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Measuring Cognitive Vulnerability to Depression: Further Evidence on the Factorial and Predictive Validity of Negative Cognitive Style

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Abstract

Background and objectives: Previous research has provided insufficient evidence on the factorial validity of the negative cognitive style questionnaires, which is a problem for the validity of the total score's computation. In Study 1, we focused on the relationship between internality and the other dimensions of negative cognitive style. In Study 2, we explored the predictive validity of negative cognitive style for negative interpretation bias.

Methods: In Study 1, 770 participants completed the Cognitive Style Questionnaire – Short Form (CSQ-SF). In Study 2, from a prescreening data collection (N = 300) we selected participants with low (N = 40) and high (N = 32) cognitive vulnerability to depression who were primed with negative mood induction and who completed a generative interpretation task.

Results: In Study 1, a confirmatory factor analysis (CFA) indicated that the best fitting model for the CSQ-SF was a bifactor model without the internality dimension. In Study 2, a CFA replicated the factorial structure of Study 1 and individuals with a high negative cognitive style exhibited a negative interpretation bias after controlling for depressive symptoms.

Limitations: The university-age sample limited the generalizability of our results to different populations, and the lack of longitudinal data prevented us from discussing further implications on the relationship between the negative interpretation bias and negative cognitive style in predicting depression.

Conclusions: Together, the results of our two studies support the construct validity of the CSQ-SF and recommend the use of a composite score of negative cognitive style without internality.

Keywords: negative cognitive style; cognitive style questionnaire; internality; interpretation bias; negative mood induction

Highlights

- Internality poorly discriminates between high and low vulnerability to depression
- We propose a bifactor structure of the CSQ-SF in which internality is excluded
- Negative cognitive style predicts negative interpretation bias
- The revised CSQ-SF shows good factorial and predictive validity

1. Introduction

Depression is a highly debilitating psychiatric disorder with severe consequences at the personal and societal level (Demyttenaere et al., 2004). Depressive symptoms, such as negative mood, feelings of worthlessness and hopelessness, concentration problems, fatigue, sleep problems, and suicidal thoughts, are among the leading causes of general poor health and disability worldwide (da Silva Lima & de Almeida Fleck, 2007), and depression is increasingly considered as a global health priority (Cuijpers, Beekman, & Reynolds, 2012). Given such a dismal scenario, it is crucial to shed light on the mechanisms that enhance the likelihood of developing major depression in order to set up effective preventive programs (Muñoz, Cuijpers, Smit, Barrera, & Leykin, 2010).

The cognitive vulnerability hypothesis (Abramson, Metalsky, & Alloy, 1989; Beck, 1967; Beck, 1987) states that the onset of depression can be triggered by negative life events (i.e., occasion setters) interacting with dysfunctional cognitive processes (i.e., vulnerability).

Among the earliest theories of depression is the hopelessness theory (Abramson, Metalsky, & Alloy, 1989), which maintains that a major vulnerability factor for depression is a negative cognitive style, which includes, (a) beliefs that the causes of negative events are *stable* and *global*, (b) inferences of other *negative consequences* deriving from a negative event, and (c) inferences of negative characteristics of the self, given the negative event (*self-worth implications*)[1]. Importantly, there is solid evidence that individuals characterized by negative cognitive style are at risk of experiencing hopelessness and, in turn, depression (Haeffel et al., 2008; Marchetti, in press; Marchetti, Loeys, Alloy, & Koster, 2016; Mac Giollabhui et al., 2018).

The Cognitive Style Questionnaire (CSQ; Alloy et al., 2000) was designed to capture the dimensions proposed by the hopelessness theory—namely, stability, globality, negative consequences, and self-worth implications. As a revision of a previous instrument (i.e., Attributional

[1] As compared to the reformulated learned helplessness theory (i.e., Abramson, Seligman, & Teasdale, 1978), the role of internal attributions was deemphasized by the hopelessness theory (Abramson et al., 1989), in that they are supposed to have a specific effect on self-esteem (Haeffel et al., 2008), rather than on depression (Metalsky & Joiner, 1992).

Style Questionnaire; Peterson et al., 1982), the CSQ also measures internal causal attributions, which, however, are not routinely considered when evaluating one's level of negative cognitive style (Liu, Kleiman, Nestor, & Cheek, 2015).

Several versions of the CSQ have been developed to deal with different populations, such as children (Children's Cognitive Style Questionnaire; Mezulis, Hyde, & Abramson, 2006) and adolescents (Adolescent Cognitive Style Questionnaire; Hankin & Abramson, 2002). Furthermore, because the original CSQ is extremely time demanding, with 144 items distributed across 24 scenarios (12 positive and 12 negative situations), the Cognitive Style Questionnaire – Short Form (CSQ-SF; Meins et al., 2012) with only eight negative scenarios was developed. Negative cognitive style, as measured by the CSQ, shows good nomological validity given that many predictions of the hopelessness theory have been empirically confirmed. For instance, a negative cognitive style requires interacting with stressful events to impact mental health (i.e., diathesis-stress hypothesis; Gibb, Beevers, Andover, & Holleran, 2006).

