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Patrick Pössel
University of Louisville

Short title: COGNITIVE ERROR QUESTIONNAIRE

Cognitive Error Questionnaire (CEQ): Psychometric properties and factor structure of the

German translation

Patrick Pössel[1]

University of Tübingen

Corresponding author:

Patrick Pössel, Dr. rer. soc.

Department of Educational and Counseling Psychology

College of Education and Human Development

University of Louisville

2301 S. Third Street

Louisville, KY 40208

Phone: 502-852-0623

Fax: 502-852-0629

E-mail: patrick.possel@louisville.edu

[1] Present address: Department of Educational and Counseling Psychology, University of Louisville, USA.

Abstract

A central component of Beck, Rush, and Shaw's (1979) cognitive theory of depression is faulty information processing reflected by so-called cognitive errors. These cognitive errors are the reason why depressed individuals systematically misinterpret the significance of events in a negative way. They are usually assessed with the application of the Cognitive Error Questionnaire (CEQ). This study examines the psychometric properties and factor structure of the German version of the CEQ in a sample of 796 volunteers at a German university. Results confirmed that the German CEQ has satisfactory to very good psychometric properties, like the American original. Confirmatory factor analyses demonstrated that a hierarchical 4-factor model with 4 subscales and 1 second order factor fits the data best. Therefore, besides using the German CEQ in studies with German-speaking samples, the similarities in psychometric properties of the American and German CEQ allow for cross-cultural studies.

Key words: depression; cognitive model; cognitive errors; psychometric property; factor structure

Depression is ranked as the fourth leading cause of disease burden, accounting for almost 12% of disability worldwide (Ustun, Ayuso-Mateos, Chatterji, Mathers, & Murray, 2004), and is expected to become the second most disabling disorder by 2010 (exceeded only by cardiovascular disease). One widely accepted and empirically supported theory explaining the development and maintenance of depression was developed by Beck, Rush, and Shaw (1979). A central component of this theory is faulty information processing as reflected by errors of logic—so-called cognitive errors. Following Beck et al. (1979), these cognitive errors are seen as the reason why depressed individuals systematically misinterpret the significance of events in a negative way. Such cognitive errors have been empirically linked to depression in many studies (e.g., Henriques & Leitenberg, 2002; Neimeyer & Feixas, 1992). Despite the significance of cognitive errors to the development and maintenance of depression, no standardized assessment instrument to measure them has been made available in German thus far. To close this gap, this study translated the widely used Cognitive Error Questionnaire (CEQ), developed by Lefebvre (1981), and evaluated it with a German sample from the general population.

The original American CEQ version was studied initially with a small sample of depressed and nondepressed psychiatric and low back pain patients, respectively (Lefebvre, 1981). This instrument includes a 24-item General CEQ and a 24-item low back pain CEQ that are composed of short (two- to three-line) vignettes followed by a dysphoric cognition about the vignette that reflects a cognitive error. Individuals are asked to rate how similar the cognition in the CEQ is to a thought that they would have in similar situations. As originally conceived, Lefebvre's plan was to construct an instrument that measured all seven cognitive errors identified by Beck et al. (1979). However, the cognitive errors overlapped considerably and raters were not able to identify seven independent cognitive errors. Therefore, Lefebvre (1981) combined and reversed errors, allowing raters to categorize the items accordingly into four subscales (a) catastrophizing (anticipation that the event is a catastrophe or its outcome will be catastrophic),

(b) overgeneralization (anticipation that the outcome of one event applies to the same or even slightly similar events in the future), (c) personalization (taking personal responsibility for negative events or interpreting such events as having a personal meaning), and (d) selective abstraction (selectively attending to negative aspects of events). The internal consistencies of the CEQ for all participants ranged from $\alpha = .62$ to .94 ($p \leq .001$) and were higher for the total scales than for CEQ subscales. Based on these results, Lefebvre (1981) concluded that all individual cognitive errors include a common factor so that a hierarchical model with four subscales and one second order factor can be assumed.

