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Running head: ACQ & BSQ

Revisiting the factor structure of the Agoraphobic Cognitions Questionnaire and Body Sensations Questionnaire: A confirmatory factor analysis study.

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Abstract

The twin scales, Agoraphobic Cognitions Questionnaire (ACQ) and Body Sensations Questionnaire (BSQ) (Chambless, Caputo, Bright & Gallagher, 1984) have been used frequently in the area of anxiety, and in particular, panic disorder with agoraphobia. The present study employed confirmatory factor analysis to investigate the factor structure of the scales on a sample of Australian anxiety disorder patients. Model testing indicated that neither the original nor the modified factor structures offered a good fit to the data. In addition, confirmatory factor analyses highlighted statistical inconsistencies in the scales. Except for a few, most of the items were problematic. This indicated a need for possible revision of the scales. Moreover, until further research is conducted, researchers and clinicians are recommended to use the scales with caution.

Introduction

Chambless and colleagues (Chambless, Caputo, Bright & Gallagher, 1984) developed the twin scales, Agoraphobic Cognitions Questionnaire (ACQ) and Body Sensations Questionnaire (BSQ), based on the "*fear of fear"* model proposed by Goldstein and Chambless (1978). According to this model agorophobia was characterized by a fear response to anxiety or panic. The anxious individuals experienced anxiety, and an exaggerated fear response was triggered by sensations associated with panic attacks, anticipatory anxiety or anxiety linked to phobia-related objects. These individuals had a tendency to be hypervigilant toward their bodily reactions. The fear experienced included maladaptive cognitions concerned with potential harm that would befall the agoraphobic individual because of anxiety (e.g., "I'll die or go crazy"), as well as an exaggerated fear response touched off by sensations linked with anxiety (e.g., increased heart beat). Chambless et al. (1984) aimed to assess the components of the fear of fear concept through the development of the two scales. The ACQ was designed to measure maladaptive thoughts about the potential for disastrous consequences arising from anxiety or panic. The BSQ measured the fear of the bodily sensations associated with high arousal and panic. The scales were an outstanding development towards evaluating the dysfunctional cognitions underlying panic and phobic experiences of agoraphobia.

The scales have been used to investigate various research and clinical questions related to the diagnosis, symptomatology (Asmundun, Norton, Lanthier & Cox, 1996; Zvolensky, Lejuez & Eifert, 1998), and intervention (Harcourt, Kirkby, Daniels & Montgomery, 1998; Khawaja & Oei, 1998) of agoraphobia and the related anxiety disorders. They are inexpensive and easily scored measures for clinical and research applications. Therefore, since their development the ACQ and BSQ have been used extensively in the area of anxiety, especially with panic disorder and agoraphobia patients (Arrindell, 1993). In spite

of the popularity of the scales, a review of the literature revealed that the psychometric properties of the scales, especially their factor structure, require further examination.

In keeping with the fear of fear model, the items of the two scales were developed on the basis of 175 clients diagnosed as suffering from agoraphobia with panic attacks, who were scheduled to attend a therapy program (Chambless et al., 1984). Clients were interviewed about the catastrophic ideation experienced by them while going through *in vivo* exposure. Similarly, therapists were interviewed about typical ideation reported by the clients during the exposure to the anxiety provoking situations. Further, clients and therapists were asked to record the distressing sensations that clients experienced during the *in vivo* sessions. Information collected about the fear-provoking thoughts and the distressing sensations was used to generate items for ACQ and BSQ measured on a five point Likert scale.

Cronbach's alpha coefficients were used to examine the internal consistency of the items. Items with adequate Cronbach's alphas were retained for the scales. The ACQ originally consisted of nine items. Six items were further added. One of these items was eliminated due to a low item total correlation ("loss of bladder or bowel control" : r = -.08). The other 14 items retained had corrected item-total correlation equal to or greater that .26, thus increasing an overall Cronbach's alpha of the scale to .80. The authors retained the 17 items generated for BSQ as they had corrected item-total correlations equal to or greater than .35. The overall Cronbach's alpha for this scale was .87.