Despite the massive use of CSQ-related instruments (Liu et al., 2015), no studies have thoroughly evaluated the internal structure of these scales by means of appropriate statistical tools, such as a confirmatory factor analysis (CFA). An indication about the factorial structure of this construct could be derived from two studies examining the Attributional Style Questionnaire (Higgins, Zumbo & Hay, 1999; Hewitt, Foxcroft, & MacDonald, 2004), which supports a three-factor solution (i.e., internality, stability, and globality). It is noteworthy to mention, however, that internality has routinely yielded lower internal consistency than the other dimensions (Asner-Self & Schreiber, 2004; Reivich, 1995). As for CSQ-related instruments, few studies have applied factor-analytic techniques, and when they do, often only do so to summarize the item scores into broader manifest variables scores. For example, Hankin and Abramson (2002) tested a confirmatory three-factor model of the Adolescent Cognitive Style Questionnaire summing its items to obtain two manifest variables for each of three latent dimensions—namely, negative inferences for cause, consequence, and self. Meins et al. (2012) applied a similar approach in their validation study of the

CSQ-SF. The authors subjected the total scores of the five CSQ-SF dimensions (internality, stability, globality, negative consequences, and self-worth implications) to a principal component analysis to produce a single global component of negative cognitive style. Hankin, Lakdawalla, Carter, Abela, and Adams (2007) applied an exploratory factor analysis to a complete set of CSQ item scores. Hankin et al. (2007), however, did not investigate the internal structure of the CSQ but only distinguished negative cognitive style from other related constructs (e.g., mood, dysfunctional attitudes, and rumination).

Due to the fact that the internal structure of the CSQ is not well understood, the literature provides no straightforward recommendations about the proper scoring procedure for the CSQ (Liu et al., 2015). For instance, while some authors have computed total CSQ score by including all five dimensions of the CSQ (Caudek, 2014; Caudek, Ceccarini, & Sica, 2017; Newcomb-Anjo, Barker, & Howard, 2017), other authors instead have excluded the internality dimension (Alloy et al., 2000; Benas & Gibb, 2008; Iacoviello, Alloy, Abramson, Whitehouse, & Hogan, 2006; Haeffel & Vargas, 2011).

It is worth noting that, according to the hopelessness theory, internality does not act as a vulnerability factor for depression because it can be either adaptive or maladaptive depending on the specific situation. For instance, when dealing with highly controllable stressors (i.e., failing an exam due to lack of preparation), internal attributions may be adaptive in improving future coping strategies and well-being (Gillham, Brunwasser, & Freres, 2008). Hence, in keeping with the hopelessness theory, several CSQ-SF validation studies have reported weak correlations between the internality dimension and the other CSQ dimensions ($r \leq .31$; Meins et al., 2012; Huys et al., 2016). Moreover, a recent meta-analytic study (Hu, Zhang, & Yang, 2015) revealed that internal causal attributions are poorly related to depressive symptoms ($r = .15$).

For all these reasons, it is important to disentangle the role of internality in the negative cognitive style construct and, in turn, clarify which factorial structure provides the best operationalization of the construct postulated by the hopelessness theory. To this purpose, in Study

1, we explored the factorial validity of the CSQ-SF and investigated whether internality is a consistent dimension of negative cognitive style.

In Study 2, we first retested Study 1's confirmatory factor models, then we examined the relationship between negative cognitive style and the interpretation bias. In fact, cognitive vulnerability is not expressed only in terms of a negative cognitive style, as multiple mechanisms have been identified as facilitating factors for depression. Capitalizing on cross-fertilization between the hopelessness theory and Beck's theory (Abramson et al., 2002), there is an increasing interest in understanding the relationship between negative cognitive style, on the one side, and information processing biases, such as attentional, memory, and self-referential biases, on the other (Alloy, Abramson, Murray, Whitehouse, & Hogan, 1997; Caudek & Monni, 2013; Haeffel, Rozek, Hames, & Technow, 2012).

Here, we will focus on the tendency to negatively interpret ambiguous information, that is, on a *negative* (information processing) *interpretation bias*, which is thought to increase the risk for depression by making negative content accessible in the mind and by fostering negative affect (Normansell & Wisco, 2017). To date, no studies have investigated the relationship between negative cognitive style and negative interpretation bias. On the one hand, we speculate that these two mechanisms are related to each other, in that both rely on altered appraisals or processing of personally relevant information (Alloy et al., 1999). On the other hand, we suggest that these two phenomena should be kept distinct, in that interpretation bias is present when ambiguous information is systematically processed in a negative way (Hirsch, Meeten, Krahé, & Reeder, 2016), whereas negative cognitive style is specifically activated when the individual faces negative events (Abramson et al., 2002). Given that a negative interpretation bias is considered to be a proximal cause of depression (Beck & Haigh, 2014; Everaert, Podina, & Koester, 2017), whereas negative cognitive style is deemed as a distal cause of depression (Abramson et al., 1989), we tested the predictive validity of the CSQ-SF in Study 2 by hypothesizing that a negative cognitive style may predict the presence of a negative interpretation bias. To do so, we classified participants into low or high

cognitive vulnerability groups, based on their level of negative cognitive style. Then, after one to three weeks, they were invited to complete a study consisting with a negative mood induction procedure, followed by an interpretation bias assessment. Given the relative insensitivity of self-report questionnaires (Rude, Valdez, Odom, & Ebrahimi, 2003), we administered a generative interpretation task to assess the participants' negative interpretation bias. The mood induction procedure was justified by the diatheses-stress hypothesis, which postulates that a stressor is required to activate the individuals' latent cognitive vulnerability (Ingram & Siegle, 2009; Segal & Ingram, 1994). In our case, negative mood induction acted as a stressor aimed at activating the participants' vulnerability.

