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The relation between stuttering behaviors and state anxiety

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Anxiety is clinically observed to be a frequent concomitant of stuttering. Experiments with regard to this relation have failed to show, however, a functional relationship between autonomic arousal responses as indicators of negative emotion and stuttering frequency. This may be partly due to the use of a molar concept of stuttering and stutterers in these studies. Although the idea that there may be different types of stuttering and stutterers has become widely recognized, stuttering research and therapy have been traditionally concerned with the molar concept of stuttering moments. Recently, particularly since the publication of Brutten and Shoemaker's two-factor theory in 1967, an increasing number of articles have appeared stressing the importance of a molecular analysis of stuttering behavior. Evidence is now available that stuttering is composed of several types of behaviors which react differently to similar stimulation and that stutterers vary considerably in the behaviors they display.

Prins and Lohr (1972), for example, factor-analyzed the audible and visible aspects of the speech of 19 stutterers and found several relatively independent dimensions of stuttering behavior. They concluded that from factor-analytic studies different syndromes of stuttering might emerge upon which stutterers may be differentiated. Since Prins and Lohr were particularly interested in the speech characteristics of stutterers they did not include any measure of negative emotion in their analysis.
The purpose of the present study is to identify a possible systematic relationship among different stuttering and associated behaviors and negative emotion as measured by autonomic arousal responses and self report. A useful technique by which this goal might be obtained is to investigate the interrelationship and structural dimensionality of the different variables by a factor-analytic procedure.

Method

Subjects

Forty-eight male stutterers between the ages of 13 and 16 years referred for therapy to the Speech Department in Utrecht, served as subjects for this study. None of the subjects was in therapy at the moment of data collection.

Procedure

Each subject was brought into a room where electrodes for recording skin resistance and heart rate were attached. Skin resistance was monitored from silver electrodes placed on the first and third fingers of the subject's left hand. Standard plate electrodes were used to record heart rate from EKG leads placed on the right wrist and left leg. A ground electrode was attached to the right leg. Both measures were recorded simultaneously by a Van Gogh polygraph and a FM tape recorder.
After a 10 min. base level period in which the subject was asked to relex, each subject was required to read silently a 230 word passage and to underline those words on which he anticipated difficulty. Following this, he was instructed to read a new copy of the passage aloud. All oral reading samples were recorded on a video-tape recorder.
At the completion of the reading task the subject was asked to rate his tension state during the previous reading on a 5-point rating scale and to complete the Brutten Speech Situation Check List.

Types of behaviors observed

The video recorded samples were replayed as many as necessary in order to identify all molecular components of stuttering behavior. The behaviors identified for each subject were classified according to the following categories:

Variable

1. Fast repetition of a single sound.
2. Fast repetition of a syllable or monosyllable word.
3. Prolongation of a sound.
4. Nonvocalized blocking without observable stress of tension.
5. Nonvocalized blocking with unusual stress of tension defined as inappropriate movements or fixations of the face and head.
6. Vocalized blocking defined as blocks with concomitant audible struggle behavior.
7. Slow repetition of a single sound.
8. Slow repetition of a syllable or monosyllable word.
9. Slow repetition of a polysyllable word.
10. Repetition of a phrase.
11. Interjection of a single extraneous sound.
12. Interjection of a single extraneous word.
13. Fast repetition of an interjected sound.
14. Breathing abnormalities defined as speaking at residual air or on inhalation.
15. Visible struggle behavior occuring with or without concomitant audible forms of stuttering.
16. Eye blinking.

Reliability

Approximately 12 months after the initial scoring a random sample of the video recordings of 10 subjects was analysed a second time in order to determine intra-observer reliability. Indices of selfagreement were calculated according to the formula A/A + D (Sander, 1961). The percentages of agreement varies from 59 % for slow sound repetition to 100 % for phrase repetition. The mean percentage of agreement for judging ten types of disfluency was 78.2 %.

Severity measures

In addition to the specific behaviors counted two measures of stuttering severity were obtained for each subject: total number of disfluencies (variable 17) and reading time in sec. (variable 18).

