



# The factor structure of the Childhood Anxiety Sensitivity Index in German children

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## Abstract

The factor structure of the Childhood Anxiety Sensitivity Index (CASI) was investigated in four nonclinic German samples ( $N = 1244, 225, 230,$  and  $143$ ) with participants aged 8–16-years-old. Factor solutions suggested for different CASI versions were tested using confirmatory factor analysis. The best goodness-of-fit indices were found for the 13-item CASI version with 4 factors (*Disease Concerns, Unsteady Concerns, Mental Incapacitation Concerns, and Social Concerns*). Testing for factorial invariance of this model with respect to age and gender revealed non-invariant factor loadings between children and adolescents as well as between boys and girls. The theoretical and clinical implications of these findings for anxiety sensitivity in children and adolescents are discussed.

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## 1. Introduction

Anxiety sensitivity, as defined by Reiss and McNally (1985), is a stable predisposition toward fearing anxiety-related bodily sensations, arising from beliefs that these sensations

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have harmful somatic, psychological or social consequences. According to Reiss and McNally (1985), anxiety sensitivity includes different kinds of anxiety symptoms, not only physical symptoms (e.g., rapid heart beat) but also mental symptoms (e.g., racing thoughts) and publicly observable physical symptoms (e.g., stomach growling). Expectancy theory (Reiss, 1991; Reiss & McNally, 1985) conceives anxiety sensitivity as a personality trait increasing a person's vulnerability to fear conditioning. Designed in accordance with expectancy theory, the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986) is a self-report questionnaire assessing adults' fears of different kinds of anxiety symptoms. To assess anxiety sensitivity with school-aged children, the Childhood Anxiety Sensitivity Index (CASI) was developed by Silverman, Fleisig, Rabian, and Peterson (1991). The child version is a modification of the ASI and includes the same 16 items contained in the adult version plus two additional items. Anxiety sensitivity in children is usually investigated with the CASI. It is a widely used and extensively researched self-report questionnaire for use with children in the field of anxiety disorders.

There has been considerable discussion about anxiety sensitivity in adults. Many studies have investigated its factor structure. Some researchers have found support for a unitary construct, whereas others have found support for a multidimensional construct (see Zinbarg, Mohlman, & Hong, 1999). Anxiety sensitivity is currently generally accepted by most researchers as a hierarchically organized construct with one general (higher-order) factor consisting of several first-order factors (see reviews in Taylor, 1999). In spite of this consensus, there is still controversy about the number and nature of first-order factors loading on a single higher-order factor. The same debate can also be observed in anxiety sensitivity research in children. Table 1 gives an overview of the different results suggested for the factor structures of the CASI as obtained by various studies. Although some findings have suggested a two-factor solution (Chorpita & Daleiden, 2000; Laurent, Schmidt, Catanzaro, Joiner, & Kelley, 1998) hierarchical models with one higher-order factor and three or four first-order factors are now more widely discussed. The two hierarchical models found by Silverman, Ginsburg, and Goedhart (1999) were confirmed by Van Widenfelt, Siebelink, Goedhart, and Treffers (2002) and also by Muris, Schmidt, Merkelbach, and Schouten (2001), who found a similar hierarchical structure (using a four-point Likert scale). Silverman, Goedhart, Barrett, and Turner (2003) summarized the different results from factor structure analysis of the CASI as well as the ASI, resulting in a 13-item CASI version. For this version, the authors suggested a hierarchical ordering of models with two, three, and four first-order factors (see Table 1).

Despite the different findings underlying the various factor models of the CASI and the ASI, there seems to be a consensus about the distinction between a factor reflecting physical concerns or fear of physiological arousal and factors representing fear or concerns of other facets like mental incapacitation, loss of control, and social concerns, depending on how many factors are distinguished. Anxiety sensitivity seems to be more than a risk factor for the development of anxiety disorders in general and panic disorder in particular. Recent research has prompted discussion about whether the specific factors are more related to pathological conditions rather than the total anxiety sensitivity construct. More specifically, *Physical Concerns* is strongly related to panic disorder, *Social Concerns* to social phobia, and *Mental Incapacitation Concerns* to depressed mood (Zinbarg, Barlow, & Brown, 1997; Zinbarg, Brown, Barlow, & Rapee, 2001). Silverman et al. (2003) found evidence that the facet *Social Concerns* is related to social phobia, but only for adolescents and not for children. These findings allow a more comprehensive understanding of concerns related to specific psychopathology. Therefore, the clarification of the factor structure of the CASI is not only of interest methodologically, but is also important