2. Study 1

The purpose of Study 1 was to examine the psychometric properties of the CSQ-SF in order to shed light on its factorial structure and to clarify the role of the internality dimension in negative cognitive style. We compared the CSQ-SF subscales by means of descriptive statistics, inter-correlations, mean corrected item-total correlations (CITCs), and corrected dimension-total correlations (CDTCs). Next, we conducted a CFA to test the internal structure of the CSQ-SF. Meins et al. (2012) proposed a unidimensional structure of negative cognitive style based on the total scores of its five dimensions. Conversely, in the present study, we evaluated the full structure of the CSQ-SF by comparing six confirmatory models: three models with all five CSQ-SF dimensions' items and three models in which we excluded the internality dimension's items.

Because the CSQ-SF's main purpose is to identify those individuals who are more cognitively vulnerable to depression, we also investigated how well each of the five CSQ-SF dimensions can discriminate between individuals with low and high cognitive vulnerability.

2.1 Materials and Methods

2.1.1 Participants and Procedure

Participants were recruited via face-to-face requests associated with the snowball technique from introductory undergraduate psychology classes at the University of Florence, Italy. The sample consisted of 770 participants (27% males) with a mean age of 24.43 years (SD = 7.13). The study was conducted in accordance with the Declaration of Helsinki. Participation in this study was anonymous and on a voluntary basis. Informed consent was obtained from all individual participants included in the study.

2.1.2 Instruments

The CSQ-SF (Meins et al., 2012) consists of eight scenarios for which the respondents are asked to imagine the reason why that specific negative situation happened to them. Using a 5-point Likert-type scale (from 1 = "Strongly disagree" to 5 = "Strongly agree"), 72 items assess five dimensions of negative cognitive style, namely internality (e.g., "It is my fault if I am not in an intimate, romantic relationship"), globality (e.g., "The reason people reacted negatively to my talk will cause failures in all areas of my life"), stability (e.g., "The reason I failed to complete the work will cause similar failure in completing work in classes in the future"), negative consequences (e.g., "This negative evaluation will lead to other negative things happening to me"), and self-worth implications (e.g., "This person not wanting to be my friend means there is something wrong with me as a person").

The total scores range between 72 and 360, with a higher total score reflecting a higher negative cognitive style. Meins and colleagues (2012) reported positive correlations between the CSQ-SF dimensions, and the principal component analysis suggested a one-factor structure with 65.08% of the observed variance explained. Internal consistency was considered good (α = .85). The CSQ-SF had been translated to and validated in Italian in earlier research (Sica, Caudek, Chiri, Ghisi, & Marchetti, 2012). The Italian CSQ-SF is reported in Supplementary Materials Appendix A.

2.1.3 Statistical analysis

We conducted our analyses with the R software (R Core Team, 2018). Given the data's ordinal nature, we performed CFAs with a diagonal weighted least squares (DWLS) estimator implemented in the R package *lavaan* (Rosseel, 2012). To determine the fit of the CFA models, we considered the comparative fit index (CFI), the Tucker–Lewis index (TLI), the root-mean-square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Hu and Bentler (1998) suggested that a good fit is indicated by values greater than or equal to .95 for TLI and CFI, less than or equal to .06 for RMSEA, and less than or equal to .08 for SRMR. We calculated internal consistency by means of categorical omega, that is, a method to calculate coefficient omega (McDonald, 1999) for categorical items (Green & Yang, 2009). Thus, we estimated categorical omega total (ω_t) and categorical omega hierarchical (ω_h) by the parameter estimates from CFA with DWLS estimation method. The total variance of a multidimensional test was estimated by ω_t, whereas, ω_h was interpreted as an estimator of the items' variance attributed to the general factor in a bifactor model (McDonald, 1999).

2.2 Results

2.2.1 Descriptive statistics of the Cognitive Style Questionnaire – Short Form

Descriptive statistics and correlations for the CSQ-SF total score and its five subscales (internality, globality, stability, self-worth implications, and negative consequences) are shown in Table 1. CSQ-SF items showed a slight deviation from normality with skewness ranging from -0.81 to 1.41 and kurtosis ranging from -1.10 to 2.08.

The internality dimension showed low-moderate correlations with both of the other CSQ-SF subscales and with the total CSQ-SF score. Also, we computed CITCs (defined as the correlation between the item and the total score without that specific item). Notably, the internality items showed a greater number of CITCs (13 out of 16) below the lower bound of .30 (Nunnally & Bernstein, 1994) and a mean CITC of .32 (see Table 1).

