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THE CONCEPTUAL AND RELATIONAL STRUCTURE OF SUBJECTIVE WELL-BEING, NEUROTICISM, AND EXTRAVERSION: ONCE AGAIN, NEUROTICISM IS THE IMPORTANT PREDICTOR OF HAPPINESS

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ABSTRACT. The purpose of this study was twofold: (1) to analyze and explore the conceptual structure of subjective well-being (SWB), neuroticism (N) and extraversion (E); and (2) to compare the effect sizes of N and E as predictors of SWB. The sample comprised 461 participants representative of the adult population in northern Norway. Analyses were conducted by means of Structural Equation Modeling (SEM), and the results on (1) supported the notion of an overall subjective well-being construct sustained by the three nested dimensions of life satisfaction, positive affect, and negative affect. A simple factor structure for N and E was not supported, and considerable modification was needed to provide even a mediocre goodness-of-fit for the trait model. On (2), N explained eight times as much of the SWB variance as did E. Moreover, through comparison of several models it was revealed that if E is the sole predictor of SWB, the influence of E on SWB is overestimated by a factor of seven. Since N and E are strongly and negatively correlated (r = –0.50), the model comparison demonstrates the importance of including both E and N as independent variables in regression models of SWB.

1. INTRODUCTION

Gradually, a common understanding of the concept of subjective well-being is being established. "Subjective well-being," in the current work used synonymously with "happiness," refers to a global, lasting and mental state of being which comprises perceived life satisfaction, presence of positive affect, and absence of unpleasant affect (Andrews and Withey, 1976; Argyle and Lu, 1990; Campbell et al., 1976; Diener, 1984; Diener, 1994; Diener et al., 1999; Kahneman et al., 1999; Veenhoven, 1984; Veenhoven, 2000). Despite this promising progress, it is necessary to



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acknowledge that defining a scientific concept in such a way that it becomes a solid and integrated component of a research domain is a difficult and tedious process. For a concept to gain some kind of objectivity, it needs to be tested against new data repeatedly (Mulaik, 1987). Similarly, relationships between the concept and other relevant constructs need to be established for the domain to be properly understood (e.g., Shapere, 1977; Thagard, 1992). Hence this article aims to supply an empirically grounded discussion of structural aspects of subjective well-being and of its relationship with neuroticism and extraversion.

Extraversion and neuroticism are often considered the two personality traits most relevant to the study of happiness. More often than not, extraversion is regarded as the more important of the two (see for example Argyle and Lu, 1990; Argyle and Martin, 1991; Brebner, 1991; Costa and McCrae, 1980; Diener and Larsen, 1993; Eysenck, 1990; Rusting and Larsen, 1997). However, a closer inspection of the literature, and in particular the effect sizes reported therein, reveals that neuroticism seems to be a far more important predictor than extraversion (for overviews, see DeNeve and Cooper, 1998; Vittersø, 2001). Nevertheless, extraversion continues to be presented as the "true" happiness trait. The second principal goal of this paper is therefore to focus attention on the role of neuroticism, as opposed to extraversion, as a predictor of happiness. In keeping with this broad theoretical approach, all estimates provided in the following discussion are based on a random sample drawn from a general population.

2. SUBJECTIVE WELL-BEING

Put succinctly, subjective well-being is a broad category of phenomena including people's emotional responses, domain satisfaction and global judgment of life satisfaction (Diener et al., 1999, 2000; Veenhoven, 2000). Campbell, Converse and Rodgers (1976) found that there is a strong general SWB factor, but also that there are components of SWB which may behave differently under some circumstances. Hence, quite often subjective well-being is presented as a three-dimensional phenomenon, comprising perceived life satisfaction, presence of positive affect, and absence of negative

affect. It follows that subjective well-being might be considered either as an overall latent construct (e.g., Liang, 1984) or as separate facets or lower-order components (e.g., Diener, 1994). A structural representation of the relationship among the well-being items should thus specify how the components of subjective well-being relate both to each other and to the overall concept of subjective well-being. Normally such a structure is considered a higher-order factor model, in which a general well-being construct is represented as a second-order factor, with life satisfaction and affects as the first-order factors (Abbey and Andrews, 1986; Chamberlain, 1988; Inglehart and Rabier, 1986; Liang, 1984, 1985; McCulloch, 1991; McNeill et al., 1986; Stones and Kozma, 1985). The second-order factor is considered to be the origin of influence for the first-order factors of life satisfaction, positive affect, and negative affect, and it should account for a substantial proportion of the variance in these three components. As an alternative to this structure, the current study proposes a model in which the general factor directly influences all the measured well-being items. Additionally, these items are influenced by so-called "nested" factors, which represent the common variance for each subcomponent (i.e., satisfaction with life, positive affect, and negative affect).

3. NEUROTICISM AND EXTRAVERSION

Personality may be defined as "a more or less stable and enduring organization of a person's character, temperament, intellect and physique" (Eysenck, 1970: p. 2). Most commonly, five "big" traits are represented as dominant in descriptive models of personality (Côtè and Moskowitz, 1998; Digman, 1990; Goldberg, 1992; Goldberg, 1995; John, 1990; McCrae and Costa, 1987; Wiggins and Trapness, 1997). Often referred to as the Five Factor Model (FFM), these big traits are neuroticism, extraversion, openness to experience, agreeableness and conscientiousness. In the present context, only neuroticism and extraversion are to be analyzed.