Table 1  
Overview of studies conducting factor analysis of the CASI

Authors	Sample	Factor model	Items	Label
Chorpita and Daleiden (2000)	nonclinic sample <i>N</i> = 228; 7–17 years	2 f.-o. f.	3, 4, 6, 7,	CASI-autonomic scale
			8, 9, 10, 11, 14, 15, 16, 18 1, 2, 5, 12, 13, 17	CASI-nonautonomic scale
Laurent et al. (1998)	3 nonclinic samples <i>N</i> = 95; 9–15 years <i>N</i> = 112; 9–14 years <i>N</i> = 144; 11–15 years	2 f.-o. f.	2, 3, 4, 6, 9, 12, 14, 15, 16	Fear of Physiological Arousal
			8, 10, 11	Fear of Mental Catastrophe
Muris et al. (2001)	nonclinic sample <i>N</i> = 819; 13–16 years	3 f.-o. f.	4, 6, 8, 9, 10, 11, 14	Fear of Physiological Arousal
			1, 5, 7, 13	Fear of Losing Control and Social Evaluation
		4 f.-o. f.	2, 3, 12, 15, 16	Fear of Mental Incapacity
			3, 4, 6, 8, 9, 10, 11, 14	Fear of Physiological Arousal
Silverman et al. (1999)	nonclinic sample <i>N</i> = 249; 7–12 years	3 f.-o. f.	3, 6, 9, 10, 11, 14, 16, 18	Physical Concerns
			2, 12, 13, 15	Mental Incapacitation Concerns
			1, 4, 5, 7, 8, 17	Concerns about Publicly Observable Symptoms
		4 f.-o. f.	3, 6, 9, 11, 14, 16, 18	Physical Concerns
			2, 12, 13, 15	Mental Incapacitation Concerns
			1, 17	Social Concerns
Silverman et al. (2003)	2 nonclinic samples <i>N</i> = 767; 7–15 years <i>N</i> = 249; 7–12 years clinic sample <i>N</i> = 258; 7–16 years	2 f.-o. f.	3, 4, 6, 8, 9, 10, 11	Physical Concerns
			1, 2, 5, 12, 15, 17	Other Concerns
		3 f.-o. f.	3, 4, 6, 8, 9, 10, 11	Physical Concerns
			2, 12, 15	Mental Illness Concerns
		4 f.-o. f.	1, 5, 17	Social Concerns
			3, 6, 9, 11	Disease Concerns
4, 8, 10	Unsteady Concerns			
	2, 12, 15	Mental Illness Concerns		
	1, 5, 17	Social Concerns		

Note. f.-o. f. means first-order factors.

conceptually. This clarification was recently carried out for the English version of the CASI. Silverman et al. (2003) found strong support for a hierarchical model for anxiety sensitivity with a single second-order factor and four first-order factors, which they labelled *Disease Concerns*, *Unsteady Concerns*, *Mental Incapacitation Concerns*, and *Social Concerns*. Further, they could show that *Disease Concerns* was the most significant facet of anxiety sensitivity. The items of this facet showed the highest loadings on the general factor, and the facet showed a very strong correlation with the total scale ( $r = 0.92$ ). With the present investigation, we will add information to the debate about the construct of anxiety sensitivity as represented in the CASI. Especially, the controversy about the number and nature of first-order factors was of interest. The main objective of our study was to attain a clear factor structure of anxiety sensitivity as represented in the German version. First, we tested pre-existing factor solution (a) the 18-item CASI solution (Silverman et al., 1999), because it was the first suggested and is still widely used for the original CASI, and (b) the 13-item CASI solution (Silverman et al., 2003), because of its wide empirical and theoretical acceptance. We have chosen these two CASI solutions above the others presented in Table 1, as the latest discussions focus more on hierarchical models with three or four first-order factors than two first-order factors. Muris et al. (2001) also confirmed the 18-item CASI solution from Silverman et al. (1999). Second, we explored the factor structure of the CASI to add new and independent results to the ongoing discussion about the number and composition of the factors of anxiety sensitivity. Finally, we explored the factor stability for the best-fitting model across age and gender.

