Pergamon

Journal of Anxiety Disorders, Vol. 10, No. 6, pp. 489–508, 1996

0887-6185/96 $15.00 + .00

PII S0887-6185(96)00025-4

Exposure to Internal and External Stimuli: Reactions in Children of Patients With Panic Disorder or Animal Phobia

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Abstract — One aim of this study was to investigate whether children of parents with panic disorder (CPAN) (n = 27) respond with higher levels of anxiety to internal stimuli (caused by voluntary hyperventilation) than children of parents with animal phobia (CPHOB) (n = 21) or children of healthy control parents (CCON) (n = 29). To test the specificity of the hypothesis, the second aim was to assess whether CPHOB respond with higher increases in fear to an external (i.e., phobic) stimulus (spider) than both CPAN and CCON. Subjective anxiety and heart rate were assessed throughout the experiment. Contrary to expectation, all three groups of children reacted to hyperventilation with significant increases in subjective anxiety and heart rate. CPAN did not

The authors would like to thank the Christoph Dornier Foundation for Clinical Psychology, Institute of Marburg, for their support of this study. The study was also supported by the German Research Foundation (DFG) grants Ma1116/1–1, Ma1116/1–4.

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respond with stronger anxiety reactions than other children to hyperventilation, nor did they show higher increases in heart rate. However, more of the CPAN prematurely terminated the hyperventilation task. When children were not divided according to parental diagnoses, but rather with respect to their own initial level of reported fear of physical symptoms (anxiety sensitivity), those with higher levels of fear showed higher increases in subjective anxiety to the hyperventilation task. As for the spider confrontation, CPHOB reacted with significantly higher increases in subjective fear than both CPAN and CCON.

Various studies have shown that children of parents with panic disorder suffer from anxiety disorders and other mental disorders more frequently than children of parents without mental disorders (Biederman et al., 1990; Silverman, Cerny, Nelles, & Burke, 1988; Sylvester, Hyde, & Reichler, 1987; Turner, Beidel, & Costello, 1987; Weissman, Leckman, Merikangas, Gammon, & Prusoff, 1984). In addition, as compared to control samples, more of these children apparently showed "behavioral inhibition." This means they had longer latency periods before interacting with unfamiliar persons, showed a lower rate of spontaneous verbal expression, and had a heightened physiological arousal when confronted with unknown situations (Rosenbaum et al., 1988). However, specifity of the above described characteristics is unclear: children of patients with other types of anxiety disorders (e.g., Silverman et al., 1988) as well as with depressive disorders (Sylvester et al., 1987; Turner et al., 1987; Weissman et al., 1984) are also at a higher risk for developing anxiety disorders and other mental disorders. Similarly, behavioral inhibition is found more often in children of patients with depressive disorders compared to the general population (Rosenbaum et al., 1988).

The aim of the present study was to examine whether children of panic patients in comparison to children of parents with animal phobia or controls show characteristics with particular significance for the development and maintenance of panic attacks or panic disorder. A second question was whether the children of patients with animal phobia react stronger than the other two groups to an external (phobic) stimulus.

Body Sensations and Their Association With Threat and Danger in Adult Panic Patients

Psychological models of panic disorder imply that panic attacks are evoked by the perception of internal stimuli (physical sensations or cognitions) and the association of these stimuli with an immediate danger to physical or psychological intactness (Clark, 1988; Ehlers & Margraf, 1989; Ehlers, Margraf, & Roth, 1988; Foa & Kozak, 1986; Margraf, Ehlers, & Roth, 1986). Such tendency of evaluating bodily sensations as signs of danger or illness and subsequently reacting anxiously has been conceptualized as anxiety sensitivity (Reiss & McNally, 1985). Anxiety sensitivity is considered to be influenced or maintained by various factors such as genetic disposition, learning experience (e.g. witnessing a heart attack in another person) as well as the personal experience of panic attacks.

Findings From Questionnaire Studies

Studies using questionnaires showed that panic patients considered physical symptoms more likely to occur, more threatening, and more frightening than did other clinical and normal controls (Chambless & Gracely, 1989; Clark et al., 1988; Dattilio & Foa, 1987; Ehlers & Margraf, 1993; Foa, 1988; Telch, Shermis, & Lucas, 1989). Compared to subjects with other anxiety disorders, panic patients showed higher anxiety sensitivity (e.g., Chambless & Gracely, 1989; Reiss, Peterson, Gursky, & McNally, 1986; Taylor, Koch, & McNally, 1992). Furthermore, it was shown that a high level of anxiety sensitivity corresponded with the frequency of panic attacks (Cox, Endler, Norton, & Swinson, 1991; Donnell & McNally, 1990). In addition, Maller and Reiss (1992) showed in a longitudinal study that healthy individuals with high anxiety sensitivity were at greater risk for subsequently developing panic disorder. Heightened anxiety sensitivity may, thus, be a predisposing variable or a cognitive risk factor for panic attacks and panic disorder.

Findings From Experimental Research

The assumption that the perception of body sensations triggers anxiety in panic patients more readily than in other persons is further supported by experimental studies in which physical symptoms were induced by methods such as lactate infusions, CO^2 inhalations, or voluntary hyperventilation (for reviews see Margraf, 1993; Margraf et al., 1986).