Furthermore, looking at the CDTCs (defined as the correlation between the dimension and the total score with the specific dimension removed), internality seems to be inconsistent with the behavior of the other dimensions. Whereas the CDTCs for globality, stability, negative consequences and self-worth implications ranged between .64 and .76, the CDTC for internality was much lower (r = .32).

Table 1

Descriptive statistics and correlations of the CSQ-SF dimensions and total score.

Measure	M(SD)	Range	r					CDTCs	CITCs
			1	2	3	4	5		
1. Internality	50.21(5.80)	27 – 75						.32	.15
2. Globality	38.32(7.23)	16 – 69	.22					.74	.37
3. Stability	38.18(7.80)	16 – 66	.30	.68				.74	.40
4. Negative consequences	18.54(4.79)	8 – 33	.13	.66	.58			.64	.40
5. Self-worth implications	39.00(10.15)	16 – 75	.36	.67	.67	.58		.76	.48
CSQ-SF Total score	184.24(28.18)	100 – 308	.49	.84	.85	.73	.89		

Note: Means (M) and standard deviations (SD), range of scores (Range), Pearson's correlations (r), corrected dimension-total correlations (CDTCs), mean corrected item-total correlations (CITCs).

2.2.2 Internal structure of the CSQ-SF

Fit statistics for all the models tested are presented in Table 2. We estimated explained variance estimated by means of ω_t. Our results showed that ω_t increased along with increasing model complexity, favoring the bifactor model (Table 3). The incremental fit indices (CFI and TLI) can be used to compare the non-nested competing models, with greater values indicating the best model fit.

The bifactor model for the CSQ-SF without internality showed the best fit indices, including a greater CFI and TLI. The ω_h was .92, indicating that the general factor had a strong influence over

the specific factors in explaining the items' variance. Notably, values of ω_h greater than .80 indicate that the total score may be conceived as essentially unidimensional (Rodriguez, Reise, & Haviland, 2016). Also, ω_h for the full-five dimensional model was high (.90), but considering the ω subscale coefficients, the different contribution of each dimension can help explain the variance in CSQ-SF scores. The ω_t coefficients for each CSQ-SF subscale revealed that internality had a lower internal consistency (.21) compared to the other subscales (.73 – .91). Conversely, the ω_h subscale coefficient was high for internality (.57) compared to the other subscales (.00 – .17), indicating that the score variance of internality is explained not by the general factor but by its specific domain. Furthermore, it should be noted that when a bifactor model for the five CSQ dimensions was specified, several internality items showed negative factor loadings both on the general factor and on the specific factor (see Supplementary Materials Appendix B), indicating their poor consistency both with the negative cognitive style construct as a whole and with the Internality dimension. These additional considerations on the internality dimension consistency lean in favor of a four-dimensional bifactor model of the CSQ-SF that supports the validity of the computation of a composite total score (consisting of globality, stability, negative consequences and self-worth implications).

Table 2

Confirmatory factor analyses of the CSQ-SF with and without the internality dimension: model comparison by DWLS method (N = 770)

Model	χ^2	df	CFI	TLI	RMSEA	RMSEA CI	SRMR
With Internality							
One-factor	13759.92	2484	.908	.905	.077	[.076; .078]	.072
Five-factor	12443.57	2474	.919	.916	.072	[.071; .074]	.069
Bifactor	10303.97	2412	.936	.932	.065	[.064; .067]	.063

Without Internality							
One-factor	7970.67	1484	.939	.937	.075	[.074; .077]	.070
Four-factor	7045.76	1478	.948	.945	.070	[.068; .072]	.066
Bifactor	6097.41	1482	.956	.953	.065	[.064; .067]	.062

Note: χ^2 = Chi-Square; *df* = Degrees of Freedom; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; RMSEA CI = RMSEA 95% Confidence Interval; SRMR = Standardized Root Mean Square Residual.

Table 3

Internal consistency coefficients of the CSQ-SF and its subscales

Model	Internality	Globality	Stability	Negative consequences	Self-worth implications	ω_t	ω_h
With Internality							
One-factor						.94	
Five-factor	.21	.81	.79	.73	.91	.95	
Bifactor	.57	.00	.16	.17	.15	.96	.90
Without Internality							
One-factor						.97	
Four-factor	-	.81	.80	.75	.90	.96	
Bifactor	-	.01	.13	.11	.23	.96	.92

Note: ω_t = Omega Total; ω_h = Omega Hierarchical.

2.2.3 Empirical distributions of the CSQ-SF dimensions in the low and high cognitive vulnerability groups

Based on the CSQ-SF total standardized scores, individuals who scored in the lowest 15th percentile formed the low cognitive vulnerability group (N = 116), whereas individuals who scored in the highest 85th percentile and above formed the high cognitive vulnerability group (N = 116). The empirical distributions of low and high cognitive vulnerability groups were compared on the five CSQ-SF subscales. Figure 1 shows that the globality, stability, self-worth implications, and negative consequences subscales discriminate well between individuals with low and high cognitive vulnerability, whereas the two groups' distributions substantially overlap on the internality dimension. The estimated area of overlap (Pastore, 2017) between the empirical distributions of the low and high cognitive vulnerability groups was 25.76% for internality, whereas it was close to 0 for the other subscales (globality: 0.83%; stability: 0.79%; negative consequences: 2.41%; self-worth implications: 0.89%).

