

BRIEF REPORTS

Separating Optimism and Pessimism: A Robust Psychometric Analysis of the Revised Life Orientation Test (LOT–R)

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The internal structure of the revised Life Orientation Test (LOT–R, German version; M. F. Scheier, C. S. Carver, & M. W. Bridges, 1994) was analyzed in a sample of 46,133 participants who ranged in age from 18 years to 103 years. Confirmatory factor analysis showed that dispositional optimism, as measured by the LOT–R, is bidimensional, consisting of an Optimism and a Pessimism factor. Consistent with previous results, there were small to moderate negative correlations between Optimism and Pessimism, but the strength of the association continuously decreased with age. The relative independence of the 2 dimensions occurred in both genders and across different age groups of patients with different medical disorders.

Keywords: optimism, pessimism, Life Orientation Test, LOT–R, dimensionality

The most frequently used measure of dispositional optimism is the Life Orientation Test (LOT; Scheier & Carver, 1985) or its revised version (LOT–R; Scheier, Carver, & Bridges, 1994). Despite its wide usage, a number of critical issues have been raised about the test (e.g., Marshall, Wortman, Kusulas, Hervig, & Vickers, 1992). One of them, the focus of this article, is whether the test measures one dimension (optimism) or two dimensions (optimism and pessimism).

Empirical findings do not convincingly support the authors' original assumption that optimism and pessimism are polar opposites on a unidimensional continuum. Analyzing the LOT–R with confirmatory factor analysis (CFA), Scheier et al. (1994) concluded "that the two-factor solution was superior" (p. 1074). Nevertheless, in an attempt to defend unidimensionality, the authors included correlated errors among the positively worded items and then reevaluated the models. The resulting nonsignificant chi-square difference between the one- and the two-factor models led them to conclude that the LOT–R should be treated as unidimensional. Using a similar strategy, Mehrabian and Ljunggren (1997) demonstrated the potential unidimensionality of the LOT–R only when setting correlations between Items 1 and 4 and between Items 7 and 9. These procedures do not ensure unidimensionality, because any single-factor model with correlated errors

reflects multidimensionality and can alternatively be specified by means of multiple latent factors.

There is more evidence suggesting that the LOT consists of partially independent Optimism and Pessimism factors (e.g., Robinson-Whelan, Kim, MacCallum, & Kiecolt-Glaser, 1997). For instance, using exploratory factor analysis, Creed, Patton, and Bartum (2002) demonstrated that, in a sample of students, the LOT–R was bidimensional rather than unidimensional and that there was little shared variance between optimism and pessimism ($r = .16$). However, it needs to be established that two-dimensionality is not an artifact of the methodology.

Kubzansky, Kubzansky, and Maselko (2004) assessed whether the two-factor structure occurs through methodological bias or reflects a substantive difference. The method artifact model posits that items cluster together because they are similarly framed, whereas the bidimensional model posits that items cluster together because they share substantive content. Reversing the framing of only half of the items on each subscale allows these models to be compared. If the factor structure is determined by item meaning, then the bidimensional structure should provide a good fit; items with a positive meaning would load on one factor, and items with a negative meaning would load on a second factor. However, if the two-factor structure is an artifact of method bias, then positively framed items should load on one factor, and negatively framed items should load on a second factor. Kubzansky et al. (2004) compared the models and found a remarkably consistent bidimensional factor structure across all versions of the LOT, regardless of how each item was framed. Differences in item distribution are another potential methodological artifact. However, in the study by McPherson and Mohr (2005), item extremity manipulations did not change the two-factor structure, and the two-factor model provided a better fit than the unidimensional model.

Furthermore, there is also a need to examine how the potentially independent factors Optimism and Pessimism are related to each other and to identify which factors moderate their relationship.

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Although Scheier and Carver (1985) originally reported a substantial negative correlation between Optimism and Pessimism in an undergraduate sample ($r = -.64$), in other studies a wide range of correlations between the two factors has been reported in various samples. For example, Steed (2002) found a correlation of $-.69$ among undergraduates, whereas Plomin et al. (1992) found that Optimism and Pessimism were uncorrelated in a sample of middle-aged and older adults ($r = -.02$).

The differentiation of optimism from pessimism is not a purely academic issue, as demonstrated in studies that have shown differential predictive validity for optimism and pessimism with criterion variables. For example, in a prospective study, Rääkkönen, Matthews, Flory, Owens, and Gump (1999) found that higher optimism but not lower pessimism was associated with lower ambulatory diastolic blood pressure, and Kivimäki et al. (2005) stated that “results of the nonparallel sickness profiles between optimists and nonoptimists and between pessimists and nonpessimists underline the importance of considering optimism and pessimism as separate concepts” (p. 419).

