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Abstract

Differences were investigated between 48 PWS and 48 PWNS concerning the autonomic and cognitive components of anxiety during oral reading. No differences were found between the two groups of subjects while reading a text out loud in task anxiety and autonomic reactivity. However, when asked to rate their speech anxiety when they have to read a text, the PWS scored higher than the PWNS. Furthermore, in PWS and PWNS, the association was investigated between the anxiety measures and specific clusters of disfluencies. Only PWS showed an association between a cluster consisting of fast repetitions of sounds and interjections and the cognitive and autonomic anxiety components. In PWS, task anxiety was associated with disfluency clusters consisting of slow repetition of syllables, words, and phrases, and slow repetition and interjection of sounds. Also, in the PWNS, disfluencies with a slow, repetitive, or interjectional characteristic were related to task anxiety. Task and speech anxiety were related both in PWS and PWNS, but its function to disfluency might be different. In PWS, the cognitive components of anxiety might trigger the postponement and avoidance of their characteristic disfluencies. While in PWNS, it may be indicative of heightened attention at the task that assists their reading performance. In conclusion, our findings strongly challenge the use in stuttering practice and research of global conceptualizations of anxiety and stuttering.

Key words: anxiety and stuttering, molecular analysis, PWS and PWNS

Introduction

Anxiety is clinically observed to be a frequent concomitant of stuttering. Various theories and therapies assume a central role of anxiety for the development and maintenance stuttering (e.g., Brutten & Shoemaker,1967; Turnbaugh, Guitar & Hoffman, 1979; Wischner, 1952). For instance, in the view of Brutten & Shoemaker, classical conditioned negative emotion is assumed to differentiate the disfluency of persons who stutter (PWS) from that of persons who do not stutter (PWNS). This difference in reactivity is suggested to be in part genetically determined. Accordingly in their view, normal speakers when exhibiting disfluencies in their speech are not aware of it, nor do they show any signs of concern about it. For the PWS, however, negative emotions such as anxiety are supposed to be associated with or precede the disfluencies. Also, in their view, negative emotion results in the disintegration of speech that is manifested in repetitions, blocks, and prolongations (type I behavior). The other disfluencies (type II), such as repetitions of words and phrases, have in their opinion the function of postponement or avoidance of type I disfluencies. However, investigations about a functional relationship of anxiety and stuttering show equivocal results (e.g., Gray & Brutten, 1965; Ingham & Andrews, 1973; Taylor, 1966). Equivocal findings may be due to a global conceptualization of anxiety as well as the use of a molar concept of stuttering. A single operationalization of anxiety is not advocated because of the substantial independence of anxiety measured employing self-report, behavioral, and physiological systems (Mathews, 1971). Anxiety should be best conceived of as multiple determined and reflected in the following interrelated response systems: cognitive/self-report, emotional/physiological, and behavioral (Lang, 1971). In addition, presently there is an increasing number of publications stressing the importance of a molecular analysis of stuttering to address the existing problems with a too general and a priori classification of stuttering. For instance, there is evidence that stuttering is composed of several types of behavior with react differently to similar stimulation and that PWS show considerable variation in the behaviors they display (e.g., Janssen & Brutten, 1973, Prins & Lohr, 1972). Moreover, it is reasonable to assume that the same determinant rules interrelated behaviors. Following this, a molecular analysis of stuttering behavior was performed and by using factor- and cluster analysis independent clusters of disfluency types and nonverbal behavior were established in PWS and PWNS (Kraaimaat, 1980b. The purpose of the present investigation was twofold, firstly to investigate the differences between adolescent PWS and PWNS in self-reported/cognitive, and autonomic anxiety in a speech testing situation. Also, secondly, to explore in both groups, the interrelationship between cognitive and autonomic components of anxiety and clusters of disfluency as revealed in the study of Kraaimaat (1980b).

Method

Subjects.

The subjects were 48 young male PWS and PWNS between the ages of 13 and 16 years. Stuttering was diagnosed by a speech therapist and the PWS were selected from a waiting list. None of the PWS was in therapy at the moment of data collection. No subjects included in the PWNS group had a history of previous speech disorders.