Through voluntary hyperventilation lasting about 2 to 3 min, all physical and psychological symptoms pertaining to a panic attack can be produced. Voluntary hyperventilaton, therefore, is an easy-to-adopt paradigm allowing a closer study of the relationship between physical symptoms and their anxious interpretation under controlled conditions. A number of studies measuring reactions to voluntary hyperventilation showed that hyperventilation produces higher subjective anxiety or more panic attacks in panic patients compared to subjects with other types of anxiety disorders and normal controls (Gorman et al., 1988; Holt & Andrews, 1989; Lum, 1981; Rapee, 1986; Rapee, Brown, Antony, & Barlow, 1990; see also Margraf, Ehlers, Herber, Meisner, & Wrobel, 1991). In many cases, however, no between-group-differences were found with respect to physiological measures (Gorman et al., 1988; Rapee et al., 1990).

In a study with college students (Holloway & McNally, 1987), it appeared that individuals with high anxiety sensitivity as measured by the Anxiety Sensitivity Index (ASI; Reiss & McNally, 1985) reacted to a hyperventilation test with more and stronger physical symptoms than those with low anxiety sensitivity. Additionally, they had significantly higher scores in subjective measures of anxiety and tension at baseline as well as immediately after each task. According to Holloway and McNally (1987), these findings support the prognostic validity of the concept of anxiety sensitivity. These findings were recently confirmed in a study by Rapee & Medoro (1994).

Anxiety Sensitivity in Children

Using a modified version of the ASI for children (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991), Silverman and colleagues did not find any differences in the degree of anxiety sensitivity between children who were referred to psychiatric institutions and a nonclinical sample (Silverman et al., 1991). On the other hand, Rabian, Peterson, Richters, and Jensen (1993) found significantly higher anxiety sensitivity in children with anxiety disorders compared to children without mental disorders.

Aim of the Present Study

Since it has been found that children of panic patients are at greater risk for developing anxiety disorders (including panic disorder), the question arises whether anxiety sensitivity is transmitted from adult panic patients to their children. In the present study it will be examined whether children of panic patients, even if they do not show panic attacks or panic disorder themselves, react more anxiously to physical symptoms than children of phobic parents or parents with no diagnosis of a mental disorder. With respect to the specificity hypothesis, it will also be tested whether children of phobic parents react with more intense anxiety to a phobic stimulus than children of either panic patients or controls.

METHODS

Subjects

Parents with panic disorder, parents with animal phobia, and control parents with no mental disorder participated in the study together with their children. Parents with panic disorder and some of the parents with animal phobia were recruited from research centers for clinical psychology and outpatient clinics where they had applied for treatment. Additional parents with animal phobia and the healthy control parents were recruited through advertisements in local newspapers. All parents provided informed consent and had obtained the consent of their children to participate in the study. Phobic patients and the healthy control parents who had responded to the advertisements were paid an amount of DM 50. Phobic patients were also informed about therapeutic possibilities and were referred to behavior therapy when required. The children received a small present for their participation.

Parents. All of the parents were diagnosed using a structured interview (DIPS; Margraf, Schneider, & Ehlers, 1991, German version of the ADIS-R, DiNardo & Barlow, 1988) for assessment of mental disorders according to the *DSM-III-R* (American Psychiatric Association, 1987). From the control parents participating in the study, additional diagnostic information as to the nonparticipating parent was obtained in order to make sure that none of the parents had a history of a mental disorder or panic attacks. The sociodemographic and clinical characteris-

tics of the parents who carried the anxiety disorder and the control parents who participated in the study are reported in Table 1. As can be seen, in most cases per group the mother carried the panic or phobic diagnosis. The three groups did not differ significantly in this variable. Parents with panic disorder, however, differed significantly from parents with specific phobia with respect to severity (rated by the diagnostician on a 9-point rating scale) and duration of the disorder. The disorder was rated as significantly less severe in animal phobics than in panic patients. Due to the fact that most animal phobias have their onset in childhood or adolescence, duration of the disorder was significantly longer in the phobic patients than in the panic patients. These differences can be seen as inherent to the nature of the two disorders. With regard to comorbidity both clinical parent groups were comparable.

Children. Of the children willing to participate, four were excluded because they were too young to complete the questionnaires by themselves; in addition,

TABLE 1
DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF THE PARENTS

	Parents With Panic Disorder $n = 17$	Parents With Animal Phobia $n = 16$	Parents Without Mental Disorder $n = 23$	p
Age[a] (years)	39.2 (4.4)	37.1 (4.9)	37.0 (5.4)	*ns*
Sex				
Female	88.2 (15)	93.7 (15)	82.6 (19)	*ns*
Male	11.8 (2)	6.3 (1)	17.4 (4)	
Marital status[a]				
Married	80 (12)	62.5 (10)	72.7 (16)	*ns*
Primary diagnoses[b]				
Panic disorder	100.0 (17)	—	—	
Agoraphobia	88.2 (15)	—	—	
Specific phobia[c]	—	100.0 (16)	—	
Severity[a] (0–8)	5.3 (1.8)	3.7 (0.8)		< .01
Duration[a] (years)	8.5 (7.7)	24.1 (11.4)		< .01
Further diagnoses[b]				
Agoraphobia	—	12.5 (2)	—	
Specific phobia	17.6 (3)	—	—	
Social phobia	5.9 (1)	6.3 (1)	—	
Generalized anxiety disorder	5.9 (1)	6.3 (1)	—	
Major depressive disorder	5.9 (1)	—	—	

