Logopedie en Foniatrie 52 (1980) 454-460

Relation between specific types of dysfluencies and autonomic and cognitive indices of anxiety in stuttering and nonstuttering adolescents

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Introduction

The concept of anxiety is still a dominant one in stuttering theory and therapy. Most writers agree that negative emotions, such as anxiety and frustration, are associated with or precede the moment of stuttering. As far as anxiety is concerned, it has to be recognized that we are dealing with a multifaceted concept. Evidence is available in the literature that self report, behavioral and psychophysiological indices of anxiety are rather independent of each other (e.g. Lang, 1971). Self report of anxiety during speaking appears to be related to stuttering frequency (e.g. Janssen and Damsté, 1976). On the other hand, no functional relationship has been found between autonomic arousal responses and stuttering.

In our opinion, the rather ambiguous results of research on the relation between anxiety and stuttering is partly attributable to an undifferentiated and molar view of both anxiety and dysfluency. During the last decade, there has been a growing recognition that stuttering is composed of several types of behavior which could be manipulated by different conditions. For example, Brutten and Shoemaker (1967) in their two-factor stuttering theory made a distinction between the type I and II behaviors of stutterers.

Frequently stuttering behaviors are placed into catogeries on an a priori basis. Yet it is not known whether the behaviors within the categories are related. A different approach would be to derive emperically related clusters of dysfluency types and nonverbal behaviors.

The purpose of the present study is: *firstly,* to establish by means of factor and cluster analysis, clusters of associated molecular verbal and nonverbal behaviors in stutters and nonstutterers; *secondly,* to explore the relation of expected anxiety, autonomic arousal responses, and the various clusters of dysfluent and nonverbal behaviors; and *thirdly,* to explore the relation of expected anxiety, autonomic arousal responses, various clusters of behavior, and experienced anxiety during speaking by both groups of subjects. For the second and third purposes, regression analyses were employed.

Method

Subjects

The subjects of this experiment were 48 young male stutterers and nonstutterers between the ages of 13 and 16 years. None of the stuttering

subjects was in therapy at the moment of data collection. No subjects included in the nonstuttering group had a history of previous speech disorders.

Procedure

The subject's task consisted of five massed oral readings of a 230 word passage. Each subject was tested individually. All oral readings were recorded on a video tape recorder for later analysis. During the whole session skin resistance and heart rate were continuously monitored. Prior to the reading task, the subject was requested to remain quietly seated for 10 minutes to allow pretest assessment of physiological measures.

Following each of the oral readings the subject rated his experienced anxiety on a 5 point scale. A score of expected anxiety for reading was obtained from the Speech Situation Checklist (Brutten, 1978).

Types of behavior observed

Frequency counts of dysfluencies were obtained for each subject across the five reading trials. The samples were analyzed according to the following categories: fast sound repetitions, fast word repetitions, prolongations, tense blocks (blocks with concomitant inappropriate movements or fixations of the face and head), *non-tense blocks,* vocalized blocks (blocks with concomitant audible struggle behavior), *sound interjections,* fast sound interjections, *word interjections, slow sound repetitions, slow syllable repetitions, slow word repetitions, phrase repetitions* and breathing irregularities.

Since in the nonstuttering group the frequencies of some of the dysflunecy types were too small to permit statistical treatment, the analysis for this group of subjects was performed on the combined frequencies of the 5 trials. The dysfluency types which were included in the analysis for the nonstutterers are (printed in italics). Interobserver reliability was assessed by means of the percentage of agreement for a randomly selected sample of recordings (Sander, 1961). Mean percentage of agreement for judging different types of dysfluencies was 83%.

From the vidoetapes, frequency counts were made of head and facial movements and of eye blinks. Interjudge reliability for evaluating nonverbal behavior was .93.

Autonomic arousal responses

Physiological data were sampled during rest period and reading period. Data were analyzed off-line by a digital computer. For heart rate 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 and number of spontaneous fluctuations. Arousal responses were obtained by computing change scores between mean base level at rest and reading period by computing change scores between mean base level at rest 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.

Results and discussion

Associated verbal and nonverbal behaviors

Spearman rank correlations were computed separately for both groups of subjects between the observed types of dysfluency, eye blinks and a combined category of all other nonverbal behaviors referred to as 'head and facial movements'. To establish clusters of associated dysfluences types and nonverbal behaviors, for stutterers and nonstutterers, a principal components factor analysis and a Johnson-cluster analysis (Johnson, 1967) were carried out on the basis of the Spearman correlations. The factor and cluster analysis resulted in 5 clusters of behaviors for the stutterers and in 2 for the nonstutterers. The clusters of behaviors found in both groups of subjects are shown in Table 1.