Unfortunately, Lefebvre (1981) did not test the structure of the General CEQ empirically. However, Scogin, Hamblin, and Beutler (1986) tested the General CEQ structure with a sample of 43 depressed ($M = 71.09$ years, range 64 to 84 years) and 53 nondepressed ($M = 72.10$ years, range 60 to 88 years). Using not items but subscales of the General CEQ, one factor explained most of the variance in both groups, confirming Lefebvre's (1981) assumption.

To examine criterion-validity, Lefebvre (1981) calculated Pearson correlations between the Beck Depression Inventory (BDI) and the General CEQ total scale ($r = .61, p \leq .001$). As the magnitude of the correlation might be influenced by the artificial separation of the BDI caused by sampling for depressed ($r = .39, p \leq .01$) and nondepressed individuals ($r = .37, p \leq .003$), the same correlation was recalculated for depressed and nondepressed patients separately. In this case, some of the reduction might be the result of the restriction of the range of the BDI so that a reanalysis with a sample from the normal population seems to be necessary.

Based on the literature, the aim of this study was not only to translate the CEQ to German and validate the German CEQ version, but also to test the factor structure of the CEQ. In a first step confirmatory factor analyses for a one-factor, a four-factor, and a hierarchical four-factor model (four subscales and one second order factor) of the German CEQ were tested. In addition, the item-scale correlation between items and each General CEQ subscales as well as the General

CEQ total scale were calculated. Following Lefebvre's (1981) conclusion that the factors of the General CEQ measure a common factor, it was expected that the items would demonstrate correlation with the General CEQ scale that are not significantly lower than the correlations with the CEQ subscales. To further explore this hypothesis, inter-correlations between the CEQ subscales as well as with the CEQ total scale were calculated with the expectation of high correlations.

To identify the reliability of the German CEQ, the internal consistencies of the subscales and the total scale as well as the four-week retest reliabilities were calculated. Finally, criterion validity was established by calculating Pearson correlations between the German CEQ version and the German Center for Epidemiological Studies – Depression Scale (CES – D, Hautzinger & Bailer, 1993) administered at the same time and four weeks later, respectively. It was expected that the concurrent validity of the German CEQ total scale would not be statistically different from the correlation between the American General CEQ and the BDI in Lefebvre's study (1981).

Methods

Participants

Volunteers for the study were 796 students, staff, and faculty at a university in the Southwest of Germany. Volunteers were given course credits or participated in a drawing to win one of five monetary prizes (EURO 100) as compensation for participating in the study.

Women comprised 80% ($n = 638$) of the sample, while 19.6% ($n = 156$) of the participants were male, and two participants (.4%) did not indicate their gender. Age ranged from 18 to 52 years, with a median age of 21 (*mean*: 23.71; $SD = 6.57$) years. At a second measurement four weeks later, 631 of these individuals participated again.

Measures

The General Cognitive Error Questionnaire (CEQ) consists of 24 items. Ratings are given on a 5-point Likert scale from 0 (*almost exactly like I would think*) to 4 (*not at all like I would think*). The scores for the CEQ scales were calculated by summing the item scores (Lefebvre, 1981).

Radloff (1977) developed the Center for Epidemiological Studies – Depression Scale (CES – D) as a quick, economical screening instrument for measuring depressive symptoms within the last week. The American and German versions of the CES-D (Hautzinger & Bailer, 1993) consist of 20 items (e.g., "I was bothered by things that usually don't bother me."). The frequency of symptoms is rated on a four-point scale ranging from 0 to 3, with higher numbers indicating higher frequency of occurrence. Item scores are summed, creating a range from 0 to 60. The CES-D showed an excellent internal consistency ($\alpha = .90$) and a good four-week retest-reliability ($r = .53$, $p \leq .01$) in our study.

Procedure

In small group sessions, participants completed the CEQ and the CES-D as part of a larger questionnaire package. Participants were asked to participate in another group session to fill out the same questionnaires again four weeks later. The study was approved by the IRB of the University of Tübingen.