Note. The table shows percentage (number of cases) or means (standard deviations) when applicable. [a]Due to missing data, number of cases per group varied from 14 to 22; [b]Up to three diagnoses per person possible; [c]12 (75%) of the parents were spider phobics, 3 (18.8%) were dog phobics, one parent (6.3%) had a bird phobia.

one child had asthma and, therefore, was not able to take the hyperventilation task; another child was excluded because the mother did not allow the child to be exposed to a spider. All in all, a total of 27 children of 17 parents with panic disorder, 21 children of 16 parents with animal phobia, and 29 children of 23 healthy control parents participated in the study. Sociodemographic and clinical characteristics of the children are reported in Table 2. Anxiety disorders were grouped into "internalizing anxiety disorders" and "externalizing anxiety disorders" (see Table 2). Children of panic patients had significantly more

TABLE 2
DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF THE CHILDREN

	CPAN $n = 27$	CPHOB $n = 21$	CCON $n = 29$	p
Age				
Years	11.1 (1.8)	10.9 (2.0)	10.7 (1.8)	*ns*
Range	(8–15)	(7–14)	(8–14)	
Sex				
Girls	44.4 (12)	66.7 (14)	44.8 (13)	*ns*
Boys	55.6 (15)	33.3 (7)	55.2 (16)	
Number of siblings[a]	10	5	6	
Primary diagnoses				
All internalizing anxiety disorders	33.3 (9)	9.5 (2)	6.9 (2)	CPAN>CPHOB, CCON
Separation anxiety disorder	14.8 (4)	—	—	
Overanxious disorder	14.8 (4)	4.8 (1)	3.4 (1)	
Avoidant disorder	—	4.8 (1)	3.4 (1)	
Panic disorder (with agoraphobia)	3.7 (1)	—	—	
All externalizing anxiety disorders	22.2 (6)	52.4 (11)	10.3 (3)	CPHOB>CCON
Agoraphobia	3.7 (1)	—	—	
Specific phobia–spider	7.4 (2)	28.6 (6)	—	
Specific phobia–other animals	7.4 (2)	4.8 (1)	3.4 (1)	
Specific phobia–blood, injections	—	9.5 (2)	3.4 (1)	
Specific phobia–heights	3.7 (1)	4.8 (1)	3.4 (1)	
Specific phobia–school	—	4.8 (1)	—	
Disruptive behavior disorders[b]	11.1 (3)	—	3.4 (1)	
Dysthymic disorder	3.7 (1)	—	—	
Elimination disorders[c]	—	4.8 (1)	3.4 (1)	

Note. CPAN: children of patients with panic disorder; CPHOB: children of patients with animal phobia; CCON: children of parents with no mental disorders. The table shows means (standard deviations) or percentage (number of cases) when applicable.
[a]Two parents with panic disorder, one parent with animal phobia had three children; [b]Disruptive behavior disorders: attention-deficit- and hyperactivity disorder or oppositional disorder; [c]Elimination disorders: enuresis or encopresis.

often a diagnosis of an internalizing anxiety disorder than both other groups of children. Children of phobic parents had significantly more often an externalizing anxiety disorder than children of normal controls.

Measures and Experimental Tasks

Children completed the trait form (STAIC-T) of the State-Trait Anxiety Inventory for Children (STAIC; Spielberger, Gorsuch, & Lushene, 1973, German translation by Unnewehr, Schneider, & Margraf, 1990) at the beginning of the investigation. The scale consists of 20 items that are rated on a three-point scale. In order to assess the degree of anxiety sensitivity, children were also asked to rate their fear of physical symptoms such as palpitations, sweating, or trembling on a 5-point rating scale (ranging from *no fear* to *very strong fear*). This scale was used in place of the CASI (Silverman et al., 1991) since it was not yet available at the time of investigation.

The following four self-rating scales were given at numerous times throughout the experimental session:

1. The Anxiety Self-Rating Scale (AR): A 5-point rating scale to assess the level of anxiety prior to and during both tasks.

2. The Excitement Rating Scale (ER): A 5-point rating scale to measure how excited the child felt prior to and during the tasks. The ER was included in addition to the AR because it was thought that the children of the three groups might differ in their ways of labelling arousal.

3. The Symptom List for Children (SLK), a modified version of the Symptom List for Adults as developed by Margraf (1989): Nineteen symptoms are rated for their frequency and intensity on a 4-point scale. Sixteen of the items pertain to panic-related symptoms such as heart palpitations, dizziness, or trembling, and panic-related cognitions such as fear of fainting, dying, or losing control. The remaining three represent control symptoms (e.g. "sweet taste in the mouth" or "itching") that usually are not associated with panic. They were included for controlling whether the children showed a general tendency toward an exaggerated reporting of symptoms. Panic-related items and control items are analyzed separately.

4. The state form (STAIC-S) of the State-Trait Anxiety Inventory for Children (STAIC, Spielberger, Gorsuch, & Lushene, 1973, German translation by Unnewehr, et al., 1990): The scale consists of 20 items and asks the children to rate their present physical and cognitve sensations and feelings of tension, nervousness, and anxiety on a 3-point scale.