Table 1. Summary of factor analysis and cluster analyses for the dysfluencies and nonverbal behaviors of stuttering and nonstuttering boys.

Stuttering boys (n = 48)		Nonstuttering boys (n = 48)	
Cluster A:	Head and facial movements, tense blocks, eye blinks, prolongations.	Cluster a:	Slow word syllable, sound and phrase repetitions, sound and word interjections.
Cluster B:	Fast sound repetitions and interjections, fast word repetitions.	Cluster b:	Head and facial movements, Non-tense blocks.
Cluster C:	Non-tense blocks, vocalized blocks.		
Cluster D:	Slow word, phrase and syllable repetitions.		
Cluster E:	Breathing irregularities, Slow sound repetitions, sound interjections.		

As can be seen in Table 1 the following 5 clusters of behavior were found in the stuttering group: *Firstly*-cluster A - nonverbal behavior, tense blocks and prolongations, *secondly*-cluster B - fast repetitions of sounds and monosyllabic words, and fast sound interjections, *thirdly*-cluster C - non tense blocks, *fourthly*-cluster D - slow repetition of syllables, words and phrases, and *fifthly*-cluster E - breathing irregularities, slow repetitions and interjections of sounds. In the nonstutterers, the last two clusters of

behaviors of the stutterers were grouped together in cluster a. The second cluster of behaviors of the nonstutterers was composed of head and facial movements and non-tense blocks.

Relation of anxiety with clusters of behavior

The relation of cognitive and autonomic components of anxiety each specific cluster of behavior displayed by the stutterers and the nonstutterers was investigated seperately by means of regression analyses. The relationship between expected anxiety, skin conductance level, spontaneous fluctuations and heart rate on the one hand, and the clusters of behaviors on the other, were explored for both the stutterers and the nonstutterers. The resulting correlations and multiple correlations are shown in Table 2.

Tabel 2. Relationship of expected anxiety and autonomic arousel responses with specific behavior clusters in stutterers and nonstutterers.

	correlations				multiple correlations			
Criterion variables	EeA	SCL	SF	HR	EeA +SCL	EeA +SF	EeA +HR	SCL +SF +HR
Stutterers								
cluster A	.36**	.21	—.10	.16	.39*	.37*	.38*	.09
cluster B	.22	.30*	.31*	.46**	.34	.39*	.49**	.29
cluster C	.17	.08	.05	.01	.18	.18	.17	.01
cluster D	.26	.04	—.01	.11	.26	.26	.27	.01
cluster E	.31*	.17	.06	.22	.33	.32	.36*	.06
Nonstutterers								
cluster a	.11	.04	.14	—.37**	.11	.17	.39*	.17
cluster b	.29*	—.09	.12	—.11	.33	.30	.32	.04

EeA = expexted anxiety; SF = spontaneous fluctuations; ** $p < .01$
SCL = skin conductance level; HR = heart rate; * $p < .05$

For the stutterers, expected anxiety correlated .36 with cluster A (nonverbal behaviors, tense blocks and prolongations) and showed a correlation of .31 with cluster E (slow repetition and interjection of sounds). For the nonstutterers, expected anxiety correlated .29 with cluster b (head and facial movements and non tense blocks).

Autonomic arousal responses words were associated with cluster B (fast repetitions of sounds and monosyllatic words) for the stutterers. This association of autonomic indices of anxiety with fast repetitions can be regarded as a partial support for the two-factor theory of Brutten and Shoemaker. This is particularly so because type I behavior is considered to be the result of a desintegration created by classical conditioned negative emotion. For the nonstutterers on the other hand a negative correlation of

—.37 was found between heart rate and cluster a (slow repetitions of sounds, syllables, words and phrases, and interjection of sounds and words). For these subjects an increase in heart rate was associated with more fluent performance. This may be explained by a sharpened attention to the reading task. Although some of the multiple correlations in Table 2 were significant, it appears that the combination of expected anxiety with the autonomic arousal responses did not explain the clusters of behaviors more efficiently than each separate variable.

Relation of expected anxiety, autonomic arousal and behavior clusters with anxiety experienced during reading

The third and last purpose of our study was to explore the contribution of expected anxiety, autonomic arousal responses and the various clusters of behaviors to the anxiety experienced during reading by both groups of subjects.

Separate regression analyses were performed for each cluster of behaviors for the stutterers and the nonstutterers. The correlations and multiple correlations are shown in Table 3.