Procedure.

The subject's task consisted of the oral reading of a 230-word passage in the presence of an experimenter. Each subject was tested individually. All oral readings were recorded on a video recorder for later analysis. Before the reading task, the subjects were requested to remain quietly seated for 10 minutes to allow the pretest assessment of physiological measures. Following the task, the subject rated his tension state during reading on a 5-point Likert scale and completed the Brutten Speech Situation Checklist (SSC; Brutten, 1973).

Analysis of disfluency and nonverbal behavior.

The speech sample was analyzed according to the following 15 types of disfluency: fast sound repetitions, fast word repetitions, prolongations, sound prolongations (within a word), tense blocks (blocks with concomitant inappropriate movements or fixations of the face or head), non-tense blocks (also called silent prolongations), vocalized blocks (blocks with concurrent audible struggle behavior), sound interjections, fast sound interjections, word interjections, slow sound repetitions, slow syllable repetitions, slow word repetitions, phrase repetitions and breathing irregularities.

Nonverbal behavior was defined as any observable movement of the orofacial structure that was not an integral part of the ongoing process of speech. The following categories were employed: eye blinks defined as the fast closure of an eye or eyes, eyebrow movements defined as excessively raising the eyebrows or wrinkling the forehead, eyelid movements including complete and partial closing of the eyes and enlarged eye openings, head movements including movements back, down or to either side, mouth movements including pressing lips together, pursing lips and sideway lip movements and jaw movements, looking away and touching nose, hair or spectacle. Due to a high variation in observed frequency within and between subjects two main categories were formed, namely eye blinks and a rest group of all other observed nonverbal behaviors (see Kraaimaat, 1980a)

Clusters of disfluency and nonverbal behavior

With the Spearman rank correlation coefficients between the 15 types of disfluency and two categories of nonverbal behavior, exploratory factor analyses, and cluster analyses were performed which resulted in five clusters in the PWS and two clusters in the PWNS (see Kraaimaat, 1980b).

The following clusters were formed in the PWS: *Cluster A*: rest nonverbal behavior, tense block, eye blinks and prolongation, *Cluster B:* fast sound repetition and fast sound interjection), *Cluster C*: non-tense block and vocalized block, *Cluster D*: slow syllable, word and phrase repetition*, Cluster E*: breathing or sound interjection and slow sound repetition, and. The two clusters in the PWNS were: *Cluster a: slow sound, syllable, word or phrase repetition, and sound or word interjection. Cluster b*: rest nonverbal behavior and non-tense block (see Kraaimaat, 1980b). Due to the deviancies of the normal distribution, a log (x + 1) transformation was performed on the obtained data before calculating parametric statistics.

Measures of self-reported/cognitive and autonomic anxiety

A *self-reported/cognitive measure* of task anxiety was obtained by the subject's rating of the extent to which they experienced anxiety during the oral text reading on a 5-point Likert scale. In addition, speech related anxiety was assessed by having the subjects fill out the emotional reaction portion of the *Speech Situations Checklist* (SSC) that contains 51 real-life speech situations that were rated on a 5-point anxiety scale (Brutten, 1973). In the present study, item-17 of the SSC (reading a text out loud) was used as a measure of self-reported/cognitive speech anxiety.

Autonomic anxiety was continuously measured using the subject's skin conductance and heart rate. All physiological responses were recorded on an Ampex instrumentation tape recorder for later analysis on a PDP-15 computer and on a Van Gogh polygraph (17 ERP-16 BZA). *Skin resistance* was recorded employing AG-AGCL electrodes placed on the palmar side of the first phalange of the first and third fingers of the subject's left hand. Raw data were converted to log conductance values per minute by the computer to obtain a *skin conductance* score. Also, the number of *spontaneous fluctuations* was calculated per minute. A spontaneous fluctuation equalizes a change in the base level of .5 Kohm minimally. *Heart rate* responses were measured through AG-AGCL electrodes placed on the subject's left leg and right wrist, with an electrode on the right leg serving as ground. Raw data were converted to R-R intervals by the computer, and the inter-pulse interval data subsequently converted to rate per minute. Heart rate and skin conductance responses were sampled during the last 5 minutes of the pretest rest period and the first minute of the reading task. Autonomic reactivity measures were obtained by computing change scores between the pretest and the reading period (see Janssen & Kraaimaat, 1980)

Self-reported/cognitive and autonomic anxiety in PWS and PWNS

The mean scores, standard deviations, and univariate F-ratio's for differences between PWS and PWNS on self-reported/cognitive and autonomic anxiety measures are shown in Table 1.