Translation of the CEQ

The American version of the General CEQ was adapted and translated according to guidelines that are widely accepted for the successful translation of instruments in cross-cultural research (Brislin, 1970). While one bilingual translator, who was a native German speaker, individually translated the questionnaire from the English-language original into German, another bilingual person translated this German CEQ version back into English. Differences in the original and the back-translated versions were discussed and resolved by joint agreement of both translators. In

addition, a panel of three German and two English native speakers reviewed the translation and

back translation. This panel agreed that the German CEQ is equivalent to the English original.

<div align="center">Results</div>

Factor Structure of the German CEQ

In order to test how well the three factor models reported above applied to the German

CEQ, confirmatory factor analyses with the maximum likelihood method were performed using

AMOS 7.0. Goodness of fit was tested with χ^2. However, as χ^2 is known to increase with sample

size and degrees of freedom, the χ^2 was complemented by χ^2/df, root mean squared of the

residuals (RMSEA; Steiger & Lind, 1980), Tucker-Lewis Index (TLI; Tucker & Lewis, 1973)

and comparative fit index (CFI; Bentler, 1990) indices. While a full explanation of these indices

and their limitations is beyond the scope of this article, a short description seems necessary:

Statistically nonsignificant values of χ^2 and values of χ^2/df that are close to 1 or smaller indicate a

good fit of the model to the data. A RMSEA value of 0 indicated a perfect model fit; a value of $\leq$

.05 is conventionally regarded as an indicator of a good model fit; and a value of $\leq$ .08 is seen as

acceptable (Hu & Bentler, 1999). TLI and CFI values of $\geq$ .95 indicate a good model fit and

values of $\geq$ .80 are regarded as acceptable (Hu & Bentler, 1999). Finally, to test the different

nested models against each other, the χ^2 values as well as the dfs of the models were subtracted

from each other. When $\Delta\chi^2$ is significant for Δdf, the models are seen as significantly different.

All three factor models were tested and compared. Based on Lefebvre (1981), the four

factors in the confirmatory factor analyses were allowed to correlate. Confirmatory factor

analyses showed that four of five indices of goodness of fit for the one-factor model [χ^2 (229, $N =$

796) = 1368.80, $p < .001$, $\chi^2/df = 5.98$, RMSEA (.079), TLI (.730), CFI (.794)] and the four-factor

model [χ^2 (226, $N = 796$) = 1381.00, $p < .001$, $\chi^2/df = 6.11$, RMSEA (.080), TLI (.722), CFI

(.791)] were not within the acceptable range while RMSEA and CFI for the hierarchical four-

factor model [χ^2 (225, $N = 796$) = 1318.10, $p < .001$, $\chi^2/df = 5.86$, RMSEA (.078), TLI (.736),

CFI (.802)] were within the acceptable range.

In line with the goodness of fit indices for the different models, comparing the three

models showed the hierarchical four-factor model to fit the data significantly better than the four-

factor model [$\Delta\chi^2$ (1, $N = 796$) = 62.90, $p < .001$] and the one-factor model [$\Delta\chi^2$ (4, $N = 796$) =

50.70, $p < .001$]. Finally, the one-factor model fitted the data significantly better than the four-

factor model [$\Delta\chi^2$ (3, $N = 796$) = 12.20, $p < .01$].

Item Analysis

As part of the item analysis means, standard deviations, and item-scale correlations for

each item with the four CEQ subscales following Lefebvre (1981) and the total scale are

calculated (see Table 1). The item-scale correlations of the German CEQ subscales show clearly

the highest correlations between items and their associated subscales, following Lefebvre (1981).

Finally, inter-correlations between the four CEQ subscales (catastrophizing –

overgeneralization: $r = .61$, catastrophizing – personalization: $r = .62$, catastrophizing – selective

abstraction: $r = .58$, overgeneralization - personalization: $r = .55$, overgeneralization – selective

abstraction: $r = .53$, personalization – selective abstraction: $r = .57$) as well as between the CEQ

scales and the total scale (catastrophizing – total: $r = .85$, overgeneralization – total: $r = .82$,

personalization – total: $r = .83$, selective abstraction – total: $r = .81$) were calculated. While the

inter-correlations between the CEQ subscales are mainly satisfactory, the correlations between

CEQ subscales and the total scale are good.