Heart rate (HR) was also measured at various times throughout the experimental session. The average heart rate per min was measured using a portable microcomputer. For this purpose, an elastic belt with inserted electrodes for signal reception was fastened around the child's chest. Attached to this belt was a transmitter transferring the registered signals to a receiver on the wrist. Every 5 s, the average HR was scanned and stored. For statistical analyses, means for each of the experimental conditions were used.

Hyperventilation task. Subjects were asked to breathe through their mouth as deeply as possible for 2 min, completing about 60 respiratory cycles per min. The rhythm for respiration was set and controlled by a metronome. In addition, the investigators ensured that the depth of breathing was comparable for all children (unfortunately, a closer examination of the degree of hyperventilation through analysis of blood gases was not possible).

The following instruction was read to the child: "Now we will do a breathing excercise. In a minute I will ask you to breathe very quickly and very deeply for two minutes. I will show you how you are supposed to do this. When the two minutes are over, I will say 'Stop' and you can breathe normally again. Then, I will again give you some questionnaires to complete. The quick breathing can cause sensations such as nervousness or make your heart beat faster. This will go away, however, as soon as you start breathing normally again. You should try to keep up the quick breathing for two minutes, but if this is very difficult for you or if it scares you too much, you can stop earlier." Thus, an instruction was chosen that represents a middle course between the announcement of a "panic attack test" as it is used in some studies and the announcement of a "breathing test" without any reference to possible anxiety reactions.

Spider confrontation. A spider confrontation was chosen because the majority of the parents with specific phobia were spider phobics (see Table 1). The child was told that a short film would be presented that he or she should watch carefully. The 2-min video film of various types of spiders was shown on a 70cm color screen.

Procedure

After the parents were assigned to the respective groups (panic, animal phobic, control) following the diagnostic interview (DIPS; Margraf et al., 1991), their children participated in the subsequent procedure: a structured interview assessing *DSM-III-R* mental disorders in children (Kinder-DIPS, *DSM-III-R* version; Unnewehr, Schneider, & Margraf, 1995) was conducted with the child and the parent who participated in the study; detailed results will be reported separately. At this time, the children also completed the trait-version of the State Trait Anxiety Inventory for Children (STAIC-T) and the self-rating of their fear of physical symptoms (anxiety sensitivity). Subsequently, the experimental session began.

A 5-min baseline was obtained at the onset and 2-min baselines between each task. During baselines, the children were instructed to sit quietly in the chair with their eyes open. After the first baseline, the following experimental tasks were conducted: (a) the hyperventilation procedure, (b) the spider confrontation, (c) a modified version of the Stroop test, and (d) a paradigm focussing on imitation-learning of selective interpretation of body sensations. Order of paradigms was varied systematically. The Stroop test and the fourth paradigm are detailed elsewhere (Schneider, 1992; Schneider, Unnewehr, Florin, Margraf, & Dornier,

1991). Heart rate and the four rating scales (AR, ER, SLK, STAIC-S) were obtained directly after the baselines and experimental tasks. The self-rating scales given after the tasks assessed retrospectively how the subject had felt *during* the task. After the second experimental task, a resting period of about 10 min was provided. During this time the child was offered something to drink and was permitted to walk around. Total duration of the session was 1.5 to 2 hours.

Statistical Analyses

For the first part of the analyses, children were divided into three groups according to the diagnoses of their parents (panic disorder, animal phobia, and no mental disorder). For the second part, they were grouped according to their level of fear of physical symptoms that was assessed on a 5-point rating scale prior to the experimental procedure. One group consisted of children who reported no fear of physical symptoms (zero-scores on the rating scale), the other group consisted of children who reported at least a medium level of fear of physical symptoms (scores of 2 or more on the rating scale). These groups are referred to as children with low fear of physical symptoms (CLF) and children with high fear of physical symptoms (CHF), respectively. To examine whether reactions to the experimental tasks were influenced by the diagnostic status of the children, additional analyses were performed comparing three groups: children who had a primary diagnosis of (a) an internalizing anxiety disorder, (b) an externalizing anxiety disorder, or (c) no mental disorder. Results on these additional analyses are presented only in short form.

For statistical analysis of the reactions to the hyperventilation task and the spider confrontation, multivariate analyses of variance (MANOVAs) with factors being Group (first MANOVA: CPAN, CPHOB, CCON, second MANOVA: children with low or high fear of physical symptoms), Task (hyperventilation, spider confrontation) and Time (baseline, task) were performed on the following subjective anxiety measures: AR, ER, STAIC-S, and SLK-panic symptoms. Post-hoc univariate analyses of variance were interpreted when the multivariate tests proved significant. Separate univariate analyses of variance with post-hoc Student-Newman-Keuls tests (SNK) were carried out for the STAIC-T, fear of physical symptoms scale, heart rate, and SLK-control symptoms, because these variables were logically distinct from the other subjective measures of anxiety.

For between-group comparisons of frequency data, χ^2 tests (Yates corrected for 2×2 tables) or, in case of expected cell values smaller than 5, Fisher's exact tests were computed. If expected values were smaller than 2, results are reported only descriptively or statistical analyses are interpreted with caution.

Independence of observations is restricted by the fact that siblings were participating in the study. An additional analysis controlled for this factor: only one child per family was randomly selected, and all analyses were performed once more with this reduced sample. No results differing from the main analysis were obtained. Therefore, results for the whole group are presented.