In a nutshell, people scoring high on the trait of neuroticism tend to be emotionally unstable and they complain more about worries and anxieties. According to Costa and McCrae (1992), neuroticism is the most pervasive domain of personality scales, and it contrasts

adjustment or emotional stability with maladjustment/neuroticism. The trait has been defined as "a broad dimension of individual differences in the tendency to experience unpleasant, distressing emotions and to possess associated behavioral and cognitive traits" (Costa and McCrae, 1987: p. 301). An important feature of neuroticism is the multifaceted description of the trait. Indeed, each of the five domains in the FFM is usually represented by several more specific facets or sub-dimensions of the trait. For example, the Costa and McCrae (1992) model subsumes the following six facets under the overall neuroticism scale: anxiety, angry hostility, depression, self-consciousness, impulsiveness and vulnerability.

From his historical overview of extraversion, Lucas (2000) identified three core features in the descriptions of the trait. He was able to trace a shift in the emphasis placed on the different features, starting with impulsiveness as the core feature of extraversion in the first half of the 20th century. About fifty years ago sociability became central. More recently, researchers have seemed to locate the core of extraversion in the area of pleasant affect (see also Watson and Clark, 1997a). However, as with neuroticism, the Costa and McCrae model uses six facets to represent extraversion, advancing them all as important components of the trait. The facets are warmth, gregariousness, assertiveness, activity, excitement seeking and positive emotions.

Exploratory factor analyses have successfully replicated the factor structure of extraversion and neuroticism in different trait models (e.g., Costa and McCrae, 1995; Digman, 1990; Eysenck, 1990; Goldberg, 1981; Goldberg, 1995; John, 1990; McCrae and Costa, 1989), or as second-order factors in the 16 PF model of Cattell (1965). However, the trait models do not seem to stand up well when subjected to goodness-of-fit tests by confirmatory factor analysis. For example, in an early application of the Five Factor Model, Borkenau and Ostendorf (1990) found that even the least restrictive model did not appropriately account for the data (p. 522). Vassend and Skrondal (1997) have demonstrated severe problems in the Five Factor Model and McCrae et al., 1996, discovered a lack of fit in their own data, suggesting that the reason was fatal flaws in the method of confirmatory factor analysis. In other words, the model is right; it is the method that is wrong. Be that as it may, Church

and Burke (1994), after concluding that parsimonious personality models are unlikely to meet conventional goodness-of-fit criteria in confirmatory factor analyses, suggest that the lack of good fit is due to the limited and simple structure of personality measures and the personality domain itself. Since traits such as neuroticism and extraversion comprise more specific facets, these sub-factors must be specifically identified in a confirmatory factor-analytical approach. Unless the relationship between facets and overall construct is explicitly specified, goodness-of-fit measures will probably continue to disappoint researchers using confirmatory factor analysis. Thus, in view of earlier results as they are reported in the literature, we do not expect our data to fit the factor model of neuroticism and extraversion adequately. However, since this article concentrates its attention on the relationship between personality traits and well-being, the issue of the structure of the traits will not be pursued in detail.

4. MODELS OF WELL-BEING AND PERSONALITY TRAITS

This paper advocates a Structural Equation Model (SEM) approach to addressing the research questions raised in the foregoing discussion. Roughly, a structural equation model is a hypothesized pattern of directional and non-directional linear relationships among a set of manifest variables and latent variables (or factors) (MacCallum and Austin, 2000). Confirmatory factor analysis (CFA), sometimes referred to as "measurement modeling," is a special case of SEM that is particularly well suited for construct validation (e.g., Bollen, 1989; Cole, 1987; Floyd and Widaman, 1995; Jackson et al., 1993; MacCallum and Austin, 2000; Mulaik and James, 1995). By testing a priori specified hypotheses, CFA is helpful in investigating whether a measure designed to assess a construct actually contains a meaningful dimensional structure. Construct validity is supported if the factor structure of the scale is consistent with the constructs the instrument purports to measure (Floyd and Widaman, 1995).

In the present study, the factor structure of subjective well-being, neuroticism and extraversion are examined. In addition, the structural relationships among these variables are estimated. Two measurement models (factor models) and one full model are presented in the course of these tasks.

The first measurement model represents the concept of overall subjective well-being in addition to nested factors of life satisfaction, presence of positive affect, and absence of negative affect. This model is presented graphically in the right half of Figure 1. The variance remaining in the three nested factors is independent from what all the well-being items have in common as methodological and conceptual similarities. One could say that this model depicts a relationship within a set of orthogonal first-order latent variables of different degrees of generality. There is one general subjective well-being factor with a relationship to all the observed variables, along with factors having a narrower range of influence (Gustafsson and Balke, 1993: p. 414). When the general factor variance is extracted from the items, the remaining latent variables are considered to be independent of each other. Thus there are no correlations among common factors in this model.

Note that this model reflects a simpler and more straightforward way of specifying the relationships among manifest variables than does the model commonly used by higher-order factor models. Basically, the nested model carries the same interpretation as a higher-order factor model does, although the mathematical formulations are not equivalent (Gustafsson and Balke, 1993; but see Mulaik and Quartetti, 1997, for a different view). We expect this model to fit the data.