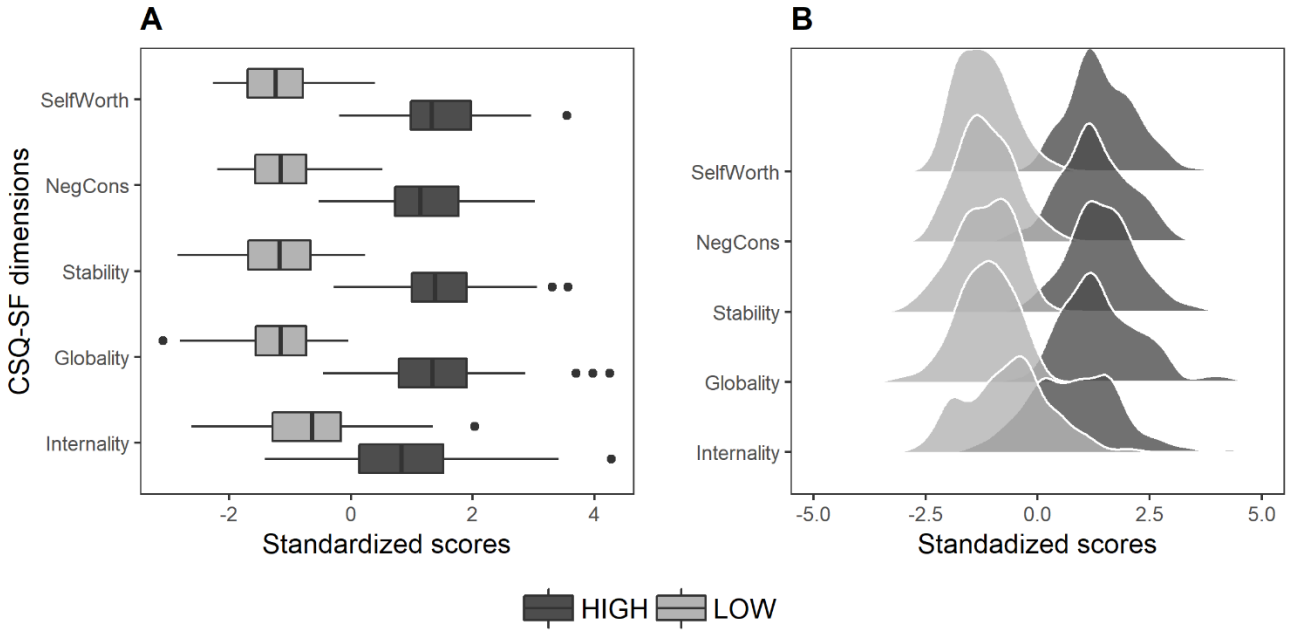

Figure 1. Score distributions of the low cognitive vulnerability group (N = 116) and the high cognitive vulnerability group (N = 116) on the CSQ-SF dimensions. Score distributions are depicted by boxplots in Panel A and by *empirical density distributions in Panel B.*

2.3 Discussion

The CSQ-SF consists of five dimensions assessing internality, globality, stability, negative consequences, and self-worth implications. Nevertheless, according to the hopelessness theory, internality should not be considered as a vulnerability factor for depression.

In Study 1, we evaluated the CSQ-SF and the revised CSQ-SF (i.e., without internality) to provide statistical justification, and not only a theoretical one, for the CSQ-SF's scoring. Our results provide several pieces of evidence for excluding the internality dimension from the computation of the total CSQ-SF score. First, the internality subscale showed a weak CDTC, unveiling its inconsistency with the other four CSQ-SF dimensions. Second, CFAs indicated the superiority of the bifactor model of the CSQ-SF without internality with respect to the model in which internality was included, both in terms of goodness of fit and in terms of internal consistency (ω_t = .96; ω_h = .92). Third, the internality dimension had the worst discriminant power between individuals with low and high cognitive vulnerability to depression (overlapping = 25.76%) compared to the other CSQ-SF dimensions. Because internal attributions are not constitutive elements that all individuals with a negative cognitive style share, internality should be scored separately from the composite CSQ-SF score.

3. Study 2

In Study 2, we examined the factor structure of the CSQ-SF in a new sample and further investigated the construct validity of the revised CSQ-SF (i.e., using the composite score of globality, stability, negative consequences, and self-worth implications) by means of a predictive validity study. By using the Interpretation Bias Questionnaire (IBQ; Wisco & Nolen-Hoeksema, 2010) as a criterion, we hypothesized that individuals with high cognitive vulnerability would be more likely to generate negatively-valenced interpretations than individuals with low cognitive vulnerability. We

administered a negative mood induction procedure before the generative interpretation task (i.e., IBQ) to activate the individuals' putative latent cognitive vulnerability (Segal & Ingram, 1994).