Factor analysis was used with the ACQ to empirically test the underlying factor structure. An orthogonal (varimax) solution found two factors: "Physical Concerns" that explained 29.1% of the variance, and "Social / Behavioral Concerns" that explained an additional 17.1 % of the variance. The Cronbach alphas for the factors Physical Concerns and Social / Behavioral Concerns were .65 and .76, respectively. Overall, four items (1,2, 7, and 14) had loadings lower that .5. Item 1 "I am going to throw up" did not load on Physical

Concerns (.24) or Social / Behavioral Concerns (.18). Further, item 7 “I am going blind” inclined to load on Social / Behavioral Concerns (.44). The authors recognized this limitation, but retained both items in the scale adding them to the Physical Concerns factor. This raises concerns regarding the ACQ from the initial development of the scale. Factor analysis was not used with the BSQ items, thus not providing empirical evidence for the use of the chosen items in a unifactorial scale.

The scales have been translated into Dutch and French languages and the factor structures have been investigated on Dutch, French, and French-Canadian clinical populations. Using Dutch panic disorder and agoraphobia patients (N = 94), Arrindell (1993) evaluated the original and the Dutch versions of the scales. He found that the hypothesized two components of the ACQ and the proposed unidimensional factor of the BSQ were replicated by a principal component analysis with varimax rotation. Furthermore, factor analysis was conducted on the joint pool of ACQ and BSQ items. The items loaded on the three hypothesized factors. Altogether, the three factors explained 43.52% of the total variance. In general, 4 items (1, 5, 7, and 9) from the ACQ scale and 3 items from the BSQ (9, 10, and 11) had loadings of less than .5. The ACQ item l failed to load on any factor. Item 7 of the ACQ loaded on Social / Behavioral Concerns (.53).

Bouvard et al. (1998) validated the French translation of the ACQ. The original two factors of the ACQ were supported by this study on 169 anxious French patients suffering from panic disorder with agoraphobia or obsessive-compulsive disorder. A principal component analysis with varimax rotation indicated two factors, which explained 43.09 % of the total variance. Three items (1, 7, and 9) had lower loadings of .23, .45, and .41, respectively. Item 1 failed to load on any factor. Item 7 loaded on Physical Concerns.

Stephenson, Marchand, and Lavallee studied the psychometric properties and factor structure of the French translation of the ACQ (1999) and BSQ (1998) with reference to

panic disorder with agoraphobia French-Canadian patients. The two dimensions of the ACQ were reproduced using a principal component analysis (with orthogonal rotation) on the responses of 153 patients. The two factors explained 39.1% of the total variance. Overall, 5 items (1, 3, 7, 9, and 10) had loadings of less than .5 with several cross-loadings and inconsistent results. The item "To have a stroke" (item 10) cross-loaded on both Social / Behavioral Concerns (.28) and Physical Concerns (.30). Item 1 had a very low loading (.10) on both factors. Item 7 loaded on Social / Behavioral Concerns. Contrary to the previous investigations of the BSQ, a principal component analysis with orthogonal (varimax) rotation (Stephenson et al., 1998) on 141 patients, produced a three-factor model. The three factors, "Somatic, Cardiac, and Psychosensorial" explained 56.6% of the total variance. An examination of the loadings revealed that 3 items (5, 6, and 7) had loadings below .5. Further, item 14, " Sweating," cross-loaded on Somatic and Psychosensorial factors.

It is apparent that there is additional need to re-examine the factor structure and psychometric quality of the scales. Some items have consistently proven to be problematic and the factor structures of the scales are still not very clear (Arrindell, 1993; Bouvard et al., 1998; Stephenson et al., 1998, 1999). In addition, the aforementioned studies used exploratory factor analyses with orthogonal rotation to assess the factor structure.

Considering the inter-factor correlations found generally in scales, oblique rotations might have rendered different and more appropriate results. Exploratory factor analysis is useful at an early stage of scale development to identify the latent constructs that account for the intercorrelations of a set of variables (Gorsuch, 1983). Confirmatory factor analysis is more appropriate as the scale is used and perhaps in need of a review. It is a much more sophisticated technique to evaluate the underlying measurement model once the initial exploratory work has been done (Gerbing & Hamilton, 1996; Tabachnick & Fidell, 2001).

