

# THE EFFECT OF ARTICULATORY COMPLEXITY ON ADAPTATION IN STUTTERED SPEECH

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## ABSTRACT

Adult stutterers and adult normal speakers read two passages eight consecutive times. The passages were selected so that a marked difference according to Brown's (1945) word weight system existed between them. Performance of all subjects was measured in terms of syllable duration. Less speech breakdown, shorter syllable duration and more rapid adaptation occurred during the stutterers' readings of the passage with the lesser weighting. Although the normal speakers had a greater mean syllable duration rate for the higher weighted passage than for the lesser weighted passage, the difference between the two passages for the normals was minimal and there was no adaptation.

## INTRODUCTION

The adaptation phenomenon in the performance of stutterers on repeated readings of the same material has been a prominent variable in stuttering research. Since Johnson and Knott's first description (1937) investigators have controlled for this variable in most experiments that called for repeated responses from a stutterer. The phenomenon of adaptation has been supported by many investigators studying such concomitant variables as the content of reading material, the time interval between repetitions and the general situational conditions in which the stutterer's oral performance was elicited. Johnson and Inness (1939) found less reduction in stuttering when the reading material differed from trial to trial; Shulman (1955) examined the effect of the length of the reading material on adaptation and Van Riper and Hull (1955) attempted to control syntax of the reading material by having the subjects do successive readings of a passage both forwards and backwards. However, there has been no study emphasizing the decrease in stuttering severity with the reiteration of the message relative to the articulatory complexity of that message.

Some researchers, for example Wischner (1952), have indicated that the stutterer responds to specific word anxiety which may or may not decrease after the initial reading of a passage because of confounding situational anxiety. This is just one of the explanations that has been offered. Milisen (1938) found that stutterers rarely experienced difficulty with words they had labelled "not difficult" and rarely failed to stutter on words which were anticipated as "difficult". These results are in agreement with numerous investigations showing that the stutterers are, indeed, accurate predictors of the words on which they will stutter. Thus, the stutterers' initial introduction to a passage should generate an anxiety level related to the number of words or sounds on which they predict they will stutter. Undoubtedly there are many individual and personal reactions to words and sounds which are not common to all stutterers. It is reasonable to assume, however, that there may be some phonemic combinations which are perceived as intrinsically difficult by all speakers.

In a series of studies Brown, with others, investigated the relationship of stuttering to the initial sounds of speech (Johnson and Brown, 1935), to grammatical function (Brown, 1937), to position in the sentence (Brown, 1938), and to word length (Brown and Moren, 1942). The results of these studies were used to construct a word weighting system (Brown, 1945), from which an estimate of the extent to which specific words will elicit stuttering could be developed. Brown's work has generated additional research which has supported his findings (Oxtoby, 1955; Trotter, 1956; Quarrington et al., 1962; and Taylor, 1966).

Brown, in interpreting these studies, arrived at 9.7 as a mean percentage of words stuttered. In the subsequent weighting system which Brown devised each word that began with /p/, /b/, /d/, /k/, /g/, /m/, /n/, /l/, /f/, /v/, /θ/, /s/, /z/, /r/, /ʃ/, /j/, /tʃ/, and /dʒ/, was given a plus value of **one** because it was found that words that began with these sounds elicited a mean percentage of stuttering of 9.7 or greater. Verbs, adverbs, nouns, and adjectives, were given a plus value of **one**, because they also elicited a mean percentage of stuttering of 9.7 or greater. In addition, words of greater than average length were given a plus value of **one**, based on an average length of 4.65 letters. A word was also given a plus value of **one** if it was one of the first three words of a sentence. Thus it can be seen that the weighting of an individual word in a passage could range from **Zero** to **Four**.

It would seem that the adaptation of stutterers' speech may be influenced by the anticipation of difficulty which, as noted above, can be estimated to some degree by use of Brown's weighting system. One would predict less adaptation when the anticipation of stuttering is less (Milisen, 1938). Therefore a message composed so that it has a low weighting in Brown's system should cause the stuttered speech to adapt more rapidly than when the message has a high weight.

The following two passages were selected as examples of high and low weighting according to Brown's (1945) Word Weighting system.

#### Passage A

Once upon a time a man and his wife had a tiny home near a wide pond. They had little of what their neighbors had but they were always able to share what they had. No matter how little they had themselves, they always gave some food to the wild animals that came to the water. The wife always tossed some food to the jays and robins and grain to the wild fowls.

Adapted from Gray et al., 1956

#### Passage B

During eighteen-ninety to eighteen-ninety-seven, a young Dutch physician, Peter Brinker, journeyed to Java searching for the missing link. Brinker discovered at Jesselton in central Java, a skull fragment, a thighbone, a lower jawbone fragment and three teeth. These looked strikingly manlike, though the skullcap looked quite primitive. An upright striding creature probably possessed this femur. The apelike superior skull surface and manlike femur suggested this descriptive label: erect ape man.