3.1 Materials and Methods

3.1.1 Participants and procedures

Participants were recruited by means of adverts posted on university social network groups and face-to-face requests to students from introductory undergraduate classes at the University of Padua, Italy. Survey participants were informed on the confidential nature of the data collection and that we were selecting subjects for a laboratory session on the basis of their questionnaire scores. A total of 300 participants (182 females) completed online a prescreening questionnaire composed by the CSF-SF and the BDI-II. Most of the participants were university students (89%) with a mean age of 23.5 years (SD = 3.8). At the end of the data collection phase, two experimental groups were formed on the basis of the study 2 sample's percentiles: Individuals who scored in the 15th percentile (CSQ-SF ≤ 107) were placed in the low cognitive vulnerability group, whereas individuals who fell in the 85th percentile and above (CSQ-SF ≥ 169) were placed in the high cognitive vulnerability group. After one to three weeks, the selected participants were asked to join the study that took place in the laboratory. Twenty-one subjects refused or were unable to take part in the second phase. The laboratory sample consisted of 72 participants. No differences were found for age and student status distributions across high and low cognitive vulnerability groups. Participants were tested individually in a private room on a computer by a trained research assistant. Participants completed again the CSQ-SF to test the stability of their levels of negative cognitive style. The laboratory session consisted of the negative mood induction procedure implemented in the open-source program OpenSesame (Mathôt, Schreij, & Theeuwes, 2012) and the generative interpretation task administration. In order to avoid participants to comply with experimental demands (Westermann, Spies, Stahl, & Hesse, 1996), the true purpose of the mood induction procedure was hidden until the end of the experimental session. All participants provided written informed consent before and after

participating in this study, which was approved by the Ethical Committee of the University of Padua (protocol number 2426).

3.1.2 Instruments

Beck Depression Inventory–II (BDI-II; Beck, Steer, & Brown, 1996; Sica, Ghisi, & Lange, 2007) is a self-rating scale composed of 21 items that evaluate key symptoms of depression, including cognitive, emotional, and somatic aspects. The respondents are asked to use a 4-point Likert-type scale to indicate the severity of their symptoms (0 = *least*, 3 = *most*). The total score ranges between 0 and 63, with higher total scores reflecting increased severity of depression symptoms. Suggested guidelines for cutoff scores are less than 14 for no or minimal depression, 14 to 19 for mild to moderate depression, 20 to 28 for moderate depression, and 29 or higher for severe depression.

Visual Analogue Scale (VAS). A digital VAS was implemented in OpenSesame and was administered at both the beginning and at the end of the negative mood induction procedure. Participants rated their mood by adjusting a scrollbar on a continuous line ranging from 0 on the left side (i.e., completely sad) to 100 on the right hand side (i.e., completely happy). The percentage of mood reduction after the negative mood induction procedure was measured by the following formula: Mood reduction % = [(VASpost – VASpre)/VASpre] × 100.

Negative Mood Induction. In order to induce a sad mood, a combined mood induction was administered. Participants consecutively: (a) listened to Albinoni's Adagio in G Minor over a period of 3:06 min while reading a set of 16 negative Velten statements (e.g., “Everything seems utterly futile and empty” or “I’ve doubted that I’m a worthwhile person”); (b) read a sad extract from the novel *La Storia* by Elsa Morante (1974) in which a mother is crazed with grief after her child died following an epileptic attack; and (c) watched a sad sequence from the movie *The Champ* (Lovell & Zeffirelli, 1979) depicting a young boy crying at the death of his father (2:00 min).

Interpretation Bias Questionnaire (IBQ; Wisco & Nolen-Hoeksema, 2010). The IBQ is a generative task in which participants are asked to vividly imagine themselves in 10 different situations

(e.g., "You're giving a speech. People in the audience start laughing. Why?") and to decide what they feel would have caused those situations if the events were actually happening to them. The IBQ was adapted into Italian by the first author and back-translated by a native English speaker (see Supplementary Materials Appendix C). In the present study, participants were instructed to think all the possible explanations (interpretation generation) and to select and write down one interpretation they deemed the "most likely" explanation for the situation. For each generated interpretation, participants rated on two 5-point Likert-type scales (from 1 = "not at all" to 5 = "extremely") the positive valence of their interpretation ("To what extent do you think this explanation is positive?") and the negative valence of their interpretation ("To what extent do you think this explanation is negative?"). The IBQ scores were calculated using the mean valence of participants' ratings on their generated interpretations (IBQ = Σ(IBQpos - IBQneg)/10). IBQ values range between -4 and 4. Negative values of IBQ are indicators of a negative interpretation bias, whereas positive values of IBQ reflect a positive valence attributed to their own interpretations.

3.2 Results

3.2.1 Replication of the Cognitive Style Questionnaire – Short Form factorial structure.

We conducted a CFA on Study 2's prescreening data (N = 300) to evaluate the factorial structure of the CSQ-SF, as investigated in Study 1 (Table 4). The CFA results replicated the findings of Study 1 and corroborated the superiority of the bifactor model without internality.