Reliability

To determine the reliability of the German CEQ version, internal consistencies and four-

week retest-reliability of the scales and the total scale were calculated. The internal consistencies

of the German CEQ are slightly lower than the consistencies of the American CEQ ($\alpha = .62$ for

catastrophizing, $\alpha = .73$ for overgeneralization, $\alpha = .64$ for personalization, $\alpha = .59$ for selective

abstraction, $\alpha = .87$ for the total scale). The four-week retest-reliabilities were satisfactory to very

good ($r = .70$ for catastrophizing, $r = .69$ for overgeneralization, $r = .69$ for personalization, $r =$

.69 for selective abstraction, $r = .79$ for the total scale) and significant ($p \leq .01$).

Criterion-Validity

To explore the concurrent and predictive validity, correlations between the German CEQ

scales and the CES-D administered at the same time and four weeks later were calculated. The

concurrent ($r = -.25$ for catastrophizing, $r = -.26$ for overgeneralization, $r = -.31$ for

personalization, $r = -.27$ for selective abstraction, $r = -.33$ for the total scale) and predictive

validity ($r = -.25$ for catastrophizing, $r = -.25$ for overgeneralization, $r = -.28$ for personalization,

$r = -.28$ for selective abstraction, $r = -.32$ for the total scale) of the German CEQ were significant

($p \leq .01$).

Discussion

The aim of this study was to translate and evaluate the American General Cognitive Error

Questionnaire (Lefebvre, 1981) in order to obtain a reliable and valid German version of the CEQ

to measure this important element of Beck et al.'s (1979) theory explaining the development and

maintenance of depression.

Results of confirmatory factor analyses testing three different factor structures

demonstrate that a hierarchical four-factor model with the four CEQ subscales as constructed by

Lefebvre (1981) and one second order factor fits the data best. These data are supported by item-

scale correlations with the German CEQ subscales. The item-scale correlations clearly show the

highest correlations between items and their associated subscales that Lefebvre (1981) found for

the American General CEQ. This result clearly demonstrates the similarity between the American

and German CEQ. Furthermore, the inter-correlations between the CEQ subscales ($r = .53$ to $.62$) as well as with the CEQ total scale are high ($r = .81$ to $.85$).

The reliabilities and validities of the German CEQ are similar to the American CEQ, as expected. As in Lefebvre's study (1981), the internal reliabilities of the German CEQ range from satisfactory to very good and are higher for the total scale than for CEQ subscales. Furthermore, retest-reliability of the German CEQ lies within the satisfactory to good range. Finally, the concurrent and predictive validity of the German CEQ ($r = .25$ to $.33$) is similar to the concurrent validity found by Lefebvre (1981) in nondepressed individuals. These data regarding retest-reliability and predictive validity are of particular significance as there are no data available for these psychometric properties of the American General CEQ.

Like every study, this one has limitations: First, the use of a nonclinical sample can be seen as a limitation. It might be that the German CEQ would demonstrate different psychometric properties when administered to psychiatric patients, and even more so if given to depressed individuals rather than our nonclinical university sample. Based on an evaluation study of the German Automatic Thoughts Questionnaire-Revised (Pössel, Seemann, & Hautzinger, 2005), it can be expected that the psychometric properties in psychiatric samples will turn out to be better than in a sample of the general population. Therefore, using a nonclinical sample is likely to produce a bias against the CEQ. This might explain the slightly lower internal consistencies of the German CEQ when compared with Lefebvre's (1981) data, which are based on a mixed depressed and nondepressed sample. Therefore, the evaluation of the German CEQ should be replicated with a depressed sample to clarify this issue.

Second, the discriminatory validity of the German CEQ was not tested. This measure would be of special interest as the specificity of the cognitive errors in adults could be tested at the same time. This might be important, as Beck et al. (1979) proposed that cognitive errors are specific for depression. However, no such study with an adult sample has focused on this issue up

to now. Nevertheless, contrary to Beck's hypothesis, a study with children and adolescents using the Children's Negative Cognitive Error Questionnaire found significant correlations between cognitive errors and anxiety after controlling for depression (Weems, Berman, Silverman & Saavedra, 2001).

