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Bipolar items for the measurement of personal optimism instead of unipolar items

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Abstract

A personal optimism scale composed of unipolar items is transformed into a scale composed of bipolar items. The transformation is performed because of the item wording problem that denotes the lack of homogeneity in scales composed of positively and negatively worded items. The original optimism scale for the assessment of personal optimism comprises eight unipolar items. It is transformed into a scale with four bipolar items by merging pairs of items. In confirmatory factor analysis the scale based on bipolar items showed an acceptable degree of good model fit. Furthermore, the personal optimism latent variables of the two types of items showed to be equivalent when investigating trait-specific equivalence.

Key words: optimism, dimensionality, item-wording problem, bipolar items, unipolar items.

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Measures comprising both positively and negatively worded items are often less homogeneous than desirable (e.g. Quilty, Oakman, & Risko, 2006; Spector, Van Katwyk, Brannick, & Chen, 1997; Vautier, Steyer, Jmel, & Raufaste, 2005). This phenomenon is termed the *item wording problem*. Latent variable analysis of such items usually reveals an insufficient model fit, and it is necessary to counterbalance the impairment by including a second latent variable, which serves as method factor, into the model. The item wording problem also has a significant impact on assessment: it remains unclear whether the construct should be considered as unidimensional, which would result in a single score from all items, or whether the scale actually reflects a mixture of two constructs, which are assessed by the positively and negatively worded items, respectively

This problem has been perceived as especially disturbing in scales of optimism and, consequently, has stimulated a lot of research work concerning the dimensionality of such scales (Chang & McBride-Chang, 1996; Herzberg, Glaesmer, & Hoyer, 2006; Lai, 1994; Marshall & Lang, 1990; Marshall, Wortman, Kusulas, Herving & Vickers, 1992; Rauch, Schweizer, & Moosbrugger, 2007; Schweizer & Rauch, 2008; Vautier, Raufaste, & Cariou, 2003). Most of the research work concentrated on the Life Orientation Test (LOT-R) that is composed of equal numbers of positively and negatively worded items (Scheier & Carver, 1985; Scheier, Carver, & Bridges, 1994) and is the most popular measure of optimism.

Different positions have been taken concerning the nature of the item wording problem. It was considered either as a problem of the construct or as a method problem. Many researchers, especially in earlier studies of the item wording problem (e.g. Marshall et al., 1992), tended to take the observation of two factors at face value. They adopted the position that the two factors indicated the existence of the two constructs *optimism* and *pessimism*. Each one of these constructs was supposed to be tapped by positively or negatively worded items exclusively. Furthermore, there have been researchers (Rauch, Schweizer, & Moosbrugger, 2007; Vautier, Raufaste, & Cariou, 2003) who ascribed the deviation from unidimensionality to method influence (Marsh, 1996). Various response biases have been considered as possible sources of method influence.

However, despite the controversy, the different positions are not mutually exclusive, because for both positions a model including a general, overarching dimension is possible. If there are two highly correlated first-order dimensions of optimism and pessimism, it is theoretically possible that there is additionally a general second-order dimension. Such a structure fits well into the framework of hierarchical models of personality (Schweizer, Altmeyer, Reiß, & Schreiner, 2010). If method influences cause the wording problem, there is also a general dimension in addition to one or several specific first-order dimensions. Such a structure fits into the framework of the bifactor model (Mulaik & Quartelli, 1997), and it would be reasonable to assume that the general first-order dimension represents general optimism.

Both of these models entail that observed scale scores are only impure representations of the construct when obtained with a scale composed of equal numbers of positively and negatively worded items; observed scale scores may represent optimism together with something else. Even if statistical methods are useful for finding out about this kind of impurity, an

applied problem remains: Modeling does not change the measure in any way. In order to obtain less impure scale scores, a viable way is to revise available measures in such a way that the problem is avoided. In this paper we investigate whether it is possible to avoid the item wording problem by using bipolar items instead of unipolar items.