The second measurement model reflects neuroticism and extraversion as latent constructs and the 12 facets as manifest variables. In other words, each manifest variable in the model is a composite variable, calculated as the mean score of the eight items defined by Costa and McCrae (1992) as comprising the facets in neuroticism and extraversion (NEO-PI-R). The neuroticism/extraversion model is presented in the left half of Figure 1. Note that the presented model is modified according to the procedures offered by the EQS software program (i.e., the Lagrange multiplier test).

The third model to be analyzed is a full structural equation model, in which the general subjective well-being variable and the three nested factors (i.e., positive affect, negative affect and satisfaction with life) are regressed simultaneously on neuroticism and extraversion. What is achieved by the structural parameters in the full model is the unique subjective well-being variance explained by

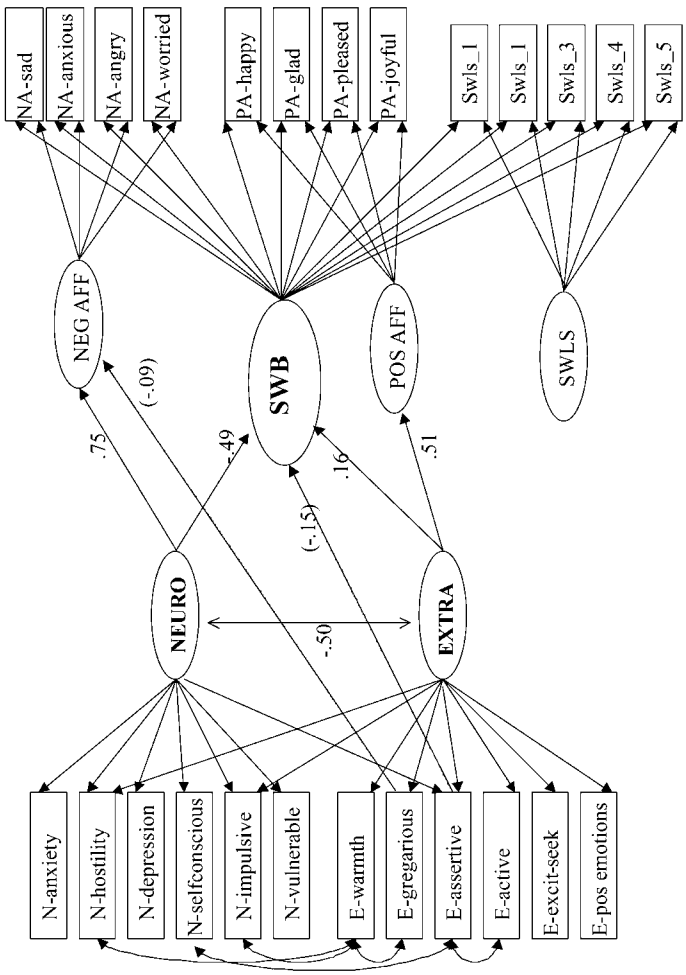


Figure 1. The full structural equation model of neuroticism, extraversion and subjective well- being. Only significant regression weights (standardized betas) are presented. Dotted arrows and betas in parentheses indicate paths that are added as a result of ad hoc modification of the full model. Uniqueness and residuals not shown for sake of clarity.

neuroticism and extraversion and whatever additional variance the personality traits may explain related to the unique affectivity or life satisfaction factors.

5. AIMS OF THE STUDY

The study of subjective well-being, personality traits, and the relationship between them is in general well described (e.g. Kahneman et al., 1999). However, some aspects still seem unsettled, and our study sets out to address two important issues. First, as underscored for example by Mayr (1982) and Thagard (1992), the gradual but decisive development of concepts is probably the most important step to be taken in the development of a scientific field. As Descartes postulated long ago, establishing the meaning of a concept starts by partitioning it into its fundamental components; and that is precisely what factor analyses are about (see for example Mulaik, 1987). Hence a leading goal for our article is to confirm some common beliefs about the factor structure of subjective well-being, neuroticism and extraversion. Furthermore, we wish to explore some alternative relationships among the components of these concepts. A structural equation approach seems especially appropriate for this aim.

Secondly, there seems to be a substantial difference in the effect size regarding the association between neuroticism and extraversion on the one hand and subjective well-being on the other, though it is overlooked in the literature. Because this unfortunate state of affairs could give a biased impression of the relative importance of neuroticism and extraversion as predictors of subjective well-being, another purpose of this paper is to question the status that extraversion has attained as the most significant predictor of subjective well-being. We regard it as beneficial to have the effect sizes estimated for a general population. To escape confounding effects, it is essential to include both neuroticism and extraversion in the regression model.

5.1. *Hypotheses*

Our first hypothesis relates to the separate factor structures of subjective well-being, neuroticism and extraversion. We hypothesize that a nested factor model with a general subjective well-being factor and nested factors of satisfaction with life, positive affect, and negative affect will fit the data well. We further hypothesize that a simple factor structure of neuroticism and extraversion will not fit the data well and that substantial modifications are needed to reach an acceptable goodness-of-fit estimate.

As an outcome of previous investigations, the next hypothesis is that the structural path from neuroticism to general subjective well-being will account for at least four times as much variance as a similar path from extraversion. The third hypothesis is that neuroticism will be associated with the unique negative factor and that extraversion will be associated with unique positive affect. Again, we expect that compared with extraversion, neuroticism will be a substantially stronger predictor of affect. Finally, we want to look for unique effects running directly from any of the personality facets to factors in the subjective well-being model. In keeping with such an exploratory approach, no hypotheses cover our expectations for this part of the analysis.