## 2. Method

### 2.1. Participants

Data on four German-speaking samples were investigated. Table 2 gives an overview of the four independent nonclinic samples. The participants from samples 1, 2, and 3 were schoolchildren from Germany, whereas the participants from sample 4 were schoolchildren from Switzerland. In all samples, the children were selected from different schools in different districts and all children of a selected class were included. For the selection of the German subjects, statistical information (e.g., sex, family status, size of class, size of school, and educational status of parents) about the total population was consulted to give an indication of the representativeness of these samples. Because of different demographic information of the samples, only the following data can be presented. Sample 1 consisted of participants in the Schneider and Hensdiek (2003) study. In Sample 1 54.1% of the students were from the east part (former German Democratic Republic) and 45.9% from the west part (former Federal Republic of Germany) of Berlin. For the majority of the participants, the parents were married (75%). Parental occupation was broadly classified, and 63.4% of fathers were in a professional position or a skilled trade, 36.3% were in unskilled positions, and 0.3% were not working. Mothers were similarly classified as being in professional or skilled positions (68%), unskilled positions (18.8%), and not working (13.2%). Sample 2 consisted of children especially recruited for data collection for the CASI. Sample 3 consisted of 8-year-olds reported by Federer, Schneider, Margraf, and Herrle (2000). The majority of the participants lived in dual-parent households (75.2%). Parental occupation was classified, and 92.1% of fathers were in a professional position or a skilled trade, 6.7% were in unskilled positions, and 1.2% were not working. Mothers were similarly classified as being in professional or skilled positions (88.5%), unskilled positions

Table 2  
Overview of the four samples

	Sample 1	Sample 2	Sample 3	Sample 4
<i>N</i>	1244	225	230	143
Sex				
Boys	522 (42.0%)	87 (38.7%)	108 (47.0%)	73 (51.0%)
Girls	722 (58.0%)	138 (61.3%)	122 (53.0%)	70 (49.0%)
Age			8	
Range	12–16	10–16		9–14
Mean	13.80	13.42		11.57
SD	1.16	1.78		1.68
Grade				
2. Grade			230 (100%)	
3. Grade				23 (16.0%)
4. Grade		12 (5.3%)		20 (14.0%)
5. Grade		33 (14.7%)		22 (15.4%)
6. Grade		31 (13.8%)		32 (22.4%)
7. Grade	344 (27.7%)	19 (8.4%)		22 (15.4%)
8. Grade	441 (35.5%)	60 (26.7%)		24 (16.8%)
9. Grade	268 (21.5%)	42 (18.7%)		
10. Grade	191 (15.3%)	28 (12.4%)		

(3%), and not working (8.5%). Sample 4 consisted of children investigated by Schneider, In-Albon, Rose, and Ehrenreich (2006).

## 2.2. Procedure

For samples 1, 2, and 4, female researchers went into the children's classroom during regular classes and handed out a questionnaire packet containing the CASI. Instructions about how to answer the questionnaires were read aloud and any questions from the children were answered by the researcher. Assistants were present during the filling out of the questionnaires to provide assistance to the children if necessary and to ensure independent responding.

The 8-year-olds of sample 3 completed the questionnaire individually with an assistant. Each child completed an oral version of the CASI. To ensure that the child understood the questions, the assistant read aloud the questions as well as the possible answers and the child had to choose the answer appropriate to him/her with a nod of the head.

## 2.3. Measure

The CASI is a self-report questionnaire containing 18 items describing reactions to body symptoms. On a three-point scale with the responses 1 (*none*), 2 (*some*), or 3 (*a lot*), children indicate for each item the extent to which they believe the experience of anxiety will result in negative consequences. The total score of the CASI ranges from 18 to 54, with higher scores reflecting higher levels of anxiety sensitivity. In American studies, the CASI has shown high internal consistency (coefficient  $\alpha = 0.87$ ) and good test–retest reliabilities of 0.76 and 0.79 for nonclinic and clinic samples, respectively (e.g., Silverman et al., 1991).

In the present study, children in all four samples completed the German version of the CASI, translated by Schneider and Hensdiek (1994). To ensure faithfulness to the English version and

to correct differences between the English and the German version, a translation back from German into English was made by a native English speaker with German as a second language. The back-translation revealed an accurate translation of the CASI with slight differences in some expressions. In sum, the chosen German formulations sufficiently captured the meaning of the English expressions judged by the authors. Only item 13 was incorrectly translated. For the word “shaky” the German expression for “afraid” was used, which does not have precisely the same meaning. This item will be corrected for future studies and was still included for the present study, allowing the comparison with the CASI versions used in the other studies (see Table 1). However, this item was not included in the analysis of the 13-item CASI version.