Table 1. Mean scores, standard deviations, and F-ratio's for differences between PWS and PWNS on self-reported and **autonomic anxiety measures.**

	PWS (n=48)		PWNS (n=48)		
	Mean	SD	Mean	SD	F-ratio
Task anxiety	3.29	.80	3.02	.56	3.69
Speech anxiety	2.81	1.08	2.10	.83	12.89
Heart rate	12.97	8.57	12.18	8.32	.21
Skin conductance	.15	. 11	.15	.07	.01
Spontaneous fluctuations	3.42	3.72	2.28	2.74	2.95

F= 3.95 p=.05 and F=6.92 p=.01

It can be seen that there was no significant difference in task anxiety during the oral reading task. Only the expectation of speech anxiety in reading a text out loud (SSC item 17) was significantly higher for the PWS than for the PWNS. The stress of the testing situation produced in all subjects obvious increases in reported tension and all three psychophysiological measures. Noteworthy is that autonomic reactivity did not differentiate the PWS from the PWNS. This finding is somewhat in contradiction with the two-factor theory of Brutten & Shoemaker (1967) which contends that classical conditioned negative emotion (i.e., autonomic reactivity) is the cause of the PWS's disintegration of speech. However, it might be that it is not the level of autonomic anxiety of the PWS but a higher vulnerability to react at an increase of physiological arousal with a disintegration of speech. In conclusion, self-reported/cognitive and autonomic anxiety as provoked by the test situation of oral reading in the presence of an experimenter is not a distinguishing feature of the person who stutters.

Relationship of cognitive and autonomic anxiety with clusters of disfluency

As mentioned before anxiety was operationalized with two measures for self-reported/cognitive anxiety and three psychophysiological measures to calculate indices for autonomic reactivity. To explore the interdependence of the measures, Pearson product-moment correlation coefficients were calculated between the self-reported/cognitive and autonomic reactivity measures.

Table 2. Correlations between self-reported/cognitive and autonomic measures of anxiety

	Task anxiety	Speech anxiety	Heart rate	Skin conductance	Spontaneous fluctuations
Task anxiety	-	*.36*	*.01*	*.11*	***-.31***
Speech anxiety	**.38**	-	*.08*	*.19*	*.10*
Heart rate	**.10**	**.25**	-	*.19*	*.07*
Skin conductance	**.17**	**.24**	**.23**	-	*.20*
Spontaneous fluctuations	**-.04**	**.04**	**.13**	**.32**	-

r > .28 then p < .05 PWS correlations are presented in bold and PWNS correlations in italics.

As can be seen in Table 2, the anxiety measures are to a high extent independent. A significant relationship was found between skin conductance and spontaneous fluctuations in PWS. In PWS and PWNS, a significant correlation was found between task anxiety and speech anxiety (SSC item 17). A finding that supports the validity of the SSC. Furthermore, in PWNS, a negative association was found between task anxiety and spontaneous fluctuations. This negative association could indicate that in PWNS, task anxiety might best be interpreted as high attention to the reading task. The results support Lang's contention that anxiety is multiple determined and best operationalized by cognitive/self-report, emotional/physiological, and behavioral (Lang, 1971). Thus it is indeed reasonable to attribute the mixed results of studies into the relationship of anxiety and stuttering to the interdependence of the various anxiety measures that were used.

To explore the extent to which of the anxiety measures were associated with a specific cluster of disfluency PM correlation coefficients were calculated in PWS (Table 3) and PWNS (Table 4).