6. METHOD

6.1. *The Sample*

Data were collected by means of a postal questionnaire distributed in the northern part of Norway during the summer of 2000. A random sample of 1000 persons was drawn from an electronic telephone book. Within this initial sample it turned out that 80 persons had died or moved to a new address, or suffered from a disability that made them unable to respond to the questionnaire. Thus we were left with an adjusted initial sample of 920 persons. After two reminders, usable responses were obtained from 461 persons, yielding a response rate of 50%.

A follow-up study by telephone was then conducted to investigate whether the non-respondents differed systematically from the respondents (N = 47). No significant differences between respond-

ents and non-respondents were obtained on such key variables as age, gender, level of education, neuroticism or extraversion (the two latter variables being composites of a short version of the full neuroticism inventory and the full extraversion inventory respectively[1]). On the other hand, a difference was found in satisfaction with life. The telephone sample registered a significantly higher score on the Satisfaction With Life Scale, described below, as compared with the mail sample (group means = 27.3 versus 24.3, $p < 0.001$). However, such a discrepancy could be expected in light of the tendency people have to endorse more socially acceptable answers in telephone surveys as compared with mail surveys (De Leeuw et al., 1996; Krosnick, 1999). For satisfaction with life, this effect has been demonstrated several times (see for example Veenhoven, 1984). Inasmuch as the purpose of our telephone sample was to compare responders and non-responders on certain key variables, no further results from the telephone sample will be given in this article.

The mean age of the mail sample was 47.8 years, with a range of 19 to 88 years and a standard deviation of 15.8 years. Respondents in the sample were 45.2 per cent female and 54.8 per cent male. On average, participants in the study had 12.3 years of education.

6.2. *Measures*

Satisfaction with life. Satisfaction with life was assessed by means of a five-item inventory developed by Diener and coworkers, the Satisfaction With Life Scale (SWLS; Pavot and Diener, 1993). Examples of the items in this inventory are: *In most ways my life is close to my ideal*, and *I am satisfied with my life*. The SWLS was measured on a rating scale ranging from 1 ('strongly disagree') to 7 ('strongly agree'). Cronbach's alpha (α) for the scale was 0.87.

Positive affect. The following four items were used to measure positive affect: *happy*, *glad*, *pleased*, and *joyful*. Participants were asked to indicate how well each of the affect items described the situation in their own lives. Answers were marked on 7-point rating scales which were end-point labeled as 'does not fit' (1) and 'fits very well' (7). Cronbach's α was 0.85.

Negative affect. Four items were used to measure negative affect: *sad*, *anxious*, *angry*, and *worried*. Participants were asked to indicate how well each of the affect items described the situation in their own lives. Again, answers were marked on 7-point rating scales which were end-point labeled as 'does not fit' (1) and 'fits very well' (7). In this case Cronbach's α was 0.79.

Neuroticism was measured by means of the revised NEO personality inventory (NEO-PI-R; Costa and McCrae, 1992), with six facets, each one of which is comprised of eight items, for a total of forty-eight items. The facets, with item examples in parenthesis, are the following: (1) Anxiety (*I am easily frightened*), $\alpha = 0.76$; (2) Angry Hostility (*I often get angry at the way people treat me*), $\alpha = 0.68$; (3) Depression (*Sometimes I feel completely worthless*), $\alpha = 0.78$; (4) Self-Consciousness (*At times I have been so ashamed I just wanted to hide*), $\alpha = 0.68$; (5) Impulsiveness (*I have trouble resisting my cravings*), $\alpha = 0.62$; and (6) Vulnerability (*I often feel helpless and want someone else to solve my problems*), $\alpha = 0.76$.

Extraversion. As measured by the NEO-PI-R, extraversion also has six facets, each of which is comprised of eight items: (1) Warmth (*I really like most people I meet*), $\alpha = 0.74$; (2) Gregariousness (*I like to have a lot of people around me*), $\alpha = 0.70$; (3) Assertiveness (*I am dominant, forceful, and assertive*), $\alpha = 0.73$; (4) Activity (*When I do things, I do them vigorously*), $\alpha = 0.64$; (5) Excitement-Seeking (*I often crave excitement*), $\alpha = 0.60$; and (6) Positive Emotions (*Sometimes I bubble with happiness*), $\alpha = 0.79$.

6.3. *Analysis*

Structural equation modeling was used to estimate the associations between personality traits and subjective well-being, and to test the goodness-of-fit for the models. Analyses were conducted with EQS 5.7 for Windows (Bentler, 1995) using maximum likelihood estimates and listwise deletion of missing data.

A critical issue in any SEM analysis is the assessment of model fit. The conventional overall test of goodness-of-fit assesses the magnitude of the discrepancy between the proposed model and the data by means of a chi-square test. A good model has low, prefer-

ably non-significant, chi-square values, relative to the degrees of freedom. Low chi-square values indicate a negligible discrepancy between the model and the data. However, several problems arise with the use of the chi-square test (see for example Bollen and Long, 1993). To overcome these drawbacks, no single measure of overall model fit should be relied on exclusively. For this reason, two additional fit indexes are employed in this study. Comparative Fit Index (CFI) measures the proportionate improvement in fit by comparing a target model with a more restricted, nested baseline model. The baseline model suggests that all the observed variables are uncorrelated. The closer the index value comes to 1.0, the better one's model (and not the baseline model) fits the data. A CFI cutoff value close to 0.95 or higher is generally recommended (Hayduk, 1996; Hu and Bentler, 1999), although cutoff values having a magnitude of 0.90 or above are regularly seen in the literature (Bollen, 1989; Hoyle and Panter, 1995).