Bipolar items as means for avoiding the item-wording problem

As an alternative to positively and negatively worded statements as items, in the history of personality measurement there is a tradition of using pairs of adjectives as bipolar items. Noteworthy in this regard are several instruments assessing the Big Five personality factors using bipolar adjective pairs (Goldberg, 1992; Langford, 2003; Peabody, 1987; Shafer, 1999; Woods & Hampson, 2005). These instruments demonstrate that bipolar scales can be a valuable research tool with a good psychometric quality. Other examples include King, King and Klockars' (1983) bipolar adjective rating scales to assess Murray's (1938) needs. King et al. (1983) observed a better psychometric quality for the bipolar adjective scales than for Jackson's Personality Research Form (1967) which also originates from the theory of needs.

In responding to bipolar items it is necessary to consider both poles of the dimension. This characteristic distinguishes responding to bipolar items from responding to unipolar items, and it is probably the major advantage of bipolar items. A similar argument was already provided by Goldberg (1992) who lists the following advantages of bipolar item: (1) they are associated with more accurate descriptions of the dimensions than items referring to one pole of the dimension only, because two descriptors are provided, and (2) they are expected to prevent idiosyncratic interpretations; if one pole is provided, idiosyncratic interpretations may result from the implicit selection of a further pole by the individual.

In typical instruments such as Goldberg's (1992), the bipolar items are pairs of adjectives, and individuals respond by checking one of a number of ordered categories which separate the adjectives serving as poles of the scale. By responding to such an item, the individual selects one of the categories by estimating the distances between the corresponding aspect of the self-concept and each of the two adjectives. In constructing such bipolar items the main problem is that the adjectives appropriately represent the construct of interest. Therefore, unipolar items with an already established appropriateness are a valuable precondition for the construction of bipolar items. It remains to find pairs of items that can be assigned to the same umbrella term or topic but oppose each other and to merge them subsequently. In the new bipolar items positively and negatively worded statements serve as poles. An example is given in the method section. In another study selecting positively and negatively worded statements according to their similarity in topic proved to be a very useful technique (Schweizer & Schreiner, 2010). The bipolar items obtained this way differ from the bipolar items of other scales by their complexity since the reduction of the statements to simple words is not possible without changing the nature of the scale.

The advantage of such bipolar items is that they no longer differ according to the wording since each one of these items includes a positively worded part and also a negatively

worded part. The different response tendencies stimulated by the two parts should balance each other. As a consequence, the responses to the bipolar items should show a higher degree of homogeneity than it can be found for the responses to a mixture of positively and negatively worded items.

The concept of personal optimism and the measure serving as outset

Following Scheier and Carver (1985) optimism is defined as the generalized expectation of a positive outcome. Personal optimism applies to a restricted set of generalized expectations, the generalized expectation of a positive outcome for the own person. According to this definition, an individual with high personal optimism can well have generalized negative expectations about non-personal outcomes such as environmental pollution or economic disasters.

A very useful prerequisite for the transformation of a scale including unipolar items into a scale with bipolar items is similarity between positively and negatively worded items according to their topic. Such a property characterizes the items of the Personal Optimism scale of the POSO-E questionnaire (*P*ersonal *O*ptimism and *S*ocial *O*ptimism – *E*xtended) (Schweizer & Koch, 2001). This scale showed a good psychometric quality when investigated according to the criteria of classical test theory and also item response theory (Rauch, Schweizer, & Moosbrugger, 2008). Cronbach's Alpha was .78, and there were substantial correlations according to expectations with various personality scales, as for example Big Five scales.

Objectives

The construction of a unidimensional optimism scale is the major objective of this study. Since the deviation from unidimensionality in optimism measures is ascribed to the difference in the wording of the unipolar items, we assume that by transforming the unipolar items into bipolar items the scale will depart less from unidimensionality. The other objective is to demonstrate that the new scale is equivalent to the existing scale of optimism. Producing a high degree of consistency of the new scale and establishing a high correlation between the two scales are not sufficient for claiming equivalence. The investigation must reveal that the same general dimension characterizes both scales.