Table 3. Correlations between anxiety measures and clusters of disfluency of PWS

	Task anxiety	Speech anxiety	Heart rate	Skin conductance	Spontaneous fluctuations
Cluster A	.26	.36*	.16	.21	-.10
Cluster B	.40*	.22	.46**	.30*	.31*
Cluster C	.12	.17	.01	.08	.05
Cluster D	.47*	.26	.11	.04	-.01
Cluster E	.48*	**.31***	.22	.17	.06

*p< .05

As can be seen in Table 3 task anxiety was significantly related to cluster B (fast sound and word and fast sound interjection), cluster D (slow syllable, word, and phrase repetition) and Cluster E (slow sound repetition, breathing, and sound interjection). The other cognitive anxiety measure, speech anxiety was significantly related to cluster A (rest nonverbal behavior, tense block, eye blinks and prolongation), and cluster E (breathing or sound interjection and slow sound repetition). Except for cluster B (fast sound repetition and fast sound interjection), none of the other clusters were significantly associated with the three autonomic reactivity measures. None of the anxiety measures was related to cluster C (non-tense block and vocalized block).

It is noteworthy that task anxiety and the autonomic reactivity measures were not associated with cluster A (30% of total disfluency) or cluster C (13% of total disfluency). Although these disfluencies are very disruptive in speech the lack of an association with the self/reported anxiety measures might indicate that the PWS has hardly any notion of these behaviors.

The association of task anxiety and the three measures of autonomic reactivity with cluster B (fast repetitions) is in line with the two-factor stuttering theory of Brutten & Shoemaker (1967). According to their theory, basic fluency failures such as repetitions, prolongations, and blocks (type I behaviors) are elicited by classical conditioned negative emotion, while the other disruptive behaviors (type II) are seen as the operant efforts to escape or avoid the type I behaviors. However in contradiction with their theory is the finding that that PWS and PWNS did not differ in any of the anxiety measures (Table 1) and that clusters A and E (i.e., prolongations, blocks) were not related with task anxiety or autonomic reactivity. Thus it are the fast repetitions, but not the blocks and prolongations that might be elicited by negative emotion in PWS. Since fast repetitions are characteristic for PWS the relationship between self-reported/cognitive and autonomic anxiety with fast repetitions is best interpreted as a particular vulnerability of the person who stutters.

The relationship of clusters D and E with task anxiety and to a lesser extent with speech anxiety and not with autonomic anxiety might indicate the subject's anticipation and concern of fluency failures with resulting efforts to avoid or escape this anticipated failures. Which is in line with Brutten & Shoemaker interpretation of these disfluencies as ruled by operant conditioning. Furthermore, some deficits in lexical and syntactic skills of PWS might also be a contributing factor to cluster D and E disfluencies.

Table 4. Correlations between anxiety measures and clusters of disfluency of PWNS

	Task anxiety	Speech anxiety	Heart rate	Skin conductance	Spontaneous fluctuations
Cluster a	.32*	.11	-.37*	.04	.14
Cluster b	.02	.29*	-.11	-.09	.12

*p < .05

In the PWNS, cluster a (slow sound, syllable, word or phrase repetition, and sound or word interjection) was positively related to task anxiety and negatively with heart rate. The disfluency failures of cluster a consist of 92% of the total disfluencies of the PWNS. As can be seen in Table 4, task anxiety is positively and heart rate negatively associated with cluster a. The relatively high autonomic reactivity in the PWNS (Table 1) might point to a heightened attention and effort at the reading task. Consequently, a negative correlation of cluster a with heart rate reactivity might display that a heightened attention facilitates the PWNS's reading performance. Cluster b (rest nonverbal behavior and non-tense block) is only associated with speech anxiety. This cluster consists of 6% of the PWNS disfluencies (see Kraaimaat, 1980b). Note that the nonverbal behaviors of the PWNS do not co-occur with their disfluencies and thus have not a function as escape or struggle behavior.

Summary and discussion

We attribute the ambiguous results of stuttering research with respect to the relationship between anxiety and disfluency, mainly to a poorly differentiated approach of both constructs. To address this issue self-reported/cognitive and autonomic components of anxiety were distinguished as well as specific groups of interrelated disfluencies.