The German version of the CASI showed good reliability and validity. For schoolchildren, internal consistencies (coefficient  $\alpha$ ) were between 0.76 and 0.86; test–retest reliability was 0.80 (e.g., Schneider & Hensdiek, 2003).

### 3. Statistical analyses and results

For descriptive statistics, item analysis, and exploratory factor analysis (EFA), we used the Statistical Package for Social Sciences (SPSS); for confirmatory factor analysis (CFA) we used the software package AMOS (Arbuckle & Wothke, 1999). Because of its large size, we used only sample 1 for the item analysis as well as for the establishment of the factor structure using exploratory factor analysis (see Table 2). Children whose responses had missing values in one of their CASI items were omitted from further analyses. This resulted in a sample size reduction of 1244 to 1226 in sample 1, whereas in samples 2–4 no missing values were observed. Item values were log-transformed to get less skewed frequency distributions as a result of the three-point Likert scale. We also checked for univariate or multivariate outliers and for multicollinearity of log-transformed item values. No outliers were detected and multicollinearity proved to be no problem.

#### 3.1. Replication of pre-existing factor solutions

CFA was conducted to test how well the two-, three-, and four-factor models of two different versions of the CASI fitted to our four samples. Thus, the 18-item CASI (Silverman et al., 1999) and the 13-item CASI (Silverman et al., 2003) were used. The goodness-of-fit indices of the resulting factor models were evaluated by using the chi-square/degrees of freedom ( $\chi^2/\text{df}$ ) ratio, the Goodness-of-Fit Index (GFI), the Comparative Fit Index (CFI), the root mean square residual (RMR), the root mean square error of approximation (RMSEA), and the Akaike’s information criterion (AIC). The value of  $\chi^2/\text{df}$  should be lower than 4 in large samples like sample 1. For the other three samples, the stronger criterion suggested by Mueller (1996) was used:  $\chi^2/\text{df} < 2.00$ . Values of GFI and CFI higher than 0.90 and of RMSEA and RMR lower than 0.05 indicate a good fit. The AIC is a relative measure where lower values imply better fit (for more information and discussion of the goodness-of-fit indices, see e.g., Gerbing & Anderson, 1993).

For all four samples, the goodness-of-fit indices of both CASI versions and their factor solutions based on the number of factors and the degree of hierarchy are presented in Table 3. The results of the two-factor solution are not presented here as they showed a bad fit for all four samples and both CASI versions. Because the results of the three-correlated-factor solution and the three-first-order factor solution were almost identical, only the model with three-correlated-factors is presented here.

Table 3  
Goodness-of-fit indices

Model	Sample	GFI	CFI	$\chi^2/df$	RMR	RMSEA	AIC
Factor models for the 18-item CASI version (Silverman et al., 1999)							
1. 3 corr. f.	1	0.934	0.808	5.64	0.015	0.062	823.1
	2	0.891	0.732	1.87	0.018	0.063	325.9
	3	0.915	0.892	1.54	0.021	0.049	281.5
	4	0.858	0.843	1.71	0.022	0.071	304.8
2. 4 corr. f.	1	0.942	0.836	5.07	0.014	0.058	738.3
	2	0.898	0.761	1.80	0.017	0.060	316.4
	3	0.901	0.828	1.88	0.033	0.062	326.7
	4	0.867	0.858	1.66	0.020	0.068	298.7
3. 4 f.-o. f.	1	0.941	0.833	5.07	0.014	0.058	743.9
	2	0.894	0.745	1.84	0.018	0.061	321.5
	3	0.915	0.887	1.56	0.021	0.050	285.6
	4	0.862	0.845	1.71	0.021	0.071	304.8
Factor models for the 13-item CASI version <sup>a</sup> (Silverman et al., 2003)							
1. 3 corr. f.	1	0.963	0.868	4.89	0.013	0.056	360.9
	2	0.934	0.783	1.67	0.017	0.055	161.6
	3	0.952	0.954	1.22	0.019	0.031	133.8
	4	0.889	0.831	1.96	0.024	0.082	179.6
2. 4 corr. f.	1	0.976	0.920	3.47	0.010	0.045	268.8
	2	0.953	0.895	1.33	0.014	0.039	143.1
	3	0.959	0.981	1.09	0.017	0.021	128.7
	4	0.911	0.883	1.69	0.022	0.070	164.0
3. 4 f.-o. f.	1	0.975	0.917	3.49	0.011	0.045	272.6
	2	0.950	0.885	1.36	0.015	0.040	143.1
	3	0.959	0.987	1.06	0.017	0.017	124.8
	4	0.907	0.871	1.74	0.023	0.072	166.2

Note. corr. f. means correlated factors; f.-o. f. means first-order factors.