Method

Participants

Participants were students of educational science and psychology of the Goethe University Frankfurt, Germany. Among the 308 participants there were 57 males and 245 females, reflecting the gender imbalance inherent in this particular population. Six partici-

pants did not report their gender. The mean age of the sample was 23.76 years of age (SD 6.28).

Measures

The personal optimism scale from the POSO-E questionnaire (Schweizer et al., 2001) consists of four positively and four negatively worded items. Responses are indicated on a four point rating scale. For the construction of the new bipolar scale, the contents of the items from the personal optimism scale were analyzed. From this analysis, positive and negative items were selected in such a way that pairs of items addressed related topics: having positive expectations / having negative expectations, zest of life / pessimism, belief in success / expectation of failure, being unconcerned / being worried (The original language of the questionnaire is German; the list of items is obtainable from the author).

The items for the new bipolar scale were constructed by merging the item pairs. The contents of the original items were assigned to the two poles of the bipolar items with minor modification for making them more similar. For example, the pair "having positive expectations / having negative expectations" was transformed into the heading "My expectations for the future are …", and the two poles of the rating scale were assigned the two words "positive" and "negative". In order to have a further example the result of the transformation of the pair "vitality / dissatisfaction with life" is also presented. This item is introduced by the heading "My mood is always determined by …" and includes vitality" and "dissatisfaction with life" as poles. The response format was a rating scale with six ordered categories.

Procedure

The sample was subdivided into two subsamples. The first subsample of 218 participants completed the unipolar version first and after a short break the bipolar version. In order to control for sequence effects, in the second subsample of 90 persons the bipolar version was administered first and the unipolar version after a break of half an hour.

Statistical analysis

The main focus was on the demonstration of the equivalence of latent variable scores associated with the original and new scales. Since the method effects associated with unipolar optimism items are well known (see above), it would not be sufficient to model "optimism" with a single general latent variable with loadings from all unipolar items. Instead, method effects stemming from both positively (e.g. Rauch et al., 2007) and negatively (e.g. DiStefano & Motl, 2006) worded items must be taken into account. Only when these method effects are statistically controlled, a test of the equivalence of the

latent variables for representing optimism as measured with the unipolar items and as measured with the new bipolar items is reasonable.

The test of latent variable equivalency utilizes a model with a general latent variable and method effect latent variables for the unipolar items; the general latent variable thus represents "optimism" adjusted for biases due to item wording. The bipolar items will be modelled using a single, general latent variable. The model is schematically shown in Figure 1.

Three latent variables denoted "positive method effect", "general dimension" and "negative method effect" constitute the unipolar part of the model, and the latent variable denoted "bipolar dimension" the bipolar part. The requirement of latent variable equivalency will be met if the general latent variable for the unipolar items correlates (almost) perfectly with the latent variable with loadings from the bipolar items. This type of equivalency should be interpreted as perfect convergent validity.