It is also important to thoroughly examine the items to identify possible weaknesses that emerge from ongoing research. This has not previously been done, and yet the scale has been in use for more than a decade. Confirmatory factor analysis is a useful tool to aid researchers in investigating whether the items are good indicators of the underlying constructs (Bentler, 1995). This type of analysis is also suited to compare competing models for a best fit. Therefore, the aim of the current study was to examine the factor structure of the ACQ and BSQ scales by using confirmatory factor analyses. The responses of an Australian sample of anxiety disorder patients were used. Factor structures identified in previous studies were evaluated systematically. Subsequently, to investigate the best fit to the data, models were tested after removing items that have consistently emerged as weak, according to their factor loadings.

Method

Participants

The participants consisted of anxiety disorder patients (*N* = 228). Out of this group, 54 % had a primary diagnosis of panic disorder with and without agoraphobia according to DSM-III-R criteria (American Psychiatric Association, 1987). Thirty-six percent of patients had a primary diagnosis of social phobia and the remaining 10 % had a primary diagnosis of either generalized anxiety disorder or obsessive compulsive disorder (DSM-III-R). The sample was comprised of 64 % women and 36 % of men with a mean age of 38 years (*SD* = 12; range = 17-75). The average duration of symptoms was 7.31 years (*SD* = 8.34 years; range = 6 months - 36 years). Forty-two percent of patients had primary, 50 % had secondary, and 8 % had tertiary level of education.

Measures

The ACQ consists of 14 items divided into two subscales, Social / Behavioral Concerns and Physical Concerns. The final total score is the average of all 14 items. Subscale

scores are the average of 7 items each. The test-retest coefficient for the total score is .86 (Chambless et al., 1984). The BSQ consists of 17 items. The score is an average of the 17 items. The test-retest reliability is .66 (Chambless et al., 1984). The authors (Chambless et al., 1984) did not report the time interval for test-retest reliability coefficients.

Procedure

As the scales were designed to measure the maladaptive thoughts and bodily sensations experienced by anxiety patients, a sample of anxiety disorder patients was selected from two clinics associated with the University of Queensland: (a) the Anxiety Disorder Clinic, Brisbane, and (b) the Psychology Clinic, School of Psychology. The participants selected from the Anxiety Disorder Clinic were referred to the clinic by the general practitioners in the Brisbane metropolitan area. The participants completed the questionnaires before receiving any treatment from the clinic. An experienced psychiatrist or psychologist interviewed the participants, using a semi-structured interview in accordance with the DSM-III-R. The duration of the interview was one hour. Finally, participants were treated on the basis of group cognitive behaviour therapy (Evans, Holt & Oei, 1991).

The Psychology Clinic at the University of Queensland was the other source of clinical data. Information about the study was published in the local print media. The advertisement called for volunteers for the study, which specified the need for participants with symptoms of panic and agoraphobia. It highlighted that although the nature of the study was assessment, therapy would be available for the participants. Those who responded to the advertisement were screened for applicability through an initial telephone interview, and suitable participants were mailed a package consisting of information about the study, a consent form, and the questionnaires. The participants returned the completed questionnaires to the Psychology Clinic on arriving for an interview. A structured diagnostic interview was used to investigate the diagnosis of the participants. The participants were offered cognitive

behaviour therapy or referred for treatment elsewhere. Although no formal reliability data on the clinical diagnostic interview at the two clinics were available, in house clinical diagnostic checks, using a small sample of patients, showed that agreement on diagnostic interviews was good. Written consent was obtained from the participants before their admission to the study. All participants were informed that they were free to withdraw from the study at any time.

Results

A preliminary analysis was performed to identify and resolve issues of missing data. Seventeen participants were excluded, as they had not completed one of the questionnaire. The other missing data had no pattern; therefore predictive equations were developed for each case of missing data in order to predict the score on the particular variable (Tabachnick & Fidell, 2001).

The data were also investigated for univariate and multivariate outliers and assumptions of normality. A few outliers, which appeared on items 3 and 7 of the ACQ, were deleted from the data. Descriptive analysis on individual items of the ACQ indicated that 78% or more of participants scored either a 1 or 2 (thought never or rarely occurs), on items 1, 3, 5, 7, 9, and 10. As such, the responses on these items were far from normally distributed. All were very skewed and / or kurtosed. The distributions of items 5 and 7 particularly were far from normal, with nearly 73% of participants endorsing 1 (thought never occurs) on item 5 and 82.5% endorsing 1 on item 7. As there was no substantial improvement in normality as a result of transformation, a decision was made to keep the data in its current form. The data for the BSQ met the assumptions of normality.