All statistical tests are two-tailed with an alpha level of 0.05.

RESULTS

Children Grouped According to Their Parents' Diagnosis

Trait-anxiety and fear of physical symptoms. Means and standard deviations of the STAIC-T and the fear of physical symptoms scale are reported in Table 3. There were no differences between groups regarding trait-anxiety, $F(2,74) = 2.68$; *ns*. However, groups differed with respect to their reported level of fear of physical symptoms. $F(2,72) = 3.78$; $p < .05$. Post-hoc SNK tests revealed that children of panic patients rated their fear of physical symptoms significantly higher than children of control parents without mental disorders.

Reactions to the Hyperventilation Task and the Spider Confrontation.

Behavioral measure: demand to stop the tasks. Significantly more children of panic patients than of both phobic patients and controls prematurely stopped the hyperventilation test (CPAN: $n = 5$; CPHOB and CCON: $n = 1$, $\chi^2 = 4.56$, $df = 1$; $p < .05$. However, due to small cell values, these results should be interpreted with caution. Regarding the spider confrontation, none of the children asked to stop the task prematurely.

Self-report anxiety measures. Means, standard deviations, and detailed results of the statistical analyses on these variables are reported in Table 4. A 3 × 2 × 2 MANOVA performed on AR, ER, SLK-panic symptoms, and STAIC-S revealed a significant Group × Time × Task interaction, $F(8,144) = 2.49$, $p < .05$, indicating that the groups showed differential reactions to the experimental tasks. Contrary to expectation, the children of all three groups showed significant increases in subjective anxiety as an effect of the hyperventilation task. With regard to the spider confrontation, only CPHOB reacted with a marked increase of subjective anxiety, whereas the levels of subjective anxiety remained stable or even decreased for CPAN and CCON. Univariate ANOVAs performed subsequent to the MANOVA showed that differences were mainly caused by the anxiety and excitement scales (AR and ER).

TABLE 3
TRAIT-ANXIETY AND FEAR OF PHYSICAL SYMPTOMS IN THE CHILDREN

	CPAN $n = 27$	CPHOB $n = 21$	CCON $n = 29$
STAIC-T (scale 20–60)	35.44 (7.68)	35.48 (5.56)	31.93 (5.81)
Fear of physical symptoms (scale 0–4)	1.04 (0.96) $n = 26$	0.86 (0.85)	0.43 (0.69) $n = 28$

Note. The table shows means (standard deviations). CPAN: children of patients with panic disorder; CPHOB: children of patients with animal phobia; CCON: children of parents with no mental disorders.

TABLE 4
REACTIONS TO HYPERVENTILATION AND SPIDER CONFRONTATION IN CHILDREN OF PARENTS WITH PANIC DISORDER, ANIMAL PHOBIA OR NO MENTAL DISORDER

	Hyperventilation		Spider Confrontation	
	Baseline	Task	Baseline	Task
Variable	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Anxiety Rating (AR) (scale 0–4)				
CPAN	0.30 (.61)	1.04 (1.02)	0.48 (.80)	0.33 (.55)
CPHOB	0.19 (.40)	0.86 (.73)	0.14 (.36)	0.71 (1.10)
CCON	0.17 (.38)	1.03 (.86)	0.31 (.60)	0.31 (.71)
Excitement Rating (ER) (scale 0–4)				
CPAN	0.67 (.68)	1.22 (.89)	0.59 (.64)	0.70 (.87)
CPHOB	0.86 (.79)	1.76 (1.04)	0.52 (.60)	0.95 (1.20)
CCON	0.69 (.66)	1.65 (1.08)	0.76 (.87)	0.34 (.48)
STAIC-State (STAIC-S) (scale 20–60)				
CPAN	31.93 (6.24)	41.67 (9.69)	33.22 (7.49)	34.07 (6.57)
CPHOB	31.67 (3.47)	40.90 (6.80)	32.38 (4.93)	35.24 (9.41)
CCON	31.24 (4.95)	40.34 (8.53)	31.86 (5.37)	31.83 (7.65)
Panic Symptoms (scale 0–48) (SLK-panic symptoms)				
CPAN	2.78 (4.36)	9.74 (8.79)	3.96 (6.05)	3.41 (4.81)
CPHOB	3.52 (2.06)	9.76 (6.13)	3.43 (2.38)	4.38 (6.67)
CCON	2.72 (3.19)	8.65 (8.37)	3.31 (3.75)	2.34 (5.11)
Control Symptoms (SLK-control symptoms) (scale 0–9)				
CPAN	0.22 (.51)	0.59 (1.05)	0.37 (.69)	0.30 (.54)
CPHOB	0.43 (.68)	0.38 (1.12)	0.38 (.67)	0.52 (1.03)
CCON	0.28 (.59)	0.48 (1.02)	0.45 (.74)	0.34 (.72)
Heart Rate				
CPAN	84.42 (9.84)	110.30 (11.93)	83.95 (10.63)	80.24 (11.08)
CPHOB	81.57 (10.71)	104.03 (13.72)	83.63 (7.74)	78.54 (9.31)
CCON	83.27 (8.94)	103.25 (12.87)	82.79 (10.55)	78.71 (9.72)