Autonomic arousal responses

Physiological data were sampled during rest period, instruction period and reading period. Data were analyzed off-line by a digital computer. For heart rate (HR) interbeat intervals in msec were measured and converted to average heart rate per min. In addition the computer was programmed to score the electrodermal activity with regard to skin conductance level (SC) and numer of spontaneous fluctuations (SF).

Arousal responses were obtained by computing change scores between mean base level at rest and instruction period and reading period respectively. For heart rate change scores were based on the first 20 sec of the reading period, for skin conductance level and spontaneous fluctuations on the first 60 sec. In this way the following six physiological arousal measures were obtained: HR instruction (variable 19), HR reading (variable 20), SC instruction (variable 21), SC reading (variable 22), SF instruction (variable 23) and SF reading (variable 24).

Self report measures

Subject's rating of his tension state during the performance of the reading task resulted in a subjective anxiety measure (variable 25). The Brutten Speech Situation Checklist that contains 51 reallife speech situations for scaled evaluation provided a score for emotional reaction (variable 26) and a score for speech disturbance (variable 27).

Results

As the frequency distributions of the specific stuttering and associated behaviors did not meet the required statistical assumption of a normal distribution, Spearman rank correlations were computed among the 27 variables representing stuttering behavior, arousal responses and self report. A principal components factor analysis was applied to these correlations resulting in six relatively independent factors. A varimax rotation produced a rotated-factor matrix with the six factors accounting for 63 % of the variance. The rotated-factor loadings of the 6 factors are shown in Table 1. In the last column of the table are given the communalities (h^2) of the 27 variables representing the amount of variance of each variable which is accounted for by the 6 extracted factors.

From the ordered data in Table 1 it appears that *factor 1* is predominated by the two severity measures, total disfluencies (17) and reading time (18), along with struggle behavior (15) and eye blinks (16). Prolongations (3) and tense blocks (5) also loaded highly on this factor, and fast sound repetitions (1) and fast repetitions of an interjected sound (13) to a moderate degree. This factor seems to point to stuttering behavior in an advanced and severe stage in which considerable motor struggle is already involved in the stuttering. On none of the other factors we find high loadings of prolongations, tense blocks and visible struggle behavior. The two severity measures have also loadings on factor 4.

Factor 2 appears to represent an „arousal" factor. Skin conductance (21, 22) and heart rate (19, 20) are the only variables with high loadings on this factor. None of the stuttering and associated behaviors has any appreciable loading, except for fast sound repetitions (1) and fast repetitions of an interjected sound (13) that load to a small degree on this factor. Correlations between fast sound repetitions anr arousal responses become more clear in *factor 5*, where spontaneous fluctuations (23, 24) loaded highly and fast sound and monosyllabic word repetitions (1, 2) have moderate loadings. The absence of significant loadings of any of the other stuttering and speech associated behaviors on the „arousal" factors 2 and 5 would indicate that, with the exception of fast sound and word repetitions, anxiety responses and stuttering behavior appear to be relatively independent response classes.

Factor 3 is dominated by behaviors which are generally labeled „avoidance-postponement" behaviors. Phrase repetitions (10), sound interjections (11), slow word and sound repetitions (9, 7), which all may be considered avoidance behaviors of the audible type, were all loaded highly on this factor. Furthermore, these is a loading on this factor of .45 for subjective anxiety (25). This variable is supposed to reflect the fear that is experienced during the reading task. It is interesting to note that self rating of state anxiety does not have any appreciable loading on the „arousal" factors. The correlations between the extent of change in physiological measures and self ratings of anxiety were extremely low and non-significant reflecting the frequently observed discrepancy between the cognitive and physiological aspects of anxiety.

As mentioned earlier *factor 4* has loadings of the two severity measures (17, 18). The highest loadings on this factor, however, came from the two scores on the Brutten Speech Situation Checklist: average emotional reaction (26) and average speech disturbance (27). Thus, factor 1 and factor 4 both appear to reflect a „severity" factor. The difference seems to be that the first factor is linked up to specific stuttering behaviors dis-

played by the subjects, while factor 4 reflects subject's own evaluation of the severity of the problem.