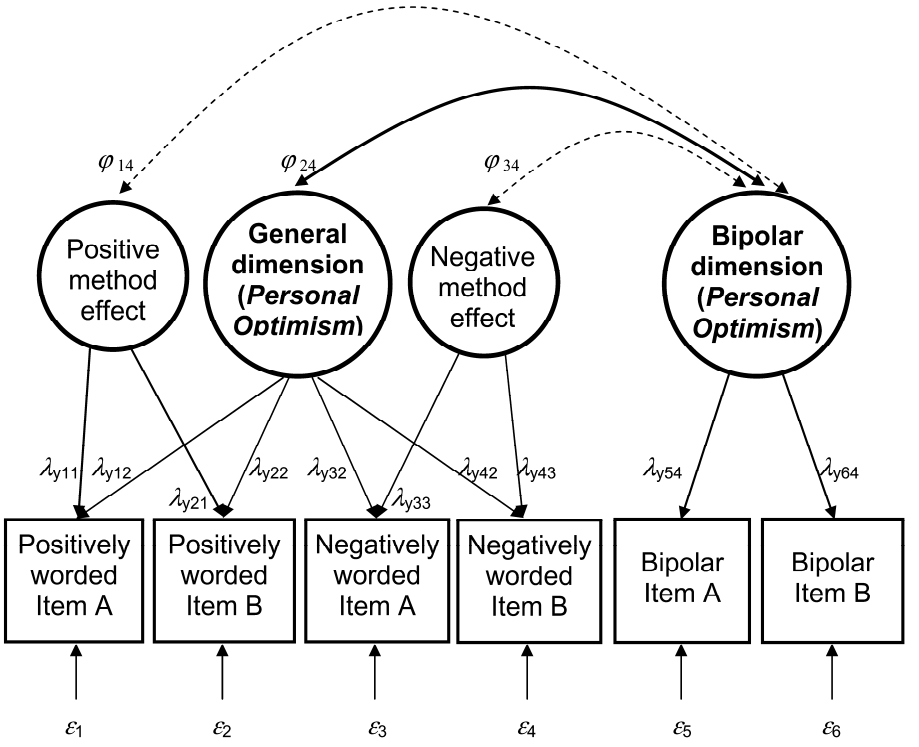

Figure 1:
Model for investigating the equivalence of the general latent variable based on unipolar items (general dimension) with the latent variable based on bipolar items (bipolar dimension) after isolating the effects due to positively and negatively worded items by specific latent variables

The left hand side of Figure 1 can be considered as a separate model including one general latent variable and two additional latent variables representing the observational methods for the unipolar items. This extended model is an extension of a standard approach to modelling personal optimism (e.g., Rauch, Schweizer, & Moosbrugger, 2007; Vautier, Raufaste, & Cariou, 2003). The standard approach consists of a general latent variable with loadings from all items and one or two additional latent variables. If there is only one additional latent variable, the loadings are from either positively or negatively worded items exclusively. Often just one of the method latent variables is needed to account for method variance; in such cases, only the positively or negatively worded items give rise to a considerable method effect that needs to be represented by a latent variable. The variance of the other method latent variable will be non-significant in these cases.

Since for the bipolar item scale there is only one method according to item wording, no method latent variables need to be included, and a single latent variable capturing the construct variance should be sufficient. The set of correlations between the latent variables of the unipolar part and the latent variable of the bipolar part should meet specific expectations. The standardized correlation between the general latent variable with loadings of all the unipolar items ("general dimension") and the latent variable with loadings of all the bipolar items ("bipolar dimension") should be (almost) perfect; a nested model comparison will be used to test if the fit deteriorates significantly when a perfect correlation is assumed. The other correlations should be considerably smaller. The correlations between the latent variables based on unipolar items were set to zero in order to achieve a separation of the various effects.

The model illustrated by Figure 1 is addressed as complete model in the following sections since it integrates two specific models. Before the complete model is evaluated, other models are considered additionally. The additional models are achieved by restricting the complete model to either the part including the unipolar items or the part including the bipolar items. In doing so, the individual parts of the complete model can be investigated, and the results can be linked to previous research on optimism. First, the original optimism model is considered. This model includes one latent variable with loadings of all the unipolar items. Second, the alternative model that is composed of one optimism latent variable and one pessimism latent variable is investigated. The positively worded items load on the optimism latent variable whereas the negatively worded items are assigned to the pessimism latent variable. The correlation between the two latent variables is set free. Third, the extended model is included in the list of relevant models. This model corresponds to the unipolar part of the complete model. An important characteristic of this model is that the latent variables are not allowed to correlate with each other. Finally, the bipolar model is considered. This model includes one latent variable only. It corresponds to the bipolar part of the complete model. Since this model applies to the bipolar items instead of the unipolar items, it can not be compared with the other models.