Statistical Analyses

Variables	Group	Task	Time	G × Ta	G × Ti	Ta × Ti	G × Ta × Ti
MANOVA on Anxiety Rating, Excitement Rating, STAIC-State, SLK-panic symptoms							
F	0.95	19.11	17.28	0.78	1.15	22.42	2.49
df	8,144	4,71	4,71	8,144	8,144	4,71	8,144
p	.478	.000	.000	.621	.336	.000	.015

(continued on next page)

TABLE 4 — *CONTINUED*

	Statistical Analyses						
Variables	Group	Task	Time	G × Ta	G × Ti	Ta × Ti	G × Ta × Ti
Post hoc ANOVAs							
Anxiety Rating (df = 1,74/2,74)							
F	0.17	14.27	38.90	1.05	1.57	23.03	3.74
p	.841	.000	.000	.354	.214	.000	.028
Excitement Rating (df = 1,74/2,74)							
F	0.84	33.89	33.19	1.50	2.50	34.68	5.99
p	.435	.000	.000	.230	.089	.000	.004
STAIC-State (df = 1,74/2,74)							
F	0.49	39.93	66.24	0.70	0.44	74.95	0.80
p	.611	.000	.000	.500	.645	.000	.452
SLK-panic symptoms (df = 1,74/2,74)							
F	0.34	58.49	39.05	0.06	0.44	58.83	0.55
p	.716	.000	.000	.941	.647	.000	.578
ANOVAs on Control Symptoms and Heart Rate							
SLK-control symptoms (df = 1,74/2,74)							
F	0.05	0.00	1.15	0.35	0.19	2.67	2.56
p	.948	.961	.287	.709	.828	.107	.084
Heart Rate (df = 1,74/2,74)							
F	0.80	312.95	132.55	2.10	1.51	364.54	1.44
p	.453	.000	.000	.130	.228	.000	.244

Note. CPAN: children of patients with panic disorder, n = 27; CPHOB: children of patients with animal phobia, n = 21; CCON: children of parents with no mental disorders, n = 29; G = Group, Ta = Task, Ti = Time.

Control symptoms. Means, standard deviations, and results of the statistical analysis are presented in Table 4. For the SLK-control symptoms, no significant differences between groups were obtained.

Heart rate. Means, standard deviations, and results of the statistical analysis are presented in Table 4. No significant differences between groups were found during either baseline or experimental tasks. The hyperventilation task caused heart-rate increases in all three groups, whereas the spider confrontation led to decreases in heart rate (significant Task × Time interaction: $F(1,74) = 364.54$, $p < .01$).

Children Grouped With Respect to Their Own Diagnostic Status

Children with internalizing anxiety disorders, externalizing (phobic) anxiety disorders, and no mental disorders did not differ in their reactions to the hyper-

ventilation task. Children with externalizing anxiety disorders showed a tendency to react more anxiously to the spider confrontation than the two other groups, but these differences failed to reach statistical significance.

Children Grouped With Respect to Their Level of Fear of Physical Symptoms (Anxiety-Sensitivity)

Nineteen percent ($n = 4$) of the children of animal phobics, 29.6% ($n = 8$) of the children of panic patients, and 10.3% ($n = 3$) of the children of parents without a mental disorder were categorized as having high fear of physical symptoms. There were two pairs of siblings in the low-fear group and three pairs of siblings in the high-fear group. Children with low fear of physical symptoms (CLF) had an average age of 10.8 years ($SD = 1.6$), those with high fear of physical symptoms (CHF) had an average age of 11.7 years ($SD = 1.8$). This difference shows a trend towards significance ($F(1,49) = 3.27$, $p = .077$). With regard to gender, both groups were comparable (CLF: 41.7% girls; CHF: 53.3% girls; $\chi^2 = 0.21$; $df = 1$; *ns*).

Reactions to the Hyperventilation Task and the Spider Confrontation.

Behavioral measure: demand to stop the tasks. Significantly more of the children with high fear of physical symptoms than of children with low fear of physical symptoms prematurely stopped the hyperventilation task (CHF: $n = 4$; CLF: $n = 1$; $\chi^2 = 4.40$; $df = 1$; $p < .05$). However, due to small cell values, these results should be interpreted with caution. None of the children asked to stop the spider confrontation prematurely.

Self-report anxiety measures. Means, standard deviations, and detailed results of the statistical analyses on these variables are reported in Table 5. A 2 × 2 × 2 MANOVA (performed on AR, ER, STAIC-S, and SLK-panic symptoms) revealed a main effect for the factor Group, $F(4,46) = 4.35$, $p < .01$, and a significant three-way interaction, namely Group × Task × Time, $F(4,46) = 3.68$, $p < .01$. Children with a strong fear of physical symptoms not only had significantly higher baseline scores in both tasks on all self-report measures (ANOVAs for AR, ER, STAIC-S, SLK-panic symptoms: $p < .05$, respectively), but also responded more strongly to the hyperventilation task as evidenced by the three-way interaction and inspection of the means and standard deviations. Univariate ANOVAs performed subsequent to the MANOVA showed that differences were mainly caused by the anxiety rating (AR) and SLK-panic symptoms.

Control symptoms. Means, standard deviations, and results of the statistical analysis are reported in Table 5. Children with high fear of physical symptoms reported a significantly higher increase in SLK-control symptoms in reaction to both tasks than children with low fear of physical symptoms (significant Group × Time interaction, $F(1,49) = 4.48$, $p < .05$).