Table 3. Relationship of expected anxiety, specific behavior clusters and autonomic arousal responses with experienced anxiety in stutterers and nonstutterers.

	correlations		multiple correlations					
	cl.	EeA +cl.	EeA +SCL	EeA +SF	EeA +HR	EeA +SCL +cl.	EeA +SF +cl.	EeA +HR +cl.
Stutterers								
analysed cl.:								
cluster A	.26	.40*	.38*	.39*	.39*	.41*	.41*	.41*
cluster B	.40**	.50**	.38*	.39*	.39*	.50**	.54**	.50**
cluster C	.12	.38*	.38*	.39*	.39*	.39	.41*	.40
cluster D	.47**	.54**	.38*	.39*	.39*	.55*	.55**	.54**
cluster E	.48**	.54**	.38*	.39*	.39*	.54**	.54**	.54**
Nonstutterers								
analysed cl.:								
cluster a	.32*	.46**	.36*	.50**	.36*	.46*	.60**	.47*
cluster b	.02	.37*	.36*	.50**	.36*	.37	.50**	.37

cl. = behavior cluster
EeA = expected anxiety
SCL = skin conductance level
SF = spontaneous fluctations
HR = heart rate
** $p < .01$
* $p < .05$

In reading Table 3 be aware of the fact that each row represents a separate regression analysis. The first row, for example, deals with the regression analysis in which cluster A, expected anxiety and autonomic arousal responses are introduced to explain experienced anxiety. The first column shows that the stutterers' experienced anxiety correlated .40 with cluster B (fast repetitions of sounds and monosyllabic words), .47 with cluster D (slow syllable, word and phrase repetitions), and .48 with cluster E (breathing irregularities, slow sound repetition and interaction).

The combinations of expected anxiety with cluster B and of expected anxiety with cluster D appeared to be more efficient than when these variables were dealt with separately. Expected anxiety in combination with cluster E did not contribute to the explanation of experienced anxiety.

For the nonstutterers, the combination of expected anxiety, cluster a (slow repetitions and interjections) and spontaneous fluctuations apparead to be more efficient in explaining experienced anxiety than each variable seperately. Not shown in this table is the negative correlation of —.31 between spontaneous fluctuations and experienced anxiety for these subjects. Cluster b dit not contribute at all to experienced anxiety for the nonstutterers.

General conclusions

The results of our study underline the relevance of a differentiated and molecular view of both anxiety and dysfluency. The relationship between anxiety and dysfluency appeared to be of a more complex nature than is generally assumed in stuttering theory. For the stutterers, the autonomic components of anxiety were related with a cluster of dysfluent behavior consisting of fast repetitions and interjections. This finding is in agreement with the assumption of the two-factor theory of Brutten and Shoemaker that classical conditioned negative emotion results in fluency failures such as fast repetitions. However, contrary to the assuption of the two-factor theory were the findings that both autonomic arousal responses and experienced anxiety did not correlate with blocks and prolongations.

The dysfluency of the nonstutterers consisted predominantly of interjections of words and sounds and the slow repetitions of words, phrases, syllables and sounds. We assume that these dysfluencies are a result of cognitieve processes that govern the structuring of language into syntactic and semantic units. These behaviors correlated positively with experienced anxiety and negatively with heart rate. Thus autonomic reactivity has to be interpreted differently for stutterers and nonstutterers.

For the nonstutterers, autonomic reactivity can be seen as indicative of an increased attention to the reading task. This attention has a facilitative effect on the syntactical and lexical skills of the nonstutterer, thus inhibiting the dysfluency types characteristic of the normal speaker. We found no indication for a similar effect in stutterers. For the stutterers, autonomic reactivity has to be seen as a desintegration of behavior that manifests itself in fast repetitions or as indicative of an attempt to prevent a form of stuttering that is characterized by fast repetitions, prolongations and tense blocks.

Summary
Cluster- and factoranalyse were carried out on molecular types of dysfluent and nonverbal behavior in 48 stuttering and 48 nonstuttering adolescents. In the stuttering group 5 clusters of behavior were formed, while in the nonstuttering group only 2 clusters appeard from the analysis. By means of regression analyses were the relations explored between each cluster of behavior and autonomic and cognitive components of anxiety in both groups of subjects. Anxiety differentiated in autonomic and cognitive components appeared to be less dominant in explaining stuttering behavior than commomly is assumed. The data are discussed in terms of the two-factor suttering theory of Brutten and Shoemaker.

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