Results

Descriptive statistics

The means, standard deviations and part-whole correlations of the items of the original scale for the measurement of personal optimism and of the new bipolar scale are presented in Table 1. The negatively worded items were recoded for computing the statistics.

The means of the original items varied between 1.23 and 2.45 and of the new items between 2.00 and 2.34. The standard deviations of the original items were between 0.55 and 0.87 and of the new items between 0.84 and 1.00. The differences between the results of the unipolar and bipolar items are partly due to the fact that the number of response categories was increased from four to six.

Scale scores were computed by adding (recoded) item scores. The mean and standard deviation of the original scale that was composed of 8 items were 14.70 and 4.00. The new scale composed of 4 bipolar items had a mean of 8.82 and a standard deviation of

Table 1:
Means, standard deviations and part-whole correlations for the items of the original scale for the assessment of personal optimism including unipolar items and of the new scale including bipolar items (N=308) (Negative items are recoded)

No. of item	Mean	Standard deviation	Part-whole correlation
Items of original scale			
1 Belief in success	1.86	0.68	.55
2 Having positive expectations	1.86	0.74	.68
3 Vitality	2.10	0.79	.52
4 Being unconcerned	2.45	0.82	.49
5 Expectation of failure	1.94	0.87	.41
6 Having negative expectations	1.23	0.55	.57
7 Dissatisfaction with life	1.73	0.78	.70
8 Being worried	1.48	0.68	.65
Items of new scale			
9 Belief in success/expectation of failure	2.31	1.00	.64
10 Having positive/negative expectations	1.99	0.84	.76
11 Vitality/dissatisfaction with life	2.21	0.94	.77
12 Being unconcerned/being worried	2.30	0.85	.83

3.00. Cronbach's Alpha was .83 for the old scale, and the part-whole correlations varied between .41 and .70. For the bipolar scale Cronbach's Alpha was .84, and the part-whole correlations varied between .58 and .75. Obviously, there was virtually constancy of Cronbach's Alpha although the number of items was reduced from 8 to 4. Furthermore, there was an increase in the part-whole correlations.

Sequence effects

In order to analyze sequence effects, the mean scale scores of the two subsamples were compared separately for the original and new scales. The comparison of the means scores obtained for the new scale was not substantial ($t(306) = 1.48$, n.s.) neither was the comparison of means scores obtained for the original scale ($t(306) = 0.89$, n.s.). Since there was no difference between the subsamples, the further investigations concentrated on the complete sample.

Investigation of the various models for representing optimism

In this first step the fit of the models for unipolar/bipolar items in isolation described in the method section was investigated by means of LISREL 8 (Jöreskog & Sörbom, 2001). The results are provided in Table 2.

The first row gives the results for the original optimism model which assumes that a single optimism latent variable accounts for the covariances of the unipolar items. The fit of this model was unacceptable according to virtually all fit statistics. The second row provides the results for the alternative model characterized by the distinction of two

Table 2:
Fit statistics of the optimism models (N=308)

Characteristic of model	χ^2	df	χ^2/df	RMSEA	GFI	CFI	NNFI	AIC
Based on items of original scale								
Optimism only	106.83	20	5.34	.119	.92	.90	.86	138.83
Optimism and pessimism	60.24	19	3.17	.084	.95	.95	.93	94.24
Optimism and Methods	13.40	12	1.11	.020	.99	1.00	1.00	61.40
Based on items of new scale								
Optimism based on bipolar items	5.87	2	2.93	.079	.99	.99	.98	21.87

latent variables for the positively and negatively worded items, i.e. optimism and pessimism latent variables. Two statistics (GFI, CFI) indicated a good model fit whereas the fit was unacceptable according to the others. The standardized correlation between the two latent variables was .80. This result indicated that it might be reasonable to consider a second-order latent variable additionally. The third row comprises the results for the model which includes a general optimism latent variable and additional latent variables accounting for method effects. The fit statistics indicated an excellent fit for this model.