Agoraphobic Cognitions Questionnaire and the confirmatory factor analysis. All analyses were performed with EQS V5.7b using the maximum likelihood estimation method (ML), along with the use of robust statistics (Bentler, 1995). The ML method has been shown to produce reasonably valid parameter estimates when the data violate the assumptions of

normality. Standard errors of the parameter estimates, however, are biased under these conditions, leading to incorrect decisions on the significance of parameter estimates. Robust statistics correct the biasing effect of violations of normality (Kline, 1998).

To test the structure of the ACQ, first the two factor structure hypothesized by Chambless et al. (1984) and supported by Arrindell (1993), Bouvard et al. (1998), and Stephenson et al. (1998) was specified. According to this, factor one, Social / Behavioral Concerns consisted of items 1, 2, 3, 4, 5, 7, and 10; and factor two, Physical Concerns, consisted of items 6, 8, 9, 11, 12, 13, and 14. An oblique factor structure, which allowed the factors to covary, was tested.

To evaluate model fit, several indices were examined. The first index, the χ^2 goodness of fit statistic, indicates whether or not the pattern of covariation in the data can be explained by the postulated factor structure. A small and non-significant χ^2 value was desirable, as this shows that the pattern of covariance in the data was unlikely to have occurred by chance. In reality, due to sensitivity to sample size achieving such a low value of this statistic would be difficult. Therefore other options were employed, specifically that the χ^2 value be less than three times the number of degrees of freedom (Kline, 1998).

The second type of model fit indices was one that assessed incremental fit. These indices described the improvement in fit that the hypothesized model provided compared to the independence model (i.e., the model with all covariances set at zero). One of the most commonly used incremental indices is the Comparative Fit Index (CFI). The possible values of this index lie between 0 and 1, and require a value in excess of .90 (Kline, 1998) and preferably above .95 (Hu & Bentler, 1999) to indicate adequate model fit. Finally, there is a range of absolute fit indices, which are based upon the residuals. These indices compare the hypothesised model with the saturated model, that is, the model that matches the data exactly. Two of the commonly reported absolute fit indices are the standardized root mean square

residual (SRMR), and the root mean square error of approximation (RMSEA). The SRMR is a standardized summary of the average covariance residuals. The RMSEA is a similar index, which has a correction for the number of degrees of freedom in the model. For both indices, small deviations between the model and the data are required, indicating that most covariance is accounted for, with only small residuals. Values for the SRMR should be less than .09 and the RMSEA should ideally be less than .06, and not exceed .08 (Hu & Bentler, 1999).

Turning first to the 2 factor solutions, as shown in Table 1, all fit indices indicated that the model (Model 1) provided a poor fit to the data. Further, a second model was investigated after excluding items 1 and 7, which have been identified as problematic in all the previous investigations either due to a poor loading or unclear links with a factor. Due to the confirmed pattern of moderately correlated factors in the previous model (Table 2) only the oblique factor structure was tested. Table 1 indicates that the fit indices of Model 2 improved slightly. However, the model was still not a good fit to the data.

Taken together, these results indicated that the ACQ was not a structurally sound scale. This was further evidenced by the factor loadings and R^2 generated in the analyses. Table 2 shows that the loadings and R^2 for item 1, 5, and 7 were low on the models tested. These items were poorly associated with the underlying dimension and failed to contribute to the scale. Further, as pointed out earlier, responses to these items were skewed. Participants failed to endorse these items. As shown in Table 2 only a few items loaded strongly on each factor. The removal of two items did not improve the structure of the scale. To examine this further, an exploratory strategy was adopted to see if a sound model could be found. This was conducted by systematically excluding the poor items. However, this step did not improve the fit indices; therefore these models are not described here.