Supplementing the CFI, this study also uses the Root Mean Square Error of Approximation (RMSEA; e.g., MacCallum, et al., 1996; Steiger and Lind, 1980) as a fit index. The RMSEA focuses on the degree of lack of fit in a model, not on whether the model is exactly correct or not. This makes it possible to test models of close fit, not just models of exact fit. In other words, in referring to the RMSEA one may ask whether the model is a decent approximation or not, rather than the scientifically uninteresting question of whether it might be an absolutely perfect fit, which is the question the ordinary chi-square test asks. Although the RMSEA value should be small, preferably in the area of 0.06 or lower to indicate very good fit (Hu and Bentler, 1999), models with RMSEA values between 0.06 and 0.08 could still be considered to manifest mediocre fit.

7. RESULTS

7.1. *Descriptives*

Table I presents the zero-order correlations and descriptive statistics of the variables in this study. The sum scores, skewness and standard deviations are all within the range of expectation. Also as expected, satisfaction with life is highly correlated with positive affect (r =

TABLE I

Pearson Correlation Coefficients, Corrected Correlations, Cronbach's Alpha, Sample Size, Sum Scores, Scale Range, Standard Deviations, and Skewness for the Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Satisfaction with Life	**0.87**	0.68	–0.27	–0.45	–0.23	–0.43	–0.28	–0.14	–0.40	0.27	0.14	0.17	0.18	0.03	0.30
2. Positive affect	0.79	**0.85**	–0.21	–0.46	–0.21	–0.40	–0.26	0.04	–0.35	0.33	0.24	0.19	0.27	0.22	0.44
3. Negative affect	–0.35	–0.27	**0.79**	0.55	0.40	0.56	0.39	0.20	0.41	–0.20	–0.21	–0.23	–0.15	–0.01	–0.21
4. N:anxiety	–0.44	–0.42	0.82	**0.76**	0.44	0.68	0.55	0.25	0.62	–0.22	–0.22	–0.38	–0.28	–0.12	–0.24
5. N:angry hostility	–0.36	–0.32	0.55	0.66	**0.68**	0.48	0.41	0.35	0.42	–0.31	–0.12	–0.08	–0.04	0.13	–0.10
6. N:depression	–0.51	–0.45	0.69	0.85	0.66	**0.78**	0.62	0.23	0.61	–0.22	–0.20	–0.41	–0.27	–0.05	–0.31
7. N:self-consciousness	–0.34	–0.29	0.57	0.79	0.63	0.86	**0.68**	0.24	0.57	–0.26	–0.23	–0.54	–0.28	–0.05	–0.26
8. N:impulsiveness	–0.18	0.02	0.30	0.35	0.51	0.23	0.38	**0.62**	0.36	–0.08	0.17	0.04	0.04	0.30	0.27
9. N:vulnerability	–0.46	–0.40	0.48	0.67	0.49	0.62	0.62	0.50	**0.76**	–0.24	–0.08	–0.39	–0.31	–0.11	–0.21
10. E:warmth	0.32	0.44	–0.23	–0.18	–0.31	–0.19	–0.32	–0.05	–0.32	**0.74**	0.50	0.14	0.34	0.11	0.43

TABLE I

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11. E:gregarousness	0.18	0.33	–0.30	–0.27	–0.13	–0.24	–0.31	0.19	–0.17	0.74	**0.70**	0.23	0.19	0.20	0.43
12. E:assertiveness	0.16	0.17	–0.32	–0.49	–0.15	–0.53	–0.72	0.07	–0.41	0.19	0.29	**0.70**	0.46	0.24	0.35
13. E:activity	0.33	0.46	–0.26	–0.35	–0.14	–0.34	–0.39	–0.03	–0.53	0.57	0.38	0.56	**0.64**	0.27	0.41
14. E:excitement-seeking	0.04	0.19	–0.09	–0.19	–0.15	–0.13	–0.05	0.39	–0.28	0.24	0.40	0.34	0.46	**0.60**	0.29
15. E:positive emotions	0.38	0.57	–0.32	–0.29	–0.16	–0.42	–0.33	0.37	–0.32	0.62	0.55	0.43	0.65	0.43	**0.79**
Sample size	457	457	458	458	457	457	458	457	459	458	458	457	458	458	459
Sum score	24.2	20.0	12.4	9.8	11.1	13.4	13.1	15.1	10.6	23.5	17.8	15.7	20.0	14.3	20.2
Scale range	5–35	4–28	4–28	0–32	0–32	0–32	0–32	0–32	0–32	0–32	0–32	0–32	0–32	0–32	0–32
Standard deviation	5.4	4.1	4.8	5.7	4.9	5.9	5.1	4.8	4.8	4.4	5.4	5.5	4.5	5.1	5.5
Skewness	–0.33	–0.53	0.45	0.38	0.17	0.26	0.09	–0.05	0.45	–0.56	–0.18	–0.10	–0.01	–0.03	–0.19

Note. Pearson correlations in the upper triangle, Cronbach's alphas in the diagonal, corrected (random error correction) correlations in the lower triangle. Correlations above 0.09 are significant at $p < 0.05$.