TABLE 5
REACTIONS TO HYPERVENTILATION AND SPIDER CONFRONTATION IN CHILDREN WITH HIGH OR LOW FEAR OF PHYSICAL SYMPTOMS

	Hyperventilation		Spider Confrontation	
	Baseline	Task	Baseline	Task
Variable	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Anxiety Rating (AR) (scale 0–4)				
CLF	0.11 (.32)	0.64 (.72)	0.22 (.48)	0.25 (.65)
CHF	0.33 (.62)	1.47 (1.06)	0.67 (.98)	0.47 (.64)
Excitement Rating (ER) (scale 0–4)				
CLF	0.61 (.60)	1.33 (.86)	0.53 (.70)	0.39 (.59)
CHF	1.00 (.93)	2.13 (1.19)	0.87 (.74)	0.67 (.72)
STAIC-State (STAIC-S) (scale 20–60)				
CLF	29.86 (3.75)	38.36 (8.00)	30.83 (3.91)	30.64 (5.78)
CHF	34.87 (6.96)	45.53 (8.42)	37.53 (9.22)	38.07 (8.84)
Panic Symptoms (scale 0–48) (SLK-panic symptoms)				
CLF	1.89 (1.77)	6.61 (5.86)	2.00 (2.14)	1.58 (2.20)
CHF	4.47 (5.22)	15.07 (10.60)	7.20 (7.08)	5.73 (8.17)
Control Symptoms (scale 0–9) (SLK-control symptoms)				
CLF	0.22 (.48)	0.28 (.88)	0.28 (.57)	0.27 (.57)
CHF	0.33 (.48)	0.86 (1.30)	0.47 (.83)	0.60 (.91)
Heart Rate				
CLF	85.06 (7.47)	104.94 (13.38)	84.58 (8.62)	80.76 (8.27)
CHF	86.25 (10.34)	111.12 (10.40)	84.67 (9.77)	80.68 (9.14)

Statistical Analyses

Variables	Group	Task	Time	G x Ta	G x Ti	Ta x Ti	G x Ta x Ti
MANOVA on Anxiety Rating, Excitement Rating, STAIC-State, SLK-panic symptoms (*df* = 4,46)							
F	4.35	13.38	11.11	1.50	1.37	24.03	3.68
p	.005	.000	.000	.217	.258	.000	.011
Post hoc ANOVAs							
Anxiety Rating (*df* = 1,49)							
F	8.77	12.00	16.01	2.03	1.03	30.95	6.39
p	.005	.001	.000	.160	.315	.000	.015
Excitement Rating (*df* = 1,49)							
F	6.83	34.26	18.74	1.62	0.99	57.25	2.65
p	.012	.000	.000	.208	.323	.000	.110

(continued on next page)

TABLE 5—*CONTINUED*

	Statistical Analyses						
Variables	Group	Task	Time	G x Ta	G x Ti	Ta x Ti	G x Ta x Ti
STAIC-State (*df* = 1,49)							
F	16.22	19.04	40.72	0.54	0.90	62.06	0.36
p	.000	.000	.000	.456	.348	.000	.550
SLK-panic symptoms (*df* = 1,49)							
F	15.42	38.26	33.28	0.81	4.29	65.88	10.68
p	.000	.000	.000	.370	.044	.000	.002
ANOVAs on Control symptoms and Heart Rate							
SLK-Control symptoms (*df* = 1,49)							
F	2.83	0.07	6.26	0.41	4.48	1.60	0.91
p	.099	.794	.016	.527	.039	.213	.344
Heart Rate (*df* = 1,49)							
F	0.62	185.33	85.30	3.40	1.25	185.56	1.55
p	.433	.000	.000	.071	.269	.000	.219

Note. CLF: children with low fear of physical symptoms, $n = 36$; CHF: children with high fear of physical symptoms, $n = 15$; G = Group, Ta = Task, Ti = Time.

Heart rate. Means, standard deviations, and results of the statistical analysis are reported in Table 5. Children with high fear of physical symptoms had a tendency towards higher scores during hyperventilation than children with low fear of physical symptoms, $F(1,49) = 3.40$, $p = .07$).

DISCUSSION

In the present study, children of patients with panic disorder, children of patients with animal phobia, and children of healthy controls were confronted with "internal" stimuli, (i.e.,physical symptoms through the hyperventilation procedure), and with "external" stimuli, (i.e.,phobic stimulus through the presentation of a spider video). It was expected that the children of panic patients would react more anxiously to the hyperventilation procedure, whereas children of phobics would react more anxiously to the spider confrontation. These hypotheses were partially confirmed.

Initial Levels of Trait Anxiety and Fear of Physical Symptoms

Children of the three parent groups did not differ with respect to trait anxiety, but children of parents with panic disorder reported higher fear of physical symptoms than children of control parents. This points to a possible familial transmission effect of a specific factor that characterizes parental symptomatology.

Reactions to Hyperventilation and Spider Confrontation in Children Grouped According to their Parents' Diagnoses

As reported, children of all three parent groups reacted to the hyperventilation with substantial increases in all of the subjective measures of anxiety and heart rate. This was contrary to the prediction that stated that reactions of the children of panic patients would be higher than those of the other groups. On the other hand, more children of panic patients than children of the other groups prematurely terminated the hyperventilation task. Although this finding points toward more severe anxiety reactions in children of panic patients, due to the small number of cases it should not be generalized until replicated. Overall, the hypothesis of stronger reactions to physical symptoms in children of panic patients could, therefore, not clearly be confirmed within this sample.