Table 4

Confirmatory factor analyses of the CSQ-SF with and without the internality dimension: model comparison by DWLS method (N = 300)

Model	χ^2	df	CFI	TLI	RMSEA	RMSEA CI	SRMR	ω_t	ω_h
With Internality									

One-factor	7372.35	2484	.918	.916	.081	[.079; .083]	.085	.95	
Five-factor	6380.58	2474	.935	.933	.073	[.070; .075]	.080	.97	
Bifactor	5405.82	2412	.950	.947	.064	[.062; .067]	.074	.97	.90
Without Internality									
One-factor	4133.26	1484	.950	.948	.077	[.074; .080]	.080	.98	
Four-factor	3541.50	1478	.961	.959	.068	[.065; .071]	.074	.97	
Bifactor	3130.05	1482	.968	.965	.063	[.060; .066]	.070	.97	.92

Note: χ^2 = Chi-Square; *df* = Degrees of Freedom; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; RMSEA CI = RMSEA 95% Confidence Interval; SRMR = Standardized Root Mean Square Residual; ω_t = Omega Total; ω_h = Omega Hierarchical.

3.2.2 Preliminary analysis.

Based on the composite CSQ-SF scores (without internality) of the prescreening test, we derived two experimental groups with the lowest (N = 40) and the highest (N = 32) negative cognitive style.

Total scores on the CSQ-SF in the laboratory session were compared to total scores in the prescreening. Test-retest reliability was excellent (*r* = .96), indicating that cognitive style was stable over a period of one to three weeks.

The high cognitive vulnerability group showed higher depressive symptoms than the low cognitive vulnerability group (see Table 5).

Table 5

Laboratory sample groups' composition

	High	Low
N total	32	40
Sex, N females	18(56%)	22(55%)
N studying currently	28(88%)	36(90%)

Age, mean (SD)	23.3(3.3)	23.6(3)
N depressed mood (BDI-II ≥ 14)	22(69%)	5(12%)
Depressive symptoms, mean (SD)	20.2(11.1)	7.1(7)

Note: Number of participants for each group (N total), number and percentage of females (Sex), number and percentage of undergraduate students in the laboratory sample (N studying currently), mean age (Age), number of participants with at least mild depressive symptoms (N depressed mood), and mean BDI scores (Depressive symptoms).

3.2.3 Effectiveness of mood induction procedure in high and low cognitive vulnerability to depression groups

The reference criterion to evaluate the effect of the negative mood induction procedure was a minimum 20% reduction in mood (Singer & Dobson, 2007; Teasdale & Fogarty, 1979). Participants with high cognitive vulnerability to depression showed a mood reduction significantly greater than 20% (M = 31.81, SD = 24.54), $t(31) = -2.7$, $p = .005$, $d = .48$. Conversely, participants with low vulnerability did not reach the mood reduction cutoff value of 20% (M = 16.52, SD = 22.67, $d = .15$).

An independent t-test showed that mood reduction was significantly greater in the high cognitive vulnerability group than in the low cognitive vulnerability group, $t(70) = 2.74$, $p = .008$, d [95%CI] = 0.65 [0.16, 1.14].

3.2.4 Interpretation bias in high and low cognitive to depression vulnerability groups

The IBQ mean score of participants with low cognitive vulnerability was significantly greater than 0 (M = 1.00, SD = 1.2), $t(39) = 5.3$, $p < .001$, $d = .83$, indicating a tendency to attribute a positive valence to their own interpretations. By contrast, individuals with high cognitive vulnerability showed a negative IBQ mean score (M = -.79, SD = .89) and significantly lower than 0, $t(31) = -5$, $p < .001$, $d = .89$, suggesting the presence of a negative interpretation bias.

In the high cognitive vulnerability group, there was a greater proportion of dysphoric individuals than in the low cognitive vulnerability group, $\chi^2(1) = 21.7$, $p < .001$; thus, it was important to verify if depression at the prescreening could be a relevant third variable that may explain the relationship between negative cognitive style at the prescreening and negative interpretation bias during the experimental session. In addition, it was also important to control for mood deterioration following the negative mood induction procedure. We thus specified a linear model in which the IBQ scores during the experimental session were predicted by cognitive vulnerability to depression (high vs. low), depressive symptoms at the prescreening, and mood variation consequent to the negative mood induction during the experimental session (see Table 6). Results showed that negative cognitive style is a significant predictor of negative interpretation bias, with the high vulnerability group showing significantly more negative interpretations than the low vulnerability group, $b = -1.32$, $p < .001$. Furthermore, our data suggest that negative interpretation bias shares a substantial amount of variance with negative cognitive style ($sr^2 = .14$), even greater than that shared with depressive symptoms ($sr^2 = .07$). By contrast, concurrent mood variation consequent to the negative mood induction (ΔVAS) did not account for any significant part of the variance in the IBQ scores. In sum, results suggest that individuals with higher scores at the CSQ-SF are more likely to show negative interpretation bias, regardless of the intensity of their reported depressive symptoms and mood fluctuations.

Table 6

Linear model predicting negative interpretation bias from negative cognitive style, depressive symptoms, and mood deterioration following the mood induction procedure.