GFI = Goodness-of-Fit Index; CFI = Comparative Fit Index; RMR = root mean square residual; RMSEA = root mean square error of approximation; AIC = Akaike's information criterion.

<sup>a</sup> CASI items 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 15, and 17.

The 13-item version performed consistently better than the 18-item version as shown by the better fit indices across all three-factor solutions and all four samples (see Table 3). Comparing the different factor solutions, the four-factor solution showed a better fit than the three-factor solution across all samples and CASI versions independently of whether the four factors correlated or not. The fit indices for both four-factor solutions were almost identical across all samples and CASI versions. Samples 1 ( $N = 1226$ ) and 3 ( $N = 230$ ) provided fits that were mostly good across both CASI versions and their associated factor solutions. Sample 4 ( $N = 143$ ) in contrast provided fits that were in general not satisfactory. Fit indices of sample 2 ( $N = 225$ ) lay between samples 1, 3, and 4.

### 3.2. Item analysis

In Table 4, the items of the CASI are listed and the results of the item analysis of sample 1 ( $N = 1226$ ) are presented. Items with a corrected item-total correlation less than 0.30 were

Table 4  
Mean (M), standard deviation (SD), and item-total correlation ( $r_{it}$ ) of the 18 items

Item	M	SD	$r_{it}$
1. I don't want other people to know when I feel afraid.	0.76	0.50	0.29
2. When I cannot keep my mind on my schoolwork, I worry that I might be going crazy.	0.31	0.50	0.30
3. It scares me when I feel shaky.	0.46	0.53	0.44
4. It scares me when I feel like I am going to faint.	0.45	0.55	0.40
5. It is important for me to stay in control of my feelings.	1.11	0.44	0.26
6. It scares me when my heart beats fast.	0.52	0.56	0.43
7. It embarrasses me when my stomach growls.	0.58	0.57	0.24
8. It scares me when I feel like I am going to throw up.	0.67	0.57	0.38
9. When I notice that my heart is beating fast, I worry that there might be something wrong with me.	0.39	0.53	0.41
10. It scares me when I have trouble getting my breath.	0.82	0.56	0.38
11. When my stomach hurts, I worry that I might be really sick.	0.51	0.53	0.32
12. It scares me when I can't keep my mind on my schoolwork.	0.38	0.53	0.38
13. Other kids can tell when I feel shaky.	0.63	0.52	0.34
14. Unusual feelings in my body scare me.	0.57	0.54	0.50
15. When I am afraid, I worry that I might be crazy.	0.23	0.45	0.40
16. It scares me when I feel nervous.	0.41	0.53	0.45
17. I don't like to let my feelings show.	0.74	0.53	0.18
18. Funny feelings in my body scare me.	0.50	0.53	0.47

Note. Italics indicate values of  $r_{it}$  of less than 0.30.

considered questionable (Nunnally & Bernstein, 1994). The results indicated that items 1, 5, 7, and 17 fell below this critical value. The internal consistency measured by Cronbach's coefficient  $\alpha$  for all 18 items was 0.79.

### 3.3. Own factor analysis

The data of sample 1 were used to reveal the factor structure of the German version of the CASI. Exploratory factor analysis (EFA) with varimax and oblimin rotation was conducted to define two-, three-, and four-factor models. Both rotation methods resulted in a similar pattern of factor loadings. Therefore, only the results of the varimax rotation will subsequently be reported.

EFA led to four factors with eigenvalues greater than one, the unrotated factors accounting for 22.4, 8.0, 6.9, and 6.1% of the total item variance. However, the scree test rather suggested a one-factor solution. The first factor labelled *Unsteady Concerns* consisted of the items 4, 8, 10, 13, 14, and 18, the second factor labelled *Disease Concerns* of the items 3, 6, 9, and 16, the third factor labelled *Mental Illness Concerns* of the items 2, 12, and 15, and the fourth factor labelled *Social Concerns* of the items 1, 5, and 17. Only items 7 and 11 had a loading below 0.40 (see Table 5).