A question that may be asked in this context is whether children aged 7 to 15 are, according to their cognitive developmental stage, able to evaluate physical symptoms as signs of imminent danger as is characteristic of adult panic patients. This would require the children to realize that physical symptoms or diseases can be caused by internal physiological or psychological mechanisms. Following Piaget's (1960) stage model of cognitive development, Bibace and Walsh (1981) and Lohaus (1990) have conducted extensive research on the development of concepts of disease in children aged 8 to 13 years. Until the age of 6, the child's comprehension of causes of disease and of the emergence of symptoms is completely "externally" oriented. Diseases are related to external and, more important, visible influences coinciding with the symptoms. In later stages, the child (around the age of 6 to 10) develops an understanding of external influences in the emergence of a disease not necessarily needing to be visible (e.g., radiation or viruses) and subsequently (around age 11) realizes that the occurrence of symptoms or diseases can have additional causes in determinants internal to the individual. According to Bibace and Walsh, it can be assumed that most of the children investigated here — with the mean age being 10 to 11 years — were already able to think of the possibility that physical symptoms may be signs of a disease. A study by Enzer and Walker (1967) similarly showed that the interpretations of physical symptoms typical of panic patients already existed in children with a hyperventilation syndrome who were comparable in age to those of the present sample.

As was hypothesized, children of animal phobics reacted, as opposed to both other groups, to the spider confrontation with substantial increases in anxiety. The question arises whether this stronger anxiety response of the CPHOB reflects a specific phobic modeling effect or, since a substantial number of CPHOB had a spider phobia or other specific phobia by themselves, whether it is an expression of the diagnostic status of the children. When children were grouped according to their own diagnoses, no significantly different reactions to the tasks were found between groups. Therefore, the above-mentioned findings in the children of animal phobics seem to be more strongly associated to their parents' symptomatology than to their own diagnostic status.

In contrast to the subjective measures, heart rate significantly decreased in children of animal phobics quite similarly to the reaction patterns in the other two groups. The reasons for this discordance between subjective anxiety and physiological responses are not clear. The explanation that the phobic stimuli were not strong enough or that the children were bored by the film or did not watch it carefully is contradicted by the self-reports of subjective anxiety. The findings should, therefore, not be interpreted until replicated.

Reactions to Hyperventilation and Spider Confrontation in Children With High Versus Low Fear of Physical Symptoms (Anxiety Sensitivity)

When children were assigned to groups according to their fear of physical symptoms, the following effects emerged: children who had initially reported at least a moderate level of fear of physical symptoms had higher baseline scores prior to both tasks and, most important, reacted with a higher increase in subjective measures of anxiety to the symptoms produced by hyperventilation than did children who had reported no fear of physical symptoms. In addition, as a behavioral measure of anxiety, or a measure of avoidance of anxiety, more of the children with high fear of physical symptoms prematurely stopped the task. This intense fear reaction appeared to be specific to confrontation with physical symptoms as opposed to confrontation with an external phobic stimulus. The fact that children with high fear of physical symptoms reported a significant increase in control symptoms during both tests points toward a generally increased tendency in these children to report bodily symptoms.

The concept of *anxiety sensitivity* was derived from research on adults, in particular those with panic disorder. The present study suggests that the concept is applicable to children as well. It may be of particular relevance for children of parents with panic disorder. As in the study conducted by Holloway and McNally (1987), previously obtained degree of anxiety sensitivity predicted subjective anxiety reactions to confrontation with physical symptoms by way of the hyperventilation procedure. Findings of this investigation, therefore, present additional evidence that anxiety sensitivity can exist prior to the occurrence of a panic attack and, thus, can be considered a possible cognitive risk factor for panic disorder or other anxiety disorders.

Methods Employed and Suggestions for Future Research

Few investigations have been published that experimentally studied possible predispositions for anxiety disorders in children of patients with the diagnosis of an anxiety disorder. Owing to this, it was not always possible to implement methods of established reliability and validity. As a further limitation of this study, it must be mentioned that an exact examination of the degree of hyperventilation by determining the arterial CO^2-partial pressure was not possible. Although obtaining this measure is not common even in studies on adults, it should be included in further studies in order to increase objectivity.

Even with these critical aspects in mind, in view of the reported findings it appears useful to investigate further the concept of anxiety sensitivity in children. Providing that the results are replicable, it would be worthwhile to conduct longitudinal studies investigating children who are high and low in anxiety sensitivity with regard to the later occurrence of panic attacks and other psychopathology. Such studies are currently being performed in our research group. If a higher rate of panic attacks should be found in children with high fear of physical symptoms, this would provide direct evidence that anxiety sensitivity is a predisposition for panic disorder. In this case, in terms of prevention it would be useful to develop specific methods of intervention for children facilitating the modification of the particular emotional and cognitive reactions to physical symptoms. It could be investigated whether these children profit from specific intervention strategies for the modification of catastrophizing interpretations of bodily symptoms. Finally, the reported findings suggest the development and evaluation of measures specifically aimed at the prevention of phobias in children of parents having animal phobias.

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