Given the inconsistencies in previous research, the present study aims to more definitively address the question about the dimensionality of the LOT-R by using a large, age-heterogeneous sample. Extending previous research, we test whether the factor structure of the LOT-R is stable across a broad range of ages and across different groups of medical patients. The wide range of correlations found in previous samples that differed in age suggests that age moderates the association between optimism and pessimism. On the basis of Plomin et al.’s (1992) and Mroczek, Spiro, Aldwin, Ozer, and Bosse’s (1993) results, we expect that optimism and pessimism will become progressively more independent with increasing age. Finally, we also examine the previously untested assumption that the underlying construct that the LOT-R measures is structurally invariant across men and women.

Method

Participants were recruited from DETECT (Diabetes Cardiovascular Risk-Evaluation: Targets and Essential Data for Commitment of Treatment),¹ a cross-sectional and prospective-longitudinal, nationwide clinical epidemiological study of unselected patients consecutively admitted to primary care in Germany. In the predetermined recruitment period, 89,742 patients attended the 3,188 participating primary care settings, of whom 59,403 were eligible to participate. Among these patients, 3,607 patients (6.1%) declined to participate. For an additional 278 patients, a medical assessment was not performed. This left a sample of 55,518 eligible patients. The LOT-R was available for 46,133 patients. The age range was from 18 to 103 years; the mean age was 53.9 years ($SD = 17.3$), and 59% were female. No indications of selective attrition could be identified. All participants gave informed consent.

Optimism and pessimism were measured with a German translation of the LOT-R, which consists of 10 items. Three items (Items 1, 4, and 10) assess optimism, 3 items (Items 3, 7, and 9) assess pessimism, and there are 4 filler items. Respondents indicated the extent to which they agreed with each item on a 5-point Likert scale that ranged from *strongly agree* to *strongly disagree*. Two members of the research group independently translated the items into German, and they then prepared a preliminary consensual translation. A bilingual native speaker of English then back-translated the items. The back-translated version very closely matched the original English version, and minor discrepancies in wording were resolved based on a consensus discussion.

Depression was assessed with the Depression-Screening Questionnaire (Wittchen & Pfister, 1997), a self-report measure with 10 items. Quality of

life was assessed with the EQ-5D (Brooks, Rabin, & de Charro, 2003), a self-report questionnaire measuring health-related quality of life. To address the issue of social desirability of the German version of the LOT-R, we administered a sample of undergraduate students ($n = 61$) the LOT-R and the SES-17 scale (Stöber, 1999), a measure of social desirability.

Results

CFA

The factor structure of the LOT-R was examined with CFA. Because ordinal variables violate the assumption of multivariate normality in CFA (the multivariate kurtosis as the normalized estimate in the actual data was 77.99), we based the analyses on a two-stage estimation approach developed by Lee, Poon, and Bentler (1995). In Step 1, polychoric correlations were computed. The model was then analyzed with the correct weight matrix obtained in Step 1. This approach ensures unbiased parameter estimates and standard errors. We used four criteria to assess how well a model fitted the data (cf. Hu & Bentler, 1999).²

For the unidimensional model, all six items were specified as indicators of a single factor. The one-factor model did not fit the data, as indicated by the robust chi-square goodness-of-fit index (Satorra & Bentler, 1994), Satorra-Bentler $\chi^2(9, N = 46,133) = 19,032.43, p < .001$ (CFI = .621, TLI = .621, RMSEA = .214, 90% confidence interval [CI] for RMSEA = .212, .217). For the two-factor model, the three positively worded items were specified as indicators of the Optimism factor, and the three negatively worded items were specified as indicators of the Pessimism factor. The two-factor model satisfactorily fitted the data, Satorra-Bentler $\chi^2(8, N = 46,133) = 654.04, p < .001$ (CFI = .987, TLI = .987, RMSEA = .042, 90% CI for RMSEA = .039, .045). Further evaluation of the difference in fit between the two models with a chi-square difference test suggested that the two-factor model was superior, Satorra-Bentler $\Delta\chi^2(1, N = 46,133) = 18,378.39, p < .001$. The correlation between the factors was $-.15$ ($p < .01$); the factor loadings ranged from .59 to .80. Cronbach’s alpha was .71 for Optimism and .68 for Pessimism.