Finally, the items means suggest that for the most part the students denied endorsing the depressive statements. This result was to be expected as the sample is nonclinical. Furthermore, it is consistent with the scale means reported by Lefebvre (1981) and Scogin et al. (1986) for their nondepressed samples. Nevertheless, this result emphasizes the importance for another evaluation study with a clinical sample.

Despite the limitations of the study, the German CEQ allows for future studies testing the validity of cognitive errors in German samples in a standardized manner. As cognitive errors are seen as causing depressed individuals to systematically misinterpret the significance of events in a negative way (Beck et al., 1979), the German CEQ can be seen as essential to test Beck et al.'s (1979) cognitive theory of depression in this population. Furthermore, the German CEQ enables cross-cultural studies comparing the importance of cognitive errors in the development and maintenance of depressive disorders in American and German samples. Finally, one of the goals of cognitive-behavioral therapy is the change of cognitive errors in depressed patients. With regard to this goal, the German CEQ can be used to evaluate the progress of these efforts not only in research studies but also by practitioners in their daily work.In summary, the results confirm that the German CEQ is a reliable and valid instrument in the studied sample. Therefore, the German CEQ can be used to measure cognitive errors with regard to Beck et al.'s (1979) theory explaining the development and maintenance of depression. This closes a significant gap in testing for relevant cognitive factors in German-speaking settings by allowing cognitive errors that have been empirically linked to depression (e.g., Henriques & Leitenberg, 2002; Neimeyer & Feixas, 1992) to be assessed using a standardized assessment. Besides using the German CEQ in

studies with German-speaking samples, the similarities in psychometric properties of the

American and German CEQ allow for future cross-cultural studies.

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Table 1

Descriptive Statistics, Item-Scale Correlations, and Z-Values of the German CEQ

			Item-Scale Correlations				
			Cata.	Over.	Pers.	Select.	Total
Item	*M*	*SD*	Scale	Scale	Scale	Scale	Scale
1. Your boss just told you that because of a general slowdown in the industry, he has to lay off all of the people who do your job including you. You think to yourself, "I must be doing a lousy job or else he wouldn't have laid me off."	2.74	1.20	.39	.36	**.62**	.36	.52
2. You are a manager in as small business firm. You have to fire one of your employees who has been doing a terrible job. You have been putting off this decision for days and you think to yourself, "I just know that when I fire her, she is going to raise hell and will sue the company."	3.13	0.95	**.41**	.23	.23	.14	.31
3. Last week you painted the living room and your spouse said it really looked great. When you were cleaning up, you found that you had gotten paint on the rug and thought, "Boy, this wasn't a very good painting job."	2.87	1.20	.30	.26	.26	**.57**	.41
4. You noticed recently that a lot of your friends are taking up golf and tennis. You would	3.30	1.03	.38	**.74**	.32	.33	.55

like to learn, but remember the difficulty you had that time you tried to ski. You think to

yourself, "I couldn't learn skiing, so I doubt if I can learn to play tennis."

5. You and your spouse recently went to an office party at the place where your spouse works. You didn't know anybody there and had a terrible time. When your spouse asks you if you want to go to the neighbors to visit, you think, "I'll have a terrible time just like at that office party."	3.03	1.10	.38	**.63**	.35	.33	.52
6. You just finished spending three hours cleaning the basement. Your spouse however, doesn't say anything about it. You think to yourself, "S/He must think I did a lousy job."	3.49	0.86	.38	.34	**.56**	.31	.48
7. Last night, your spouse said s/he thought you should have a serious discussion about sex. You think to yourself, "S/He hates the way we make love."	1.67	1.21	**.60**	.36	.32	.33	.49
8. You have been working for six months as a car salesperson. You had never been a salesperson before and were just fired because you had not been meeting your quotas. You thought, "Why try to get another job, I'll just get fired."	3.43	0.85	.39	**.57**	.34	.34	.50
9. Your job requires a lot of travel. You had hoped to drive 400 miles today but you hit bad weather that slowed you down. When you stopped for the night, you thought, "I didn't make that 400 miles: Today was a complete waste."	3.24	0.91	.40	.39	.33	**.63**	.53