Insert Table 1 & 2 about here

Body Sensations Questionnaire and the confirmatory factor analysis. Two models were tested. First, the original one factor model hypothesized by Chambless et al. (1984) was tested. Subsequently, the three-factor model obtained by Stephenson et al. (1998) from an exploratory factor analysis was assessed. An oblique structure was used to allow the factors to co-vary. The three-factor model had the following structure: Factor 1, Somatic, consisted of items 6, 9, 10, 11, 12, 14, and 15, Factor 2, Cardiac, consisted of items 1, 2, 3, 4, and 5 and finally, Factor 3, Psychosensorial, consisted of items 7, 8, 13, 16, and 17.

Insert Table 3 about here

As shown in Table 3, neither of the models provided an adequate fit to the data in this instance. The three-factor solution, which appeared to be better, still provided a poor fit to the data. Table 4 shows the factor loadings, the R^2 for the two models, and the inter-factor correlations for the three-factor solutions. The factor loadings and R^2 values of many items in the two models were small. On Model 1 (Table 4), five items (9, 10, 11,12, and 14) in particular loaded poorly. Further, the variance contributed by these items was also very low. In the same manner, most of the other items loaded moderately low. In general, the loadings and R^2 values of the items improved as they were forced to load on three factors. Items 3, 4, 5, 7, 15, 16, and 17 emerged as good items. The other items had moderately low values, with item 9 providing the lowest loadings and R^2 values.

The results indicated that the BSQ was not unifactorial, as predicted by Chambless et al. (1984), but a multi-dimensional scale. The inter-factor correlations revealed that the third factor Psychosensorial was moderately correlated with the first (Somatic) and the second (Cardiac) factors, indicating a possibility of two underlying dimensions. Factor one and two were mildly correlated. Two factor structures were investigated by combining factors one and three and then two and three together. The fit indices did not indicate these models as a good fit. Therefore, these models are not described here. Further, an attempt was made to adopt an

exploratory approach to remove the weakest items in order to improve the overall model fit. However, this step also did not produce a model with adequate fit. A further construction of new items, which perform better statistically, is required.

Insert Table 4 about here

Discussion

Considering the importance and extensive use of the ACQ and BSQ in the area of anxiety, the present study aimed to confirm the factor structure of the two scales on a sample of Australian anxiety disorder patients. Confirmatory factor analysis failed to empirically confirm the two-factor structure of the ACQ (Arrindell, 1993; Bouvard et al., 1998; Chambless, et al. 1984; Stephenson et al., 1999) as an adequate fit to the data. Furthermore, the loadings of a number of items were low indicating that they have a very minimal contribution to the scale. The present assessment found that even the removal of items did not improve the fit indices. Low scores, and therefore restricted dispersions on some of the items, indicated that the participants in spite of their anxiety disorders were not experiencing the anxious thoughts manifested by these items.

Similarly, the confirmatory factor analyses on the BSQ failed to reveal an adequate unifactor solution. Consistent with the study by Stephenson et al. (1998) and therefore contrary to the original investigation by Chambless et al. (1984), the scale appeared to have more than one dimension. However, due to the weakness of some items, the number of underlying dimensions was unclear. As found with the ACQ, removal of poorly performing items did not improve the integrity of the scale. These results demonstrated the item weaknesses in the ACQ and BSQ that have been consistently noted by previous studies (Arrindell, 1993; Bouvard et al., 1998; Chambless, et al., 1984; Stephenson et al., 1998, 1999).

Due to the limitations of the study, the outcome should be interpreted with caution. A larger sample would have been more appropriate. The sample was comprised of individuals

with a variety of anxiety disorders instead of only panic disorder with or without agoraphobia, for which the scales were originally designed. There was no control over the comorbidity issues. However, even with this in mind, the current findings do emphasize in detail the limitations of the scales, which were identified in previous factor analysis studies.

Having supported empirically the problems with the factor structure, the current research proposes that there is a need to construct a new item pool that would retain some of the strong items highlighted by this and prior research. The new item pool should be more reflective of the contemporary research findings in the area of panic disorder and agoraphobia. Recent developments (Uhlenhath et al., in press), which emphasize that certain anxious thoughts and cognitive styles characterize agoraphobics can be incorporated to construct new items for ACQ. Similarly, fresh items for BSQ can be framed by taking into consideration the fearful sensations and panic symptomatology identified by the latest factor analytical and clinical research (Austin & Richards, 2001). The factor structures should be validated on a variety of clinical and non-clinical populations, with greater attention to the diagnostic categories of clinical participants. Until further investigations are conducted, care is recommended when using the ACQ and BSQ in research and clinical settings.