0.68/0.79, $p < 0.001$ – corrected correlation after the slash), and negatively correlated with negative affect (r = –0.27/–0.35, $p <$ 0.001). Positive affect and negative affect correlate slightly and negatively with each other (r = –0.21/–0.27, $p < 0.001$). Moreover, all neuroticism facets are positively and significantly correlated with each other, in the range r = 0.23/0.23 to 0.68/0.85. Similarly, all extraversion facets are positively and significantly correlated with each other, in the range 0.11/0.19 to 0.50/0.74. The mean Cronbach's $\alpha = 0.84$; for all three subjective well-being scales, $\alpha = 0.71$ for the six neuroticism facets and $\alpha = 0.70$ for the six extraversion facets.

7.2. *Measurement Models*

The subjective well-being factor model (right half of Figure 1) fits the data well: χ^2 (53, n = 434) = 65.6*, $p = 0.12$, CFI = 0.99*, RMSEA = 0.05. (As an alternative, an ordinary second order SWB model was analyzed with the same data. This model revealed poorer goodness-of-fit, with χ^2 (52, n = 434) = 95.2*, $p < 0.001$, CFI = 0.97*, RMSEA = 0.07.) Due to heavily non-normal data (normalized Mardia's multivariate kurtosis coefficient = 48.5), the chi-square statistics and CFI estimates are calculated with Satorra-Bentler robust statistics (Satorra and Bentler, 1994); the corrected estimates are indicated with an asterisk. The factor loadings revealed in Table II show that the general SWB factor dominates the SWLS and POAF items more than it dominates the NEAF items. On average, 56% of the variance in the SWLS items is explained by the general SWB factor; 40% of the variance in the POAF items is explained by the general SWB factor. The average variance explained for the NEAF items is only 6%.

Initially, and as expected, the factor model for neuroticism and extraversion reveals poor goodness-of-fit (χ^2 (53, N = 452) = 436.1*, $p < 0.001$, CFI = 0.77*, RMSEA = 0.14). To reach a level of mediocre model fit (defined as CFI > 0.90 and RMSEA < 0.08), and with use of the Lagrange multiplier modification procedure, three cross-loadings and five correlated errors were freed up to suggest a revised ad hoc model of neuroticism and extraversion. The revised model (left side of Figure 1) was supported by the data in accordance with the criteria for mediocre goodness-of-fit (χ^2 (45, N = 452) =

TABLE II

Factor Loadings for Subjective Well-being Factor Model

Item	SWB	SWLS	POAF	NEAF
SWLS1	0.73	0.29		
SWLS2	0.76	0.65		
SWLS3	0.80	0.11		
SWLS4	0.74	–0.06		
SWLS5	0.69	–0.15		
Happy	0.64		0.47	
Glad	0.67		0.54	
Pleasant	0.67		0.42	
Joyful	0.53		0.36	
Sad	–0.18			0.74
Anxious	–0.27			0.49
Angry	–0.20			0.56
Worried	–0.32			0.69

Note. N = 434. SWB = Subjective Well-Being; SWLS = Satisfaction With Life Scale; POAF = Positive Affect; NEAF = Negative Affect.

158.8*, $p < 0.001$, CFI = 0.93*, RMSEA = 0.08). For the personality items the distribution departs somewhat from the expectation of normality (normalized Mardia's multivariate kurtosis coefficient = 13.2). All factor loadings in the neuroticism model have factor loadings above 0.65, and the factor has its greatest impact on anxiety and depression, with factor loadings of 0.80 and 0.83 respectively (Table III). On average, the factor explains 56% of the variance in the neuroticism facets.

Note that after modification, the impulsiveness facet is about equally influenced by neuroticism and extraversion, revealing factor loadings of 0.65 on neuroticism and 0.67 on extraversion. Also, several of the error terms for the neuroticism facet correlate significantly with error terms produced by the extraversion facets, notably Angry Hostility (correlating –0.32 with the error term for Warmth), Self-consciousness (correlating –0.31 with the error term for Assertiveness), and Impulsiveness (correlating –0.38 with the error term for Warmth).

TABLE III

Factor Loadings and Correlated Error Terms for Neuroticism and Extraversion

Item	N	E	Correlated errors
Anxiety	0.80		
Angry hostility	0.69	0.26	–0.32 (with warmth)
Depression	0.83		
Self-consciousness	0.73		–0.31 (with assertiveness)
Impulsiveness	0.65	0.67	–0.38 (with warmth)
Vulnerability	0.76		
Warmth		0.54	–0.32 (with angry hostility)
			-0.38 (with impulsiveness)
			0.28 (with gregariousness)
Gregariousness		0.50	0.28 (with warmth)
Assertiveness	–0.30	0.34	–0.31 (with self-consciousness)
			0.23 (with activity)
Activity		0.55	0.23 (with assertiveness)
Excitement-seeking		0.42	
Positive emotions		0.75	

Note. N = 452. N = Neuroticism, E = Extraversion. The N and E factors correlated –0.50.