Factor 5 has already been discussed in connection with factor 2. The fact that there are two arousal factors supports the frequently reported relative independence between different physiological measures.

The last factor, *factor 6*, is loaded by two types of blocking: blocks without observable tension (4) and vocalized blocks (6). Word interjections (12) and slow syllable repetitions (8) are loaded on this factor in the opposite direction. The fact that there are no significant loadings of the severity measures or of any of the other speech variables on this factor seems to indicate that, at least for this age group, blocking without tension is a relatively isolated behavior representing a mild form of stuttering.

Discussion

The results of the present study may best be discussed within the framework of Brutten and Shoemaker's two-factor theory. According to this theory basic fluency failures, such as repetitions and prolongations (type I behaviors), are thought to be triggered by certain environmental cues

Table 1. Rotated-factor matrix for stuttering behaviors, arousal measures and self report measures of 48 stutterers.

variables	factors	1	2	3	4	5	6	h^2
17.	total disfluencies	81	06	31	37	15	—09	91
15.	struggle behavior	74	18	11	19	—05	05	84
3.	prolongations	70	09	—04	08	09	—07	66
16.	eye blinks	66	02	21	35	—16	16	87
18.	reading time	65	05	24	54	—05	—10	87
5.	tense blocks	63	—05	15	14	—21	10	80
1.	fast sound repetitions	50	25	33	—17	45	04	75
13.	fast rep. interj. sound	49	27	21	—09	17	03	63
21.	SC instruction	09	81	—06	36	07	13	90
22.	SC reading	07	79	03	35	03	02	88
19.	HR instruction	11	55	—12	—25	—07	—02	58
20.	HR reading	23	46	09	—10	23	—04	80
10.	phrase repetitions	01	05	74	13	—01	28	71
14.	breathing abnormalities	10	—02	62	01	06	—10	58
11.	sound interjections	27	—02	59	03	—01	—12	57
9.	slow word repetitions	18	07	50	34	15	21	70
25.	subjective anxiety	31	05	45	11	—05	16	52
7.	slow sound repetitions	37	00	41	36	09	09	74
26.	subj. emotional reaction	27	08	15	73	10	—06	77
27.	subj. disturbed speech	27	10	08	73	09	06	79
23.	SP instruction	03	—08	—07	24	83	—01	82
24.	SP reading	—16	14	06	05	61	—33	79
2.	fast word repetitions	03	08	—00	—02	48	17	78
4.	blocks without tension	22	—05	17	17	—07	—67	56
6.	vocalized blocks	00	—13	43	08	—05	—48	71
12.	word interjections	13	—00	21	06	—05	42	62
8.	slow syl. repetitions	06	—08	16	14	—03	35	54

via negative emotional responses which are classically conditioned. Other disruptive behaviors are learned instrumentally to avoid or escape stuttering (type II behaviors). Stuttering is viewed as a type of speech disruption which is „part of the generalised autonomic response complex which in essence defines negative emotion" (p. 30).

To the extent that the physiological measures used in this study are regarded as indicators of negative emotion, our data do suggest a functional relationship between emotional responding and a fast repetitive speech behavior pattern. On the other side, prolongation another behavior considered by Brutton and Shoemaker as basic to stuttering, was not related to any of the physiological or selfreported arousal responses.

As far as the stuttering and associated behaviors themselves are concerned, a separation in Type I (classical conditioned) and Type II (instrumental conditioned) behaviors is also partially supported by the factor analysis data. Type II behaviors of the audible kind that according to Brutten and Shoemaker are learned as instrumental acts, do cluster together in one factor (factor 3). The fact that visible struggle behavior and eye blinks representing the theoretically defined class of instrumentally conditioned non-verbal behaviors, is positively loaded on factor 1 along with repetitions and prolongations does not need to contradict the predicted pattern. This factor seems to be defined by a stuttering pattern in a severe form where struggle behavior has already become an automatic concomitant of the bacis fluency failers.

References

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