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Table 1

Fit indices for Confirmatory Factor Analysis of the ACQ

Model	χ^2	χ^2R	Df	CFI	CFIR	SRMR	RMSEA
1. Two factors, Oblique	315.22	243.31	76	.759	.757	.092	.118
2. Two factors, Oblique Without item 1& 7	226.47	183.14	53	.805	.805	.084	.120

Note. χ^2 = chi square goodness of fit statistic; χ^2R = robust chi square goodness of fit statistic; Df = degrees of freedom associated with the Chi^2 statistics; CFI = comparative fit index; CFI R = robust comparative fit index; SRMR = standardised root mean square residual; RMSEA = root mean square error of approximation.

Table 2

Factor loadings and R-Squared from Confirmatory Factor Analysis of the ACQ showing the two factor solution

		Factor 1/ R^2		Factor 2 / R^2	
Item	Item Name	Model 1	Model 2	Model 1	Model 2
1	I am going to throw up	.314 / .098			
2	I am going to pass out	.622 / .386	.595 / .355		
3	I must have a brain tumour	.607 / .368	.594 / .353		
4	I will have a heart attack	.799 / .638	.835 / .698		
5	I will choke to death	.413 / .170	.378 / .143		
6	I am going to act foolish			.609 / .371	.618 / .382
7	I am going blind	.328 / .108			
8	I will not be able to control myself			.614 /.377	.616 / .380
9	I will hurt someone			.376 /.141	.374 / .140
10	I am going to have a stroke	.782 / .624	.801 /.642		
11	I am going to go crazy			.705 / .497	.693 / .481
12	I am going to scream			.659 /.434	.652 / .425
13	I am going to babble or talk funny			.644 / .415	.653 /.426
14	I will be paralyzed by fear			.612 /.375	.617 / .380
	Interfactor correlation F2	.533	.478		

Note. Factor loadings shown before the /, R^2 shown after the /; F1= Physical Concerns; F2 = Social / Behavioral Concerns.

Table 3

Fit indices for Confirmatory Factor Analysis of the BSQ

Model	χ^2	χ^2R	Df	CFI	CFI R	SRMR	RMSEA
1. One factor,	978.76	735.66	119	.563	.622	.127	.179
2. Three factors, Oblique	640.66	485.46	116	.733	.773	.107	.142

Note. χ^2 = chi square goodness of fit statistic; χ^2R = robust chi square goodness of fit statistic; Df = degrees of freedom associated with the Chi 2 statistics; CFI = comparative fit index; CFI R = robust comparative fit index; SRMR = standardised root mean square residual; RMSEA = root mean square error of approximation.

Table 4

Factor loadings and R^2 from Confirmatory Factor Analysis of the BSQ showing the one and three factor solutions.

			Factor 1 / R^2		Factor 2 / R^2	Factor 3 / R^2
	Item	Item Name	Model 1	Model 2	Model 2	Model 2
	1	Heart Palpitations	.536 /.287		.522 / .272	
	2	Pressure in chest	.570 / .325		.591 / .349	
	3	Numbness in arms or legs	.739 / .545		.924 / .855	
	4	Tingling in finger tips	.661 / .437		.777 / .604	
	5	Numbness in another part of your body	.694 / .482		.808 / .652	
	6	Feeling short of breath	.593 / .351	.527 / .278		
	7	Dizziness	.736 / .542			.768 / .590
	8	Blurred or distorted vision	.657 / .432			.686 / .471
	9	Nausea	.424 / .179	.456 / .208		
	10	Butterflies in stomach	.254 / .065	.574 / .330		

11	Knot in stomach	.271 / .073	.570 / .325		
12	Lump in throat	.479 / .229	.657 / .431		
13	Wobbly or rubber legs	.629 / .396			.652 / .424
14	Sweating	.422 / .178	.657 / .432		
15	Dry throat	.576 / .332	.770 / .593		
16	Feeling disoriented and confused	.679 / .462			.764 / .584
17	Feeling disconnected from your body only partly present	.640 / .410			.721 / .520
Inter Factor correlation F1				.387	.638
F2					.691

Note. F1= Somatic; F2 = Cardiac; F3 = Psychosensorial.

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