Based on the results of the item analysis and the exploratory factor analysis, item 7 was excluded from further analyses, resulting in a 17-item CASI version. Item 7 was the only item showing a low item-total correlation combined with a low factor loading and an unclear factor affiliation. Although items 5 and 17 showed poor item-total correlations their factor loadings were sufficiently high to keep them in the model.

Based on the 17-item CASI, we ran the EFA again constraining the number of factors to two, three, or four. For the two-factor solution, items 2, 3, 6, 9, 11, 12, 15, and 16 loaded on one

Table 5  
Factor loadings from principal components analysis

Item	Factor			
	1	2	3	4
1. I don't want other people to know when I feel afraid.	0.218	0.073	−0.020	<b>0.651</b>
2. When I cannot keep my mind on my schoolwork, I worry that I might be going crazy.	0.081	0.018	<b>0.815</b>	−0.030
3. It scares me when I feel shaky.	0.198	<b>0.583</b>	0.098	0.148
4. It scares me when I feel like I am going to faint.	<b>0.565</b>	0.143	0.136	0.026
5. It is important for me to stay in control of my feelings.	0.002	0.241	0.031	<b>0.592</b>
6. It scares me when my heart beats fast.	0.070	<b>0.697</b>	0.161	0.065
7. It embarrasses me when my stomach growls.	0.377	−0.066	0.258	0.050
8. It scares me when I feel like I am going to throw up.	<b>0.547</b>	0.098	0.205	0.010
9. When I notice that my heart is beating fast, I worry that there might be something wrong with me.	0.077	<b>0.724</b>	0.066	0.040
10. It scares me when I have trouble getting my breath.	<b>0.603</b>	0.090	−0.038	0.228
11. When my stomach hurts, I worry that I might be really sick.	0.304	0.367	0.054	−0.056
12. It scares me when I can't keep my mind on my schoolwork.	0.097	0.222	<b>0.649</b>	0.005
13. Other kids can tell when I feel shaky.	<b>0.478</b>	0.025	0.065	0.338
14. Unusual feelings in my body scare me.	<b>0.589</b>	0.382	0.037	0.050
15. When I am afraid, I worry that I might be crazy.	0.187	0.169	<b>0.613</b>	0.087
16. It scares me when I feel nervous.	0.086	<b>0.489</b>	<b>0.411</b>	0.145
17. I don't like to let my feelings show.	0.042	−0.073	0.107	<b>0.689</b>
18. Funny feelings in my body scare me.	<b>0.545</b>	<b>0.422</b>	0.026	−0.019

Note. Factor 1 = Disease Concerns, Factor 2 = Unsteady Concerns, Factor 3 = Mental Incapacitation Concerns, and Factor 4 = Social Concerns. Factor loadings  $\geq 0.40$  are listed in boldface type.

factor labelled *Fear of Physiological Arousal*; items 1, 4, 5, 8, 10, 13, 14, 17, and 18 on the other factor labelled *Fear of Losing Control*. For the three-factor solution the distribution of the items was as follows: Factor 1 (*Physical Concerns*) with items 3, 4, 6, 8, 9, 11, 14, and 18; Factor 2 (*Mental Illness Concerns*) with items 2, 12, 15, and 16; Factor 3 (*Social Concerns*) with items 1, 5, 10, 13, and 17. The four-factor solution contained two factors that were almost identical with two factors of the three-factor solution. The distribution of the items was as follows: Factor 1 (*Disease Concerns*) with items 3, 6, 9, 11, and 16; Factor 2 (*Mental Illness Concerns*) with items 2, 12, and 15; Factor 3 (*Social Concerns*) with items 1, 5, and 17; Factor 4 (*Unsteady Concerns*) with items 4, 8, 10, 13, 14, and 18.

In a next step, CFA was conducted to test how well the two-, three-, and four-factor models of the 17-item version fitted to all four samples (see Table 6). Again, the results of the two-factor solution are not presented and for the three-factor solutions only the solution with correlated factors is presented, for the same reasons as mentioned in Section 3.1. The fit indices showed a slightly but consistently better fit than the original version with 18 items and a clearly poorer fit than the 13-item version across all factor solutions and all four samples (see Table 3).