Table III further reveals that only one of the extraversion facets loaded higher than 0.60 (Positive Emotions = 0.75), whereas two extraversion facets showed factor loadings below 0.50 (Assertiveness = 0.34, and Excitement Seeking = 0.42). On average, the extraversion factor explained 28% of the variance in the facets, clearly illustrating that extraversion is a less coherent factor than is neuroticism. One of the extraversion facets had a significant cross-loading on the neuroticism factor, yielding a factor loading equal to –0.30. Several of the error terms produced by the extraversion factor correlated with each other. The error term related to Warmth correlated with Gregariousness (0.28) in addition to several error terms as described above. Moreover, the Assertiveness error correlated at 0.23 with the activity error (Table III).

TABLE IV

Well-being Variance Explained by only Neuroticism, only Extraversion, and Both Neuroticism and Extraversion (in Percentages)

	Predictor: Only N	Predictor: Only E	Predictors: Both N and E	
			N	E
Subjective well-being	30	20	24	3
Positive affect	2	24	0	26
Negative affect	56	15	56	0
Mean	29	20	27	10

Note. N = 429. N = Neuroticism, E = Extraversion.

7.3. *The Full Model*

The general subjective well-being factor and the nested SWLS, POAF and NEAF factors were simultaneously regressed on the neuroticism and extraversion factors. The standardized regression coefficients are shown in Figure 1 (only significant paths included). The model has the following goodness-of-fit characteristics: χ^2 (246, n = 429) 556.6*, $p < 0.001$, CFI = 0.93*, RMSEA = 0.07. The normalized Mardia's multivariate kurtosis coefficient is 41.9. Neuroticism strongly predicts the general SWB variable and the negative affect variable (β's = –0.47 and 0.76 respectively – both significant at $p < 0.001$). Extraversion has a small impact on subjective well-being and a large impact on positive affect: β's = 0.15 ($p < 0.05$) and 0.51 ($p < 0.001$) for SWB and POAF respectively.

In the language of explained variance, neuroticism accounts for 24% of the SWB variance and 56% of the negative affect variance. Extraversion, on the other hand, explains 3% of the SWB variance and 26% of the positive affect variance (Table IV). In other words, compared with extraversion, neuroticism explains about eight times as much of the variance in general subjective well-being and more than twice as much of the variance in the affect variables.

Note that neuroticism and extraversion are negatively and highly correlated (r = –0.50). As is well known from the non-experimental causality literature, correlations among exogenous variables may seriously confound the estimated strength (and sometimes the direction) between a dependent and an independent variable if they

are omitted from the regression model (e.g., Cohen and Cohen, 1983). Unfortunately, a large proportion of the subjective well-being literature is biased in this respect (see Vittersø, 2001, for a review), leading to a potentially spurious estimate of the relationship between well-being and personality traits. To illustrate the seriousness of omitting exogenous variables, two separate models were run on the current sample, one making only neuroticism a predictor of subjective well-being, the other using extraversion as the sole predictor. In these models, extraversion explains about 20 per cent of the well-being variance, neuroticism about 29 per cent. In other words, if neuroticism is omitted from a well-being/personality model, the estimated paths from extraversion to subjective well-being may be grossly overestimated (cf. Table IV). Thus it is misleading to report results on the relationship between personality and subjective well-being without including both neuroticism and extraversion in the equation.

7.4. *Modifying the Full Model*

By its very nature, the SEM approach is suitable for evaluating unique effects between important components of a model. For example, a specific effect might be expected between the positive emotion variable of extraversion and the nested positive affect factor in the subjective well-being structure. A Lagrange multiplier test assists the search for such unique effects by suggesting how additional paths not previously specified in the model will increase the goodness-of-fit of the model. Because of our interest in the conceptual structure of subjective well-being, neuroticism and extraversion, we wanted to look for possible links that go directly from any of the personality facets to one or several of the subjective well-being factors.

As an outcome of this procedure, two direct effects are found to be significant in our data, and both have a negative direction. The first path runs from the extraversion facet of Assertiveness to the general SWB factor ($\beta = -0.15$, $p < 0.05$). The second runs from the extraversion facet of Gregariousness to the nested factor of Negative Affect ($\beta = -0.09$, $p < 0.05$). These paths are shown as dotted arrows in Figure 1. They denote that a negative covariance exists uniquely between assertiveness and general well-being. In

other words, when the overall extraversion factor is controlled for, it is revealed that people with high assertiveness scores generate lower scores on subjective well-being than do people with low assertiveness scores. In similar fashion, there is a unique and negative covariance between the gregariousness facet and negative affect, and it is captured neither by the extraversion factor nor by the overall subjective well-being factor.

8. DISCUSSION

In this study we have sought to analyze the structure of, and relations among, the constructs of subjective well-being, neuroticism and extraversion. Data from a representative sample of the population of northern Norway support the notion of a general subjective well-being factor sustained by three nested factors: satisfaction with life, positive affect, and negative affect. A simple factor structure of neuroticism and extraversion is not supported, and several modifications are needed before the model achieves something akin to an acceptable fit.

Secondly, we have wanted to replicate the finding that neuroticism is a more important predictor of subjective well-being than is extraversion, and this assumption has been confirmed by the data. Overall, neuroticism explains eight times as much of the subjective well-being variance as does extraversion. On average neuroticism, compared with extraversion, explains about three times as much variance as a composite consisting of the three well-being variables. Neuroticism has its largest influence on negative affect (explaining 56% of the variance), whereas extraversion is found to have a large and unique influence on positive affect (explaining 26% of the variance).