Adapted from Montague, 1958

In terms of Brown's word weighting system, Passage A contains 2 **Four** words, 7 **Three** words, 19 **Two** words, 21 **One** words, and 25 **Zero** words. The total plus count for Passage A is 88. The total count for Passage B is 172. It is evident that it contains many longer and less familiar words than Passage A, and as a result, the sentence structure is generally more complex. Therefore, the two passages also represent a separation in articulatory complexity, with Passage B containing more complex phonemic sequences than Passage A.

## PROCEDURE

### Subjects

Four normal speaking adults were tape recorded reading both of the passages eight consecutive times. Two of these normal speakers read Passage A first, and two of them read Passage B first.

Eight consecutive readings of each passage were also recorded on tape by eight adult stutterers. Four of the stutterers read Passage A first and four of the stutterers read Passage B first.

Each of the stutterers and each of the normal speaking adults was given the following directions:

You are to read each of these passages eight consecutive times as if you were reading them to a group of twenty people. You will begin each reading only after I have signaled you to do so and have said a number. You should read each passage in a natural and meaningful fashion. Remember, you are reading to a group of twenty people.

### Method

Each recorded reading was timed three times with a stop watch, and a single value was obtained by averaging. A measure of syllable duration was derived for each reading by dividing the reading time by the number of syllables in the passage. This computation is expressed by the following formula:

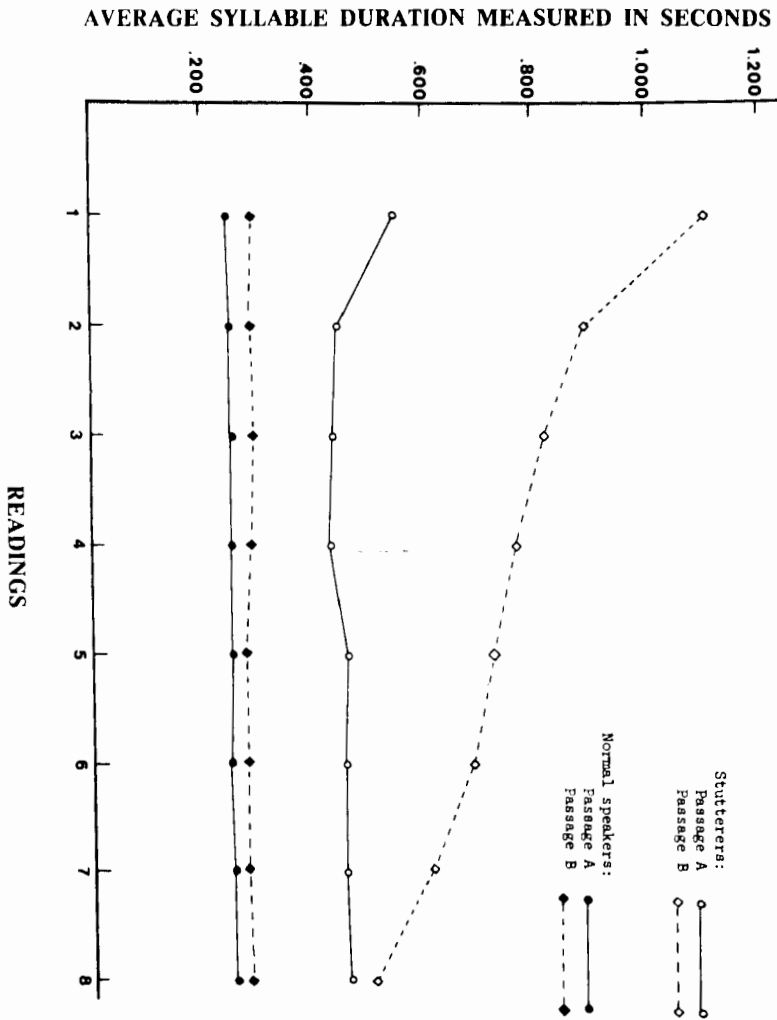
$$SD = \frac{T}{S} \quad \begin{array}{l} SD = \text{syllable duration} \\ T = \text{reading time in seconds} \\ S = \text{number of syllables} \end{array}$$

$$S (\text{Passage A}) = 89$$

$$S (\text{Passage B}) = 125$$

Syllable duration was selected because it enabled an objective measure to be applied to the stutterers' oral reading performance. This avoided any subjective judgement concerning number of stutterings or stuttered words. Such a measure of reading rate shows a substantial correlation with disfluency counts (Sander, 1961).

Figure A. Average syllable duration for eight consecutive readings of Passage A (Low Brown Weighting) and Passage B (High Brown Weighting) for stutterers and normal speakers.