Stability of the Model

Multigroup CFA was used to test the appropriateness of the two-factor model across gender, age, and different groups of

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² Two of these criteria are measures of absolute model fit—the root-mean-square error of approximation (RMSEA) and the 90% confidence interval for RMSEA—and two of them are measures of relative model fit—the comparative fit index (CFI) and the Tucker-Lewis index (TLI). RMSEAs less than .05 represent a close fit, RMSEAs between .05 and .08 represent a reasonably close fit, and RMSEAs greater than .10 represent an unacceptable model. CFI and TLI indicate how well a given model fits the data relative to a null model, which assumes that sampling error alone explains the covariation among the observed measures. Hu and Bentler (1999) have suggested that measurement models should have a CFI and TLI of at least .95.

Table 1
Goodness-of-Fit Indices for Models of Optimism–Pessimism

Model	χ^2_{S-B}	df	$\Delta\chi^2_{S-B}^a$	CFI	TLI	RMSEA	90% CI of RMSEA
Male–female							
One-factor model	21,897.99	18	—	.556	.260	.162	.161, .164
M1: same item–factor assignment	786.75	16	21,111.24 <i>df</i> = 2 <i>p</i> < .001	.984	.971	.032	.030, .034
M2: M1 + equivalent factor loadings	819.13	20	32.38 <i>df</i> = 4 <i>p</i> < .001	.984	.976	.029	.028, .031
M3: M2 + same correlations	879.64	21	60.51 <i>df</i> = 1 <i>p</i> < .001	.983	.975	.030	.028, .031
Age groups							
One-factor model	23,028.65	90	—	.540	.234	.074	.074, .075
M1: same item–factor assignment	992.54	80	22,036.11 <i>df</i> = 10 <i>p</i> < .001	.982	.966	.016	.015, .017
M2: M1 + equivalent factor loadings	1,076.23	116	83.69 <i>df</i> = 36 <i>p</i> < .001	.981	.975	.013	.013, .014
M3: M2 + same correlations	1,737.14	125	660.91 <i>df</i> = 9 <i>p</i> < .001	.968	.961	.017	.016, .017
Disease groups							
M1: same item–factor assignment	895.70	40	—	.981	.964	.022	.021, .023
M2: M1 + equivalent factor loadings	911.90	52	16.20 <i>df</i> = 12 <i>p</i> < .05	.981	.972	.019	.018, .021
M3: M2 + same correlations	991.79	60	79.90 <i>df</i> = 8 <i>p</i> < .001	.979	.974	.019	.018, .020
Age-adjusted disease groups							
M1: same item–factor assignment	433.19	40	—	.984	.969	.020	.019, .022
M2: M1 + equivalent factor loadings	450.43	52	17.24 <i>df</i> = 12 <i>p</i> < .05	.983	.976	.018	.017, .020
M3: M2 + same correlations	465.03	60	14.60 <i>df</i> = 8 <i>p</i> < .05	.983	.979	.017	.016, .018

Note. M1, M2, and M3 are two-factor models. *N* for chi-square: age-adjusted disease groups = 23,502; all others = 46,133. Dashes indicate that there was no preceding model to compare. S–B = Satorra–Bentler, 1994; CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root mean-square error of approximation; CI = confidence interval.

^a Model comparison refers to the preceding model. For model denotations, see the Results section.

patients. Because the one-factor model did not pass the goodness-of-fit test (see Table 1), only two-factor models were considered. Three nested models were tested for each group. The weakest model assumed the item–factor assignment in the two-factor model described above; however, the correlation between Optimism and Pessimism, the factor loadings, and the measurement errors were estimated freely. The second model assumed the same item–factor assignment, and the factor loadings were constrained to be equivalent across groups. Additionally, the third model assumed an equal correlation between Optimism and Pessimism.

Given the large sample size, the chi-square values were not treated as absolute indicators of fit but rather used to evaluate the appropriateness of increasingly restricted models via consideration of changes in their values.