10. You have just finished nine holes of golf. Totaling your score, you recall that although you got par on seven holes, you got two over par on the last two holes. You think to yourself, "Today I really played poorly."	3.56	0.80	.26	.25	.34	**.52**	.41
11. You went fishing for the first time today with some of your friends who love fishing. Nobody got anything, and the group seemed to be discouraged. You think to yourself on the way home, "I guess I made too much noise or did something that scared the fish off."	3.54	0.83	.39	.34	**.56**	.33	.49
12. Your friends are all going out to ride their snowmobiles. Last time you went, you ran out of gas, and you think to yourself, "What if I run out of gas again, I'll freeze to death."	3.21	0.97	**.59**	.27	.30	.34	.45
13. You have three children who generally do quite well in school. One of your children came home today and told you that he had to stay after school because he got into a fight. You think to yourself, "He wouldn't have gotten that detention if I disciplined him more."	3.43	0.83	.35	.35	**.58**	.39	.51
14. You are taking your coffee break when your boss stops by and reminds you of some work that has to get done today. You think to yourself, "If I don't start getting back to work earlier, I'm going to lose this job."	3.02	0.98	**.61**	.42	.50	.45	.60
15. You have noticed that many of your friends have begun playing tennis and are now urging you to play, too. You had taken golf lessons with your spouse last year and had	3.40	0.90	.36	**.72**	.33	.34	.54

difficulty learning to play golf. You think to yourself, "I had so much trouble learning golf,

I doubt if I could learn tennis."

16. Your seven-year-old son normally does very well in school. Last week, he brought home a paper which he had done incorrectly and was supposed to do over. You think to yourself, "Oh no, now he's having trouble in school. I better make an appointment with his teacher."	3.47	.81	.30	.22	.27	**.47**	.38
17. Earlier today, your spouse asked to have a serious talk with you after work about some things that were troublesome at home. You have no idea what's going on and you think, "We don't communicate enough: Our marriage is going to fall apart."	2.51	1.07	**.69**	.41	.47	.39	.59
18. On your last job, you had not received a raise even though a co-worker with similar experience had. You are now up for a raise in your present job and think, "I didn't get a raise the last time and I probably won't now."	2.80	1.03	.51	**.65**	.45	.40	.62
19. Your teenage daughter has just asked if two of her friends can stay overnight. You recall that you got very upset when your son had some friends over for pizza several weeks ago, and they had made a lot of noise. You think, "If they come over, I'll get upset again."	3.02	0.95	.38	**.61**	.39	.37	.53
20. You run a day care center. Today, the mother of a child you have been having	2.80	1.22	.41	.35	**.65**	.36	.53

difficulty with calls and notifies you that she has quit work and will be withdrawing her

child from your program. You think, "She probably thinks I wasn't handling him as well as

I should."

21. You took your children to the neighborhood pool for the afternoon. Although your kids urged you to swim with them, you were enjoying lying in the sun. Later you look up and see them arguing over a float. You think to yourself, "If I had gone in the water, they probably wouldn't be fighting now."	3.36	0.94	.31	.25	**.59**	.34	.44
22. You went shopping for some new clothes today and were unable to find anything you liked. You think, "What a waste of a day."	2.55	1.30	.30	.28	.34	**.66**	.47
23. You met with your boss today to discuss how you have been doing on your job. He said that he really thought you were doing a good job, but asked you to try to improve in one small area. You think to yourself, "He really thinks I'm doing a lousy job."	3.23	0.95	.46	.45	.49	**.59**	.60
24. Last time you went skiing, you took a hard fall and got shook up. You're supposed to go skiing this weekend but think, "I'll probably fall and break my leg and there will be no one to help me."	3.31	0.95	**.61**	.44	.36	.39	.55

Note. Cata. = catastrophizing; Over. = Overgeneralization, Pers. = Personalization, Select. = Selective abstraction. Bold numbers represent the item-scale correlation between items and the scale they belong to following Lefebvre (1981).