | 7.28 | 8.16 |
| 16 | 5.17 | 5.43 | 5.95 | 6.41 | 6.42 | 5.72 | 6.77 | 6.98 | 7.64 | 9.55 |
| 17 | 4.41 | 5.56 | 5.63 | 6.13 | 7.26 | 7.27 | 7.52 | 7.55 | 8.40 | 11.87 |
| 18 | 4.09 | 4.78 | 4.44 | 5.85 | 7.20 | 8.14 | 8.55 | 9.09 | 9.81 | 11.61 |
| 19 | 6.65 | 6.84 | 7.99 | 8.94 | 8.98 | 6.12 | 6.27 | 6.71 | 7.05 | 7.89 |
| 20 | 5.06 | 5.15 | 5.16 | 5.72 | 6.02 | 5.63 | 6.49 | 6.60 | 7.07 | 7.80 |

Table 4. Dysfluencies Per 100 Words for the Five "Normal" and the Five "Fast" Trials for the Spontaneous Speaking Task

| Subject No. | "Normal" trials | | | | | "Fast" trials | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.5 | 20.0 | 16.6 | 57.1 | 14.0 | 16.0 | 14.2 | 9.8 | 11.3 | 21.8 |
| 2 | 4.0 | 12.1 | 6.8 | 7.8 | 7.1 | 10.8 | 7.4 | 10.0 | 1.9 | 33.3 |
| 3 | 13.7 | 28.8 | 16.6 | 24.1 | 23.5 | 28.5 | 20.8 | 22.3 | 26.6 | 17.6 |
| 4 | 17.3 | 8.5 | 25.0 | 10.8 | 15.5 | 11.1 | 8.8 | 21.7 | 15.3 | 32.2 |
| 5 | 15.7 | 28.5 | 21.4 | 8.6 | 9.0 | 20.0 | 15.0 | 20.0 | 50.0 | 29.4 |
| 6 | 8.8 | 9.3 | 7.0 | 16.9 | 5.8 | 12.9 | 6.1 | 10.0 | 6.8 | 11.7 |
| 7 | 18.5 | 15.3 | 12.5 | 11.6 | 17.8 | 8.0 | 7.8 | 18.5 | 10.1 | 25.0 |
| 8 | 20.4 | 16.6 | 25.0 | 33.3 | 26.4 | 28.5 | 66.6 | 40.0 | 55.5 | 26.4 |
| 9 | 5.8 | 6.6 | 18.4 | 12.5 | 15.0 | 5.5 | 5.4 | 8.3 | 2.3 | 14.7 |
| 10 | 20.0 | 13.1 | 10.1 | 18.0 | 9.2 | 14.2 | 14.4 | 4.4 | 12.8 | 20.4 |
| 11 | 12.5 | 3.4 | 7.3 | 5.1 | 5.1 | 8.3 | 6.1 | 1.4 | 11.3 | 5.3 |
| 12 | 25.0 | 12.5 | 20.0 | 4.0 | 20.0 | 4.8 | 7.5 | 13.6 | 5.0 | 3.7 |
| 13 | 16.1 | 5.3 | 2.1 | 2.3 | 6.1 | 3.6 | 3.9 | 3.7 | 2.0 | 8.0 |
| 14 | 20.8 | 8.0 | 13.6 | 8.8 | 5.8 | 16.0 | 14.0 | 7.1 | 7.6 | 2.6 |
| 15 | 5.8 | 6.2 | 28.5 | 16.6 | 14.2 | 16.6 | 14.2 | 20.8 | 4.5 | 3.4 |
| 16 | 1.8 | 12.5 | 11.6 | 3.8 | 11.1 | 6.0 | 15.2 | 15.0 | 17.6 | 9.2 |
| 17 | 23.8 | 12.9 | 7.3 | 17.1 | 15.1 | 8.3 | 12.0 | 11.5 | 26.1 | 14.1 |
| 18 | 28.5 | 33.3 | 16.6 | 33.3 | 5.1 | 9.0 | 12.5 | 7.1 | 12.1 | 20.0 |
| 19 | 4.6 | 4.5 | 12.9 | 10.0 | 10.2 | 0.0 | 4.6 | 14.8 | 10.0 | 15.0 |
| 20 | 14.2 | 9.5 | 4.8 | 7.8 | 7.1 | 16.6 | 0.0 | 7.14 | 21.4 | 13.6 |

Table 5. Syllables Per Second for the "Normal" and the "Fast" Trials for the Oral Reading Task

| Subject No. | "Normal" trial | "Fast" trials | | | |
|---|---|---|---|---|---|
| 1 | 6.57 | 7.75 | 7.97 | 9.03 | 9.07 |
| 2 | 5.94 | 7.36 | 7.69 | 7.84 | 9.15 |
| 3 | 6.21 | 7.42 | 7.88 | | |
| 4 | 5.12 | 5.98 | 6.51 | 6.51 | |
| 5 | 5.26 | 6.41 | 7.03 | 7.51 | 10.13 |
| 6 | 5.55 | 6.77 | 7.02 | 7.57 | |
| 7 | 5.54 | 5.94 | 6.58 | 6.77 | 7.98 |
| 8 | 5.71 | 6.93 | 7.01 | 7.35 | |
| 9 | 5.13 | 6.33 | 6.64 | | |
| 10 | 6.71 | 10.73 | | | |
| 11 | 6.70 | 8.33 | 9.36 | | |
| 12 | 6.83 | 8.32 | 9.38 | 10.31 | |
| 13 | 5.04 | 6.75 | 7.41 | | |
| 14 | 6.05 | 9.62 | 10.45 | 11.54 | |
| 15 | 6.14 | 8.81 | | | |
| 16 | 6.13 | 8.88 | 9.35 | 10.00 | 10.16 |
| 17 | 6.73 | 10.24 | | | |
| 18 | 6.91 | 12.63 | | | |
| 19 | 6.57 | 8.18 | 8.52 | | |
| 20 | 4.86 | 6.82 | 7.39 | | |

Table 6. Dysfluencies Per 100 Words for the "Normal" and the "Fast" Trials for the Oral Reading Task

| Subject No. | "Normal" trial | "Fast" trials | | | |
|---|---|---|---|---|---|
| 1 | 0.00 | 4.54 | 0.00 | 1.69 | 2.63 |
| 2 | 1.96 | 2.17 | 0.00 | 0.00 | 3.03 |
| 3 | 0.00 | 4.54 | 1.47 | | |
| 4 | 0.00 | 1.61 | 5.08 | 0.00 | |
| 5 | 2.04 | 3.03 | 7.40 | 4.54 | 6.66 |
| 6 | 0.00 | 6.89 | 3.84 | 0.00 | |
| 7 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8 | 1.63 | 5.71 | 4.65 | 0.00 | |
| 9 | 6.12 | 4.16 | 8.06 | | |
| 10 | 0.00 | 0.00 | | | |
| 11 | 0.00 | 0.00 | 2.43 | | |
| 12 | 3.22 | 0.00 | 3.57 | 4.00 | |
| 13 | 4.47 | 13.79 | 6.89 | | |
| 14 | 0.00 | 1.16 | 0.00 | 0.00 | |
| 15 | 2.59 | 8.16 | | | |
| 16 | 0.00 | 0.00 | 0.00 | 0.00 | 2.22 |
| 17 | 1.61 | 4.46 | | | |
| 18 | 1.29 | 7.40 | | | |
| 19 | 3.22 | 4.00 | 1.17 | | |
| 20 | 0.00 | 8.16 | 1.63 | | |