### 3.4. Factorial invariance of the 13-item CASI version

To test for factorial invariance of the German CASI with respect to age and gender, we used the four-correlated-factor model of the 13-item CASI version, which – together with the four-first-order factor model – showed the best fit. We only tested for the factorial invariances of the

Table 6  
Goodness-of-fit indices

Model	Sample	GFI	CFI	$\chi^2/df$	RMR	RMSEA	AIC
Factor models for the 17-item CASI version <sup>a</sup>							
1. 3 corr. f.	1	0.946	0.848	5.08	0.013	0.058	663.7
	2	0.895	0.763	1.87	0.019	0.062	291.0
	3	0.918	0.895	1.53	0.021	0.049	252.6
	4	0.868	0.859	1.69	0.021	0.070	270.8
2. 4 corr. f.	1	0.956	0.881	4.29	0.012	0.052	564.5
	2	0.914	0.828	1.64	0.017	0.054	266.3
	3	0.921	0.902	1.52	0.021	0.048	251.8
	4	0.875	0.879	1.61	0.021	0.066	262.3
3. 4 f.-o. f.	1	0.955	0.876	4.34	0.012	0.052	575.6
	2	0.913	0.818	1.67	0.018	0.055	268.6
	3	0.920	0.898	1.52	0.021	0.048	251.8
	4	0.872	0.875	1.62	0.022	0.066	262.8

Note. corr. f. means correlated factors; f.-o. f. means first-order factors.

GFI = Goodness-of-Fit Index; CFI = Comparative Fit Index; RMR = root mean square residual; RMSEA = root mean square error of approximation; AIC = Akaike's information criterion.

<sup>a</sup> All CASI items except item 7.

factor loadings and not for the factor variances and covariances, or the error variances or covariances.

Constraining all factor loadings to be equal across the four samples resulted in a significantly worse model compared with the model in which loadings were freely estimated ( $\Delta\chi^2_{27} = 46.5$ ,  $p = 0.011$ ). We were, therefore, unable to combine the four samples to test for factorial invariance as they were too heterogeneous with respect to their factor loadings. Instead, we used sample 1 to test for invariance of loadings between boys and girls as this sample was the largest (see Table 2). The model fits were reasonable for all three data sets, i.e. for boys only, for girls only, and for girls and boys combined without constraints on their loadings (see Table 7). The chi-square difference test rejected invariance of factor loadings for gender ( $\Delta\chi^2_9 = 27.3$ ,  $p = 0.001$ ) thus pointing to differences among at least some factor loadings between boys and girls in sample 1.

To test for invariance of factor loadings for age, we defined two age groups, 8 to <12 years ("children") and  $\geq 12$ –16 years ("adolescents"). Because only samples 2 and 4 contained students of both age groups (see Table 2) and these two samples were rather small, we decided to combine them, in view of the factorial invariance between these two samples ( $\Delta\chi^2_9 = 12.7$ ,  $p = 0.18$ ). The model fits for age were reasonable for all three data sets, i.e. for children only, for adolescents only, and for both children and adolescents combined without constraints on their loadings (see Table 7). Again the chi-square difference test rejected factorial invariance for age ( $\Delta\chi^2_9 = 18.8$ ,  $p = 0.027$ ) thus pointing to different factor loadings between age groups in the combined samples 2 and 4.

#### 4. Discussion

The present study represents a first step in investigating the factor structure of the German version of the CASI and adds new results to the ongoing discussion on number and composition of the factors of anxiety sensitivity in children. First, pre-existing factor solutions that are

Table 7  
Multigroup analyses

Model	GFI	CFI	$\chi^2/df$	RMR	RMSEA
Based on sample 1 ( $N = 1226$ )					
Boys	0.974	0.947	1.54	0.010	0.032
Girls	0.972	0.920	2.40	0.012	0.044
Boys and Girls, loadings unconstrained	0.973	0.930	1.97	0.011	0.028
Boys and Girls, loadings constrained	0.970	0.919	2.04	0.012	0.029
Based on combined samples 2 and 4 ( $N = 368$ )					
8–11 years	0.896	0.970	1.49	0.012	0.067
12–16 years	0.952	0.977	1.51	0.011	0.045
Both age groups, loadings unconstrained	0.934	0.974	1.50	0.011	0.037
Both age groups, loadings constrained	0.928	0.970	1.54	0.018	0.038

Note. GFI = Goodness-of-Fit Index; CFI = Comparative Fit Index; RMR = root mean square residual; RMSEA = root mean square error of approximation.

widely accepted for the English CASI version could be replicated. Fit indices were satisfactory for all samples, independent of the CASI version and the factor solution. Only for the sample of schoolchildren aged 9–14 years (sample 4) did the fit indices perform consistently poorly, probably due to the small sample size ( $N = 143$ ) relative to the number of parameters estimated. Regarding the similar results of the factor solutions for the different samples, it can be assumed that the factor structure of the CASI is not influenced by demographic factors. However, we cannot prove it, as we do not have any more demographic information for the four samples.