For men (*n* = 19,312) and women (*n* = 26,821), all tested models had adequate goodness of fit (see Table 1). Testing differences among all the models revealed significant chi-square values for changes in model fit. Evaluating all of the fit indexes indicated that the model with equal factor loadings and equal correlations between Optimism and Pessimism fitted the data best. The corre-

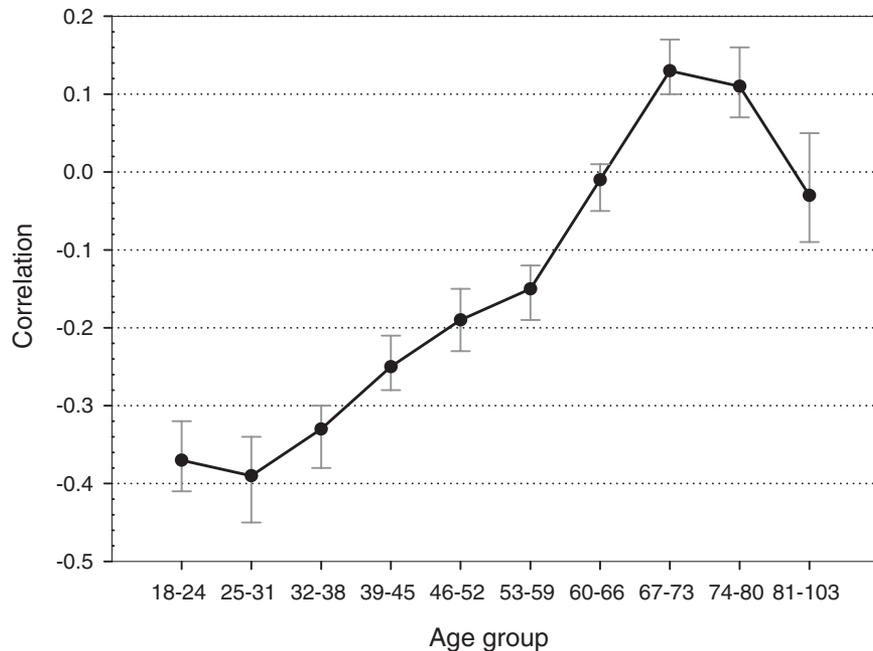


Figure 1. Correlations between the latent variables optimism and pessimism for different age groups, with 90% confidence intervals from 2,000 bias-corrected bootstrap runs.

lation between Optimism and Pessimism was $-.13$ ($p < .01$) for both men and women. The point-biserial correlations between gender and Optimism and between gender and Pessimism were $.05$ and $.02$ ($ps > .05$), respectively. Thus, the results indicate gender invariance in the LOT-R factor structure.

In addition, we evaluated the generalization of the relative independence of optimism and pessimism across healthy people (who attended primary care offices for medical check-ups and who were free of major illnesses; $n = 4,938$; $M = 53.5$ years, $SD = 15.6$) and four patient groups diagnosed with coronary heart disease ($n = 5,061$; $M = 67.8$, $SD = 10.6$), diabetes ($n = 6,059$; $M = 64.5$, $SD = 11.7$), hypertension ($n = 15,162$; $M = 63.2$, $SD = 12.1$), or hyperlipidemia ($n = 12,507$; $M = 61.6$, $SD = 12.3$). Participants differed significantly in age, $F(4, 43722) = 942.47$, $p < .001$, but there was a medium effect size for age ($f = .30$). Again, all of the models that were tested had good fit (see Table 1). The chi-square test of the difference between Model 1 and Model 2 in model fit was nonsignificant, $\Delta\chi^2(12, N = 46,133) = 16.20$, $p > .05$, but the test of the difference between Model 2 and Model 3 in model fit was significant, $\Delta\chi^2(8, N = 46,133) = 79.90$, $p < .001$.³

Age as a Moderator

The sample size for testing the influence of age on the relationship between optimism and pessimism was 46,133. Participants were assigned to age groups consisting of 6-year intervals, beginning with the 1st group, who ranged from 18 to 24 years. The last 3 groups were collapsed because of their small size. This procedure resulted in 10 age groups that ranged in size from 7,308 (60- to 66-year-olds) to 1,293 (81- to 103-year-olds). Similar to the results reported earlier, all of the two-factor models that were

tested had a good model fit, but the one-factor models did not (see Table 1). The model with equal factor loadings but different correlations between Optimism and Pessimism across the age groups was the best fitting model. The age-graded correlations between Optimism and Pessimism are shown in Figure 1. It is apparent that, with increasing age, optimism and pessimism become more independent of each other. The correlations between age and Optimism and between age and Pessimism were $-.01$ and $.02$ ($ps > .05$), respectively.