In order to compare our results with previous research aimed at identifying the best model for unipolar positively and negatively worded items, the different models for unipolar items were compared using the AIC statistic as a means of comparing non-nested models. The AIC statistic takes model complexity into account. The model which represented optimism besides method latent variables fitted considerably better than the other models, even taking into account the higher model complexity, which results in a smaller number of degrees of freedom. This result is in agreement with most of the recent findings comparing two-construct models with models including method latent variables.

In the fourth row of Table 2, the results for the model with bipolar items are displayed. The model fits excellently according to some statistics (GFI, CFI, NNFI) and is acceptable according to the others, so that unidimensionality of the bipolar items can be assumed.

Fit results for the complete model

In the second step the complete model including latent variables for optimism and for the effects associated with positively and negatively worded items was investigated (see Figure 1). An acceptable degree of fit was obtained (χ^2 = 117.93 (*df* = 43), RMSEA = .075, GFI = .94, CFI = .95, and NNFI = .92). Table 3 provides the completely standardized loadings on the latent variables for the original items (upper part) and the new items (lower part) for the completed model and also the error variances since the method latent variables also account for variance.

The high loadings in the upper part ranging between .36 and .80 indicate a good representation of the general latent optimism variable. From the lower part of Table 3 it is apparent that the representation of optimism based on bipolar items was very good since the loadings were between .68 and .84. The last column of the Table indicates that the model accounted for a considerable part of the variance of the items.

Results concerning the equivalence of the optimism latent variables

In order to demonstrate latent variable score equivalence, the latent variable based on bipolar items should correlate perfectly with the general latent variable with loadings of positively and negatively worded items when method effects are taken into account. In order to find out about the relationship of interest, the correlations between the latent variables were computed as part of the complete model. The results for the structural part of the model including completely standardized correlations are presented in Figure 2.

Table 3:
Completely standardized loadings and error variances obtained for the complete model (N=308) (Negative items are recoded)

No. of	Loading	Error variance
Items of original scale		
1 Belief in success	.66	.43
2 Having positive expectations	.80	.33
3 Vitality	.64	.52
4 Being unconcerned	.60	.53
5 Expectation of failure	.36	.66
6 Having negative expectations	.58	.60
7 Dissatisfaction with life	.61	.28
8 Being worried	.66	.44
Items of new scale		
9 Belief in success/expectation of failure	.74	.45
10 Having positive/negative expectations	.84	.30
11 Vitality/dissatisfaction with life	.81	.34
12 Being unconcerned/being worried	.68	.54

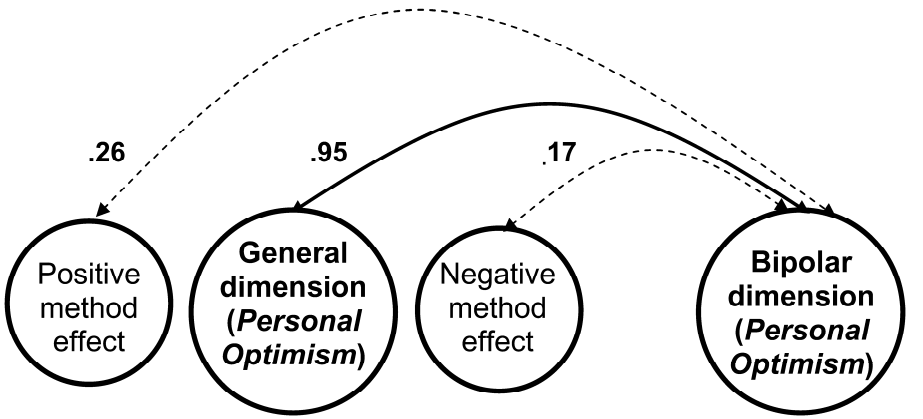

Figure 2:
Latent structure of unipolar and bipolar latent variables representing general optimism and of latent variables representing positive and negative wording, respectively, with completely standardized correlations.