At first, differences were investigated between PWS and PWNS regarding the self-reported/cognitive and autonomic components of anxiety during the oral reading of a 230-word passage. Except for expected speech anxiety concerning reading a text out loud, no differences were found between the two subjects groups for anxiety during oral reading. Thus in contradiction with the two-factor theory of stuttering proposed by Brutten & Shoemaker (1967), there were no differences found in 'classically conditioned' negative emotion (i.e., autonomic reactivity) between PWS and PWNS. In line with Mathews (1971) and Lang (1971) support was found for the contention that cognitive and psychophysiological components of anxiety are generally independent and thus that a single operationalization of anxiety might lead to confusing results.

Next, the relationship was investigated with the self-reported/cognitive and autonomic anxiety measures and five empirically constructed clusters of disfluencies in PWS and two clusters of disfluencies in PWNS. In PWS, anxiety appeared to influence the clusters of disfluency more differentially and less than is generally assumed. It was only with a cluster consisting of fast repetitions of sounds and fast sound interjections that a relationship was found with the self-reported/cognitive and autonomic components of anxiety. Furthermore, in PWS the self-report of task anxiety was found to be associated with disfluencies concerning the slow repetition of syllables, words, and phrases, and slow repetition and interjection of sounds. In the PWNS, their predominant normal disfluencies with a slow, repetitive or interjectional character were related to the self-report of task anxiety, while heart rate reactivity was negatively associated with these group of disfluencies.

Besides, no association was found for the cognitive nor autonomic components of anxiety with the non-verbal behaviors and the non-tense blocks of the PWNS.

We assume that the groups of disfluency which typify the PWS are the result of inadequate development of co-articulation and coordination of breathing, phonation, and articulation (Kraaimaat, 1980a). In literature, the prolongations, blocks, and fast repetitions of the PWS are perceived as primary forms of stuttering. Our findings indicate that these behaviors are differentially influenced by anxiety. Both cognitive and autonomic components of anxiety were found to be related to only one cluster of disfluency consisting of fast repetition of sounds and sound interjections. The association of the indices of autonomic anxiety with the fast repetitions of the PWS is in line with the two-factor theory of Brutten & Shoemaker (1967). The non-verbal behaviors of the PWS which accompany blocks and prolongations may be perceived either as automatic avoidance and escape responses (Brutten & Shoemaker, 1967) or be seen as motoric struggling (Lanyon, 1978). In accordance with the two-factor theory the PWS's slow syllable, word, and phrase repetitions (type II) might function as an avoidance of their characteristic disfluencies (type 1).

The disfluencies of the PWNS consisted predominantly of the interjection of words and sounds and the slow repetition of words, phrases, syllables, and sounds. This form of disfluency is localized at the juncture of syntactic elements (Vaane, 1976). We assume that this form of disfluency originates from cognitive processes which governs the structuring of language into syntactic and meaningful units (Kraaimaat, 1980a). In addition, these behaviors may also operate somewhat similar as in PWS and have the function of postponement or avoidance of reading errors.

PWS and PWNS reacted similar to reading the text aloud with a considerable increase in cognitive and autonomic anxiety from the rest condition. This increase is attributed to the test situation of reading a text in the presence of an experimenter. In PWS, the cognitive and autonomic components of anxiety were shown to have an eliciting function concerning fast repetitions and interjections. For the PWS, autonomic reactivity has to be seen as a disintegration of behavior that manifests itself in fast repetitive kind of disfluency. While the cognitive components of anxiety in PWS might be indicative of their tension and efforts towards the postponement and avoidance of primary stuttering. The task anxiety and heart rate reactivity of the PWNS might reveal high attention and effort to the reading task which assists their syntactical and lexical skills and slows down reading errors and normal disfluencies. We found no indications for a similar effect in the PWS.

In conclusion, our findings strongly challenge the use in stuttering practice and research of global conceptualizations of anxiety and stuttering. Diagnostically speaking, more attention should be paid to the dominant disfluency pattern of each PWS in order to be able to formulate appropriate strategies for correcting the observed behaviors (Janssen & Kraaimaat, 1980).

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