Interestingly, although our own item analysis and EFA, using sample 1, postulated a 17-item CASI version cross-validation revealed the best fit for the 13-item CASI version (Silverman et al., 2003) across all samples and factor solutions. More specifically, the 17-item version showed a slightly better fit than the 18-item version, but a clearly poorer fit than the 13-item version, independent of the sample and the factor solution. Comparing the different factor models, the best fit was found for a four-factor solution across all CASI versions and all samples. However, two different four-factor solutions, a hierarchical model with four first-order factors and a model with four-correlated-factors showed very similar goodness-of-fit indices. The similar results of these two models do not allow us to favour one model over the other. In any case, based on our results, the existence of a general, higher-order factor for anxiety sensitivity cannot be ruled out. Summing up these results and earlier findings, as summarized by Silverman et al. (2003), it can be assumed that there is clear empirical evidence for the differentiation of four CASI factors that can be labelled as *Disease Concerns*, *Unsteady Concerns*, *Mental Incapacitation Concerns*, and *Social Concerns*. These consistent results, now allow for further investigations of new aspects in the field of anxiety sensitivity research: a better understanding of specific concerns, measured with the CASI, and their relation with specific psychopathology might provide important additional information on the etiology of the different anxiety disorders. Zinbarg and Barlow (1996) described anxiety sensitivity as a specific risk factor for the development of anxiety disorders. Their hierarchical model for anxiety disorders contains, besides risk factors that are generally accepted for all anxiety disorders (e.g., trait anxiety, behaviour inhibition), more specific risk factors differentiating between anxiety

disorders. Thus, specific features are related to specific anxiety disorders (e.g., panic disorder, social phobia). Further investigations on the facets of anxiety sensitivity might have the potential to provide more information on these relations. First studies focusing on this issue could show that there is an association between concerns of bodily symptoms and panic, or between social concerns and social phobia (e.g., Zinbarg et al., 1997, 2001).

Testing for factorial invariance of the 13-item CASI version with respect to factor loadings across age and gender revealed unequal factor loadings between children and adolescents and also between boys and girls. These findings of factor stability of the CASI are not consistent with past findings regarding the 18-item CASI version (e.g., Silverman et al., 2003; Van Widenfelt et al., 2002). Nevertheless, the results of the present study should be interpreted with caution because of two reasons. First, with large sample sizes such as sample 1, null hypotheses will easily be rejected even if effect sizes are small. It remains to be shown that the factorial invariance of the factor loadings between age and gender groups as found here is of any practical value. Second, with respect to the testing of factorial invariance between age groups, we must point to a partial confounding between age group and sample in the combined samples 2 and 4. Sample 2 consisted of four times as many adolescents than children, whereas sample 4 contained only slightly more adolescents than children. Thus, differences in the factor loadings between the two age groups could be attributed – at least in part – to differences in samples. One potential explanation for the observed factorial invariance between children and adolescents might be that younger children have more difficulties in understanding the questions or that they understand them in a different way that can be explained by developmental aspects like cognitive development or social meaning (e.g., Silverman et al., 1991, 1999). This raises the question of how anxiety sensitivity can be measured in young children. In the present study, for 8-year-old children the CASI was implemented by a diagnostician who has read the CASI items to the children. The main advantage of this procedure is that the understanding of each of the items is guaranteed. However, such an implementation may be susceptible to suggestive questions by the diagnostician.

In conclusion, several studies, including the present one, provide strong support for measuring anxiety sensitivity in children and adolescents with the 13-item CASI. Both the age of respondents and the economic aspect may play an important role in opting for a short questionnaire. Therefore, the 13-item CASI may provide new opportunities for investigating anxiety sensitivity in children. It should be mentioned that all four samples were nonclinic samples. Further investigations in clinic-referred children and adolescents should be carried out to illuminate the nature of anxiety sensitivity. Specifically, the next step should be to examine the relation between the different facets of anxiety sensitivity and psychopathological conditions.

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