The standardized correlation between the latent variable based on bipolar items and the general latent variable based on unipolar items was $r = .95$ ($t = 34.69$, $p < .01$) for this unrestricted model. Furthermore, the standardized correlation between the latent variable based on bipolar items and the latent variables representing the method effects due to positively and negatively worded items, respectively, were only small to moderate in size but reached the level of significance (positive wording: $t = 3.29$, $p < .01$; negative wording: $t = 3.20$, $p < .01$). Since these correlations were rather similar in size, it could be assumed that there was a kind of balance between the remaining relationships to the two alternative methods.

As a final test of latent variable score equivalence, the correlation between the latent variable based on bipolar items and the general latent variables with loadings from the positively and negatively worded items was constrained to one while all the other characteristics of the model exactly corresponded to the characteristics of the unrestricted model. The chi-square difference of 2.75 ($df = 1$) indicated a non-significant decrease in model fit. General fit statistics for the constrained model were good or acceptable: $\chi^2 = 120.68$ ($df = 44$), RMSEA = .075, GFI = .94, CFI = .95, and NNFI = .92. This result showed that the optimism latent variable based on bipolar items was equivalent to the general latent variable based on positively and negatively worded items.

Discussion

Recent studies have identified method effects due to item wording as the source of dimensionality problems in questionnaires with positively and negatively worded items. The results of the present investigation are in line with these observations. In the present investigation the model fit for unipolar items was insufficient. It was not possible to achieve a good model fit without considering latent variables associated with the two observational methods. Although the corresponding model suggested the existence of a general latent variable, it also made obvious that there were substantial effects resulting from positive wording and negative wording, respectively. However, the insight achieved by means of such complex confirmatory factor models is unfortunately not associated with an opportunity of obtaining scale scores which are pure representations of the trait of interest. Therefore, the utility of such models for assessment is rather limited. Homogeneity that means purity in measurement must be achieved in another way. The replacement of unipolar items by bipolar items is a means for achieving this aim. The transition from unipolar items to bipolar items can be assumed to eliminate differences due to item wording since each item includes the same combination of item wordings. Interestingly, both ways of eliminating effects of observational methods, the statistical way and the merging of unipolar items, led to the same result: the two latent variables representing personal optimism could be considered as equivalent. The observed correlation between these latent variables did not differ from the perfect correlation.

Evidently, the use of bipolar items can be instrumental in an attempt of avoiding the item wording problem. Although both correlations with latent variables representing an observational method reached the level of significance, the sizes of these correlations were

small to moderate only. It was also good that the sizes of these correlations did not differ considerably since this way it was clear that the latent variable of the bipolar items was not implicitly linked to one of the observational methods. The virtual independence of effects due to observational methods is one property that qualifies the new scale based on bipolar items for the assessment of personal optimism. Another noteworthy property is the considerable degree of internal consistency. The Alpha consistency of the new scale can be considered as equivalent to the Alpha consistency of the old scale although the number of items was reduced by one half. The part-whole correlations of the new scale are higher than the part-whole correlations of the old scale.

At the end of the transformation process a new scale of personal optimism is available that can be expected to show the same pattern of relationships to scales representing established concepts as for example neuroticism, depression and anxiety as the original scale. This new scale shows some favorable properties: it is an economic scale that can be assumed to provide a better representation of the concept of personal optimism than the original one since impurity due to observational methods is largely eliminated. Furthermore, it is a scale with agreeable psychometric properties according to established criteria. Especially because of the high level of purity the new bipolar scale can be expected to enable the unbiased assessment of personal optimism. Finally, despite all these positive aspects it also needs to be mentioned that there is also a limitation resulting from the large number of females who participated in the study.

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