Predictor	*b*	*b* 95% CI	sr^2	sr^2 95% CI
High vulnerability group	-1.32***	[0.71, 1.93]	.14	[.02, .26]
BDI-II	-0.04**	[-0.07, -0.01]	.07	[-.02, .16]

ΔVAS	-0.00	[-0.01, 0.01]	.01	[-.02, .03]

Note: *b* = unstandardized regression weights; sr^2 = squared semi-partial correlation.

* $p < .05$. ** $p < .01$ *** $p < .001$

3.3 Discussion

The first result of Study 2, is that we replicated the factor structure of the revised CSQ-SF that we found in Study 1 in a new sample. Study 2 was motivated by the hypothesis that individuals with high cognitive vulnerability to depression would be more prone to show a negative interpretation bias. The results of the generative interpretation task confirmed our hypothesis: Participants with high cognitive vulnerability tended to interpret ambiguous situations in a negative manner compared to the low cognitive vulnerability group, which, conversely, tended to provide a positive valence to the interpretations. Importantly, this result was observed also when statistically controlling for depressive symptoms at the baseline. Furthermore, when we examined the effects of mood induction across the two groups, we found a stronger mood reduction (below the -20% threshold) in the high vulnerability group than in the low vulnerability group, although this enhanced susceptibility to mood modification did not impact the interpretation bias.

4. General Discussion

Taken together, the results of our two studies strengthen the construct validity of the CSQ-SF. Study 1 shows that the factorial structure of the CSQ-SF is well accounted for by a bifactor model that simultaneously accounts for the specificity of the attributional dimensions and the unidimensional nature of the negative cognitive style construct. The bifactor model of the four CSQ-SF dimensions (globality, stability, negative consequences, and self-worth implications) provides a good fit to the sample's data. Indeed, the comparison between the confirmatory factor models of the

CSQ-SF with and without internality supports a factor solution without the internality dimension, both in terms of goodness of fit and greater internal consistency. In Study 2, we replicated this factor structure in a new sample, providing even greater evidence about the solidity of the CFA results. On the basis of these factor-analytic results, we suggest computing the total CSQ-SF score by summing the scores related to the dimensions of globality, stability, negative consequences, and self-worth implications (i.e., without the internality dimension). Furthermore, in line with previous observations that internal attributions do not contribute to explain hopelessness and depressive symptoms (Metalsky & Joiner, 1992), our results support the choice of excluding the internality dimension from the total score computation because of the low CDTCs and CITCs, because of the low internal consistency derived by the ω coefficients computed by considering and by excluding the internality dimension, and because of the low discriminant power of the internality dimension between individuals with low and high cognitive vulnerability to depression.

At the more general level of theory integration, research on negative cognitive style has shown a growing interest in cognitive biases and has highlighted the similarity in the mechanisms underlying both the Beck model and the hopelessness theory (Pössel & Knopf, 2011). Our contribution to this debate is to show that the negative interpretation bias can be understood as a link between the two theories. The negative interpretation bias has been identified as a fundamental cognitive factor involved in the onset and maintenance of depression (Everaert, Podina, & Koester, 2017). In Study 2, we showed that a negative cognitive style, which is considered a distal cognitive factor for the onset of depression, is associated to negative interpretation bias, which is regarded as a proximal cognitive cause of depression (Everaert et al., 2017). Specifically, we found that high CSQ-SF scores can predict a negative interpretation bias over a period of about three weeks. We also found that individuals with high negative cognitive style produced more intense negative interpretations compared to individuals with low CSQ-SF scores. This result was independent of depressive symptom severity and of mood deterioration following negative mood induction. Our findings thus show that negative cognitive style, on the one side, and negative interpretation bias, on the other,

despite belonging to different theoretical frameworks, are indeed closely related constructs that influence each other over time and together conspire in the facilitation of the onset of depressive symptoms.

Several limitations of the present research should be mentioned. Despite the fact that, to our knowledge, this is the first study to examine the internal structure of the CSQ-SF by means of a CFA, we recognize the limited generalizability of our results because, although they were replicated in two samples, they both rely on university-age participants. Future research should generalize our findings to different populations by means, for instance, of multigroup-factor analysis. Furthermore, we highlight the weakness of several CSQ-SF items (i.e., low or negative factor loadings), probably due to the high rate of reverse coded items, suggesting that further refinement of the questionnaire should improve its psychometric properties. Regarding Study 2, future research should plan for the presence of a control group (i.e., with neutral or positive mood induction) to better clarify the effect of mood induction on the interpretation task. Moreover, the presence of a control group would give additional support to our claim of the stronger effectiveness of negative mood induction in the high vulnerability group compared to the low vulnerability group. Finally, the cross-sectional nature of the design prevented us from discussing further implications on the relationship between negative interpretation bias and negative cognitive style in predicting depression.

In conclusion, our studies show that negative cognitive style is an important mechanism, whose role goes beyond that attributed by the hopelessness theory. In fact, it is likely that depressotypic attributions and inferences exert their influence over different components of the network of depressive mechanisms, such as interpretation bias. Future studies should more comprehensively take into account the variety of vulnerability factors of depression.

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