Differential Predictive Validity

Relationships between optimism and pessimism, on the one hand, and depression and quality of life, on the other, were also

³ To control for age differences between the healthy and the disease groups, we ran this analysis again, this time with age-homogeneous groups. We created age-homogeneous groups by excluding persons who were older than 63, 64, 65, or 66 years and who had coronary heart disease, diabetes, hypertension, or hyperlipidemia, respectively. The sample sizes and mean ages of the age-adjusted groups with the four diagnoses were as follows: coronary heart disease ($n = 1,310$; $M = 54.0$, $SD = 7.8$), diabetes ($n = 2,419$; $M = 53.3$, $SD = 8.9$), hypertension ($n = 7,515$; $M = 53.6$, $SD = 9.0$), and hyperlipidemia ($n = 7,320$; $M = 53.7$, $SD = 9.3$). The groups no longer differed in age, $F(4, 23497) = 1.18$, $p > .05$. Again, all of the tested models yielded a good fit. The test of the difference between models, however, revealed a nonsignificant chi-square for change in model fit between Model 1 and Model 2, $\Delta\chi^2(12, N = 46,133) = 17.24$, $p > .05$, and between Model 2 and Model 3, $\Delta\chi^2(8, N = 46,133) = 14.60$, $p > .05$. Thus, the model with equal factor loadings and equal correlations between Optimism and Pessimism across the disease and healthy groups was most appropriate. The correlation between Optimism and Pessimism was $-.12$ ($p < .05$) for all groups.

evaluated. Two covariance structure models were tested. The first model freely estimated the path coefficients from optimism and those from pessimism to depression. The second model constrained both paths to be equal. Results indicated that optimism and pessimism were related differently to depression ($\beta_s = -.47$ and $.24$ for optimism and pessimism, respectively), corroborating differential predictive validity from the magnitude of the correlations, not simply from differences in their direction. Furthermore, pessimism contributed a significant incremental portion of the variance beyond optimism alone to the prediction of quality of life. Finally, depression was highest among participants with true pessimism (high pessimism and low optimism) and lowest among those with true optimism (high optimism and low pessimism). True pessimists reported having the lowest quality of life of any of the groups, whereas true optimists reported having the highest quality of life. Finally, the correlations between social desirability and both optimism ($r = .21$) and pessimism ($r = -.19$) were small but nonsignificant ($p > .05$).

Discussion

The present study demonstrates through CFA that the optimism and pessimism items on the LOT-R measure two independent constructs rather than a single, bipolar, continuous trait. Representative samples were tested whose sizes exceeded those in all previous studies. The findings were stable across gender, age groups, and groups of medical patients with various diagnoses, and the independence of optimism and pessimism was supported by differential concurrent validity. Although optimism and pessimism were largely independent across the sample as a whole, they were correlated differently with each other in different age groups.

We took a number of steps to prevent possible methodological biases. First, we controlled random measurement error by examining the relationship between constructs at the level of latent factors. Second, we ran polychoric correlations, which require large sample sizes but which are less affected by various kinds of measurement error. Third, we ensured that systematic measurement error did not threaten the validity of the analyses. Because the LOT indexes previously had been found to be relatively independent of social desirability (Scheier & Carver, 1993), we tested associations among these variables in a preliminary study with the German version of the LOT-R. The LOT-R scores were influenced by social desirability only to a minor degree, if at all.

In view of the methodological precautions that we took, how can we interpret the potentially counterintuitive finding that optimism and pessimism are partly independent? As described by metacognitive theory (Wells, 2000), beliefs and expectations about the world must be assumed to be actively construed and revised on the basis of internal rules and appraisals. People might hold different metacognitive beliefs about pessimism and optimism, and they might very well be able to differentiate between the two constructs in terms of the degree of adaptive coping strategies that each reflects. People might, for example, believe that having a certain degree of optimism is adaptive, but they might also believe that having a certain amount of pessimism is also adaptive (e.g., because being pessimistic about the future might help prevent disappointments). These metacognitive beliefs might influence how respondents answer a questionnaire such as the LOT-R. This interpretation might also help explain why the correlation between

optimism and pessimism diminished with increasing age. Because of their expanded life experiences and reduced capabilities, older people's metacognitive beliefs about the relative adaptiveness of optimism and pessimism might change somewhat independently of each other.

As a practical consequence of the present results, we recommend that future research use separate measures of optimism and pessimism with all age groups, and we advise researchers to use caution when interpreting results of empirical studies that treat the LOT-R as a unidimensional measure. Additionally, the coefficient alphas that we obtained for both of the scales indicate that they should be used only for research, not for clinical assessment.

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