## RESULTS

**Stutterers**

Inspection of Figure A indicates that the stuttering group had a longer average syllable duration when reading Passage B than when reading Passage A for each of the eight consecutive readings. Wilcoxon's Paired Replicates Test (1949) was run between Passage A and Passage B for the average syllable duration of the first five readings. The *t* value, significant at the 5 per cent level, indicates that the obtained difference was not due to chance. It can be noted from Figure A that adaptation was an ongoing process throughout all eight readings of Passage B. However, adaptation was achieved by the second reading of Passage A, that is, the syllable duration remained relatively constant for Readings two through eight. When Wilcoxon's Paired Replicates Test was applied to the syllable durations of Reading One and Reading Eight of Passage B, the *t* value obtained was significant at the .01 level. The same test, run between Readings One and Eight of Passage A, gave a *t* value which was significant at the .05 level. However, when the mean syllable durations between Reading Two and Reading Eight of Passage A were compared, the obtained *t* value was not significant and indicates that there were only chance differences in syllable duration between Readings Two and Eight and supports the conclusion of complete adaptation after the second reading for Passage A.

The adaptation which occurred with each successive reading of Passage B is similar to the adaptation found by Johnson and Knott (1937) who first reported a decrease in non-fluencies for stutterers with each successive oral reading of the same material. Adaptation similar to that found by Johnson and Knott (1937) occurred during the eight successive readings of Passage B but did not occur during the eight successive readings of Passage A. One must assume that, as the percentage of words stuttered decreases, the syllable duration should also decrease. Evidently, from the data of this study, adaptation occurs more rapidly as well as more completely when the reading material is less difficult for the stutterer. In this particular instance, Passage A was weighted at approximately half the value of Passage B with respect to Brown's values of his four characteristics likely to produce stuttering. One can venture the guess that had Johnson and Knott (1937) inadvertently used a passage similar to Passage A, the adaptation effect would not have been as dramatic as they obtained. However, the actual message used is not cited in the published reports of their study.

On the subjective level, it appeared that the stutterers were much less fluent in their reading of Passage B than in their reading of Passage A. Non-fluencies were more severe, more struggle behavior occurred and articulation errors were more frequent on Passage B than on Passage A. Indeed, on Passage A, it was apparent that maximum fluency had been attained by the second reading.

These results may be considered validation for the word weighting system developed by Brown (1945). Two passages which were of neutral emotionality and were made up so that marked differences in total word weights according to the Brown system did exist, resulted in shorter syllable duration and rapid adaptation for the lesser weighted passage. The additional phonemic complexity of Passage B appeared to increase the stress of the reading situation; as a result, considerably more speech breakdown occurred on Passage B than on Passage A. These results would be in agreement with those of Trotter (1956) who found that "the higher weight words are deemed, by the stutterer, to be more important or conspicuous; thus his greater desire for fluency on these words precipitates more stuttering on them."

### **Normal Speakers**

It can be observed in Figure A that the average syllable duration for any reading of Passage A for normal speakers was shorter than the average syllable duration of any reading by them of Passage B. This would suggest that, even for normal speakers, Passage B was more difficult than Passage A. Syllable duration through the eight readings of both passages showed very little change from reading to reading. This is in agreement with the findings of Winchester, Gibbons, and Krebs (1959) who note that the reading rate for normal speakers over a prolonged period of time did not show significant variation. They asked subjects to read a 2000 syllable prose passage which they divided into ten segments of 200 syllables. No significant difference in mean reading time for 60 subjects was found between any of the 200 syllable segments.

The average syllable duration for all readings of both passages by the normal speaking subjects in this study was shorter than any average syllable duration of any reading of either passage by the stuttering group. The fact that the average syllable duration remained constant throughout all readings and that no average syllable duration for these normal speakers was as great as any average syllable duration for readings by the stutterers, suggests that the normal speakers did not feel the amount of stress that the stutterers did, nor did they show the change in stress; that is, there was no necessity to adapt to a nonexistent stress situation.

### **SUMMARY**

Eight adult stutterers and four adult normal speakers read two passages with different values according to Brown's (1945) Word Weighting system, eight consecutive times. One half of the stutterers and one half of the normal speakers read the lower weighted passage first. The other half of the stuttering group and the normal group read the passage with the higher weighting first. Performance of all subjects was measured in terms of syllable duration.

The following conclusions can be drawn:

1. The average syllable duration for stutterers was always longer when reading the passage with the lower weighted value.
2. Adaptation for stutterers was an on-going process throughout all eight readings of the passage with the higher value. The syllable duration for the passage with the lower value remained relatively constant after the second reading.
3. The adaptation effect obtained with stutterers during successive oral readings of the same passage was dependent upon the particular passage read.
4. Non-fluencies, struggle behavior, and articulation errors occurred more frequently when stutterers read the passage with the greater value than when they read the passage with the lesser value.
5. The obtained results of the stutterers performance reading these passages may be considered validation for Brown's (1945) system of word weights. Less speech breakdown, shorter syllable duration, and more rapid adaptation occurred during the oral readings of the passage with the lesser weighting.

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