Conceptually, our study contributes to the evidence in favour of the oft-mentioned but rarely tested idea that subjective well-being consists of an overall dimension of general evaluation (e.g., Diener and Lucas, 2000; Diener et al., 1999; Kahneman, 1999; Vittersø, in press). Such a general well-being concept can explain a large proportion of the variance measured in well-being variables related to satisfaction with life and affective responses; more so for the positive affects than the negative affects. The excellent goodness-of-

fit estimates revealed for the subjective well-being model confirm that we have a fair understanding of the relationships among the well-being items and that only covariances of a trivial size are left unexplained in the current conceptualization. Of course we have not proven that this structure is the correct representation of the assumed reality of subjective well-being, only that our a priori notion of subjective well-being does not contradict the data. Theoretically, an infinite number of alternative representations of this structure might exist (Raykov and Marcoulides, 2001), although in fact competing structures that also make theoretical sense are more difficult to detect.

As for personality traits, the study has failed to confirm a simple structure for two of the major traits in the Five Factor Model. A growing body of evidence now suggests that a more complex factor structure than the FFM is needed before researchers can claim to have reached a comprehensive description of personality traits (Barrett, 1999; Block, 1995; Borkenau and Ostendorf, 1990; Church and Burke, 1994; McCrae et al., 1996; Parker et al., 1993; Pervin, 1994; Saucier and Goldberg, 1998; Vassend and Skrondal, 1995; Vassend and Skrondal, 1997; Vittersø, 1998). In view of what seems to be a consistent lack of fit in the FFM model when analyzed by means of confirmatory factor analysis, it is surprising that in the literature the five big traits are taken more or less for granted as the 'true' model of personality. A more consistent explanation for the relationships between items and facets, and between facets and factors, will obviously be required of future theories of the five personality traits.

About the core features of neuroticism and extraversion, the factor loadings presented in the results section reveal that neuroticism contributes heavily and evenly to all its six facets. Extraversion, on the other hand, is more fragile and mainly dominates the facet representing positive emotions. Moreover, two unique paths from the extraversion facets to the subjective well-being factor have been shown to improve the goodness-of-fit for our full model (Figure 1), a finding that indicates the extraversion factor does not capture the essence of its facets adequately. Additionally, extraversion exerts a significant influence on the variance in the impulsiveness facet, which is defined by Costa and McCrae (1992)

as a neuroticism facet. However, as several scholars have argued, impulsiveness is also a dominant part of the extraversion concept (e.g., Derryberry and Reed, 1994; Eysenck, 1970; Gray, 1981). The dominant role of positive emotions as a core feature in the concept of extraversion (see Rusting, 1997; Larsen and Ketelaar, 1991; Lucas et al., 2000; Tellegen, 1985; Watson, 2000; Watson and Clark, 1997b) is supported in this study. Besides the strong correlation between positive emotions and the extraversion factor, the extraversion factor stands in a clear and unique association with the positive affect items in the subjective well-being domain. Moreover, a potential path from the facet of positive emotion to either positive affect or subjective well-being does not reach the level of significance, a result indicating that the core of that construct is fully mediated through the overall construct of extraversion.

The results revealed in this study may not reflect a universal fact. Rather to the contrary, is it likely that cross-cultural differences exist within this domain. For example, in a study of college students in 41 nations, correlations between extraversion and satisfaction with life were above 0.30 for 6 countries, below 0.30 for 35 other nations (Vittersø, 1998). The U.S.A. was among the six high-correlation countries. Because studies from North America dominate the international literature on subjective well-being, one could speculate that the impression of a strong relationship between extraversion and well-being originates in culturally specific circumstances in the USA.

As an illustration of the moderating role of culture, consider the following. Lucas and his coworkers (Lucas et al., 2000) found that extraversion was less strongly correlated with pleasant affects in collectivistic societies than in individualistic societies. Even within the same nation, differences in the relationship between extraversion and well-being might exist. Moreover, in a study conducted in a jail, introverted prisoners reported higher levels of happiness than did extraverted (reported in Diener and Lucas, 1999).

In spite of the somewhat impressive growth of scientific understanding within the field of subjective well-being, conceptual and relational elaborations are still needed. Nowhere is the need for elaboration more urgent than in the area of cross-cultural differences.

Finally, a comment should be made on the overall question of personality and subjective well-being. Although the links between neuroticism/extraversion and subjective well-being are strong and consistent, examining personality and well-being through the lens of a FFM and in no other way would be too narrow in the long run. Other personality concepts and models, such as self-esteem and optimism, have also revealed strong associations with measures of well-being (Baumeister, 1989; Brebner et al., 1995; Carver, 1992; Diener, 1994; Diener and Lucas, 1999; Dweck, 1996; Higgins et al., 1999; Kwan et al., 1997; Lyubomirsky and Ross, 1999; Peterson, 2000; Sandvik et al., 1993; Schaller and Cialdini, 1990; Scheier and Carver, 1985). In fact, DeNeve remarks that the most important personality trait is not to be found among the five big traits, but rather in the so-called repressive-defensiveness trait (the tendency to avoid threatening information), with an average correlation of $r = -0.40$ (DeNeve, 1999: p. 143). Although several studies have examined relationships between well-being and different models of personality, future research needs to incorporate the relevant personality variables into one model in order to partial out possibly overlapping covariance among the personality variables. Until a model that includes all relevant traits is established, the true relations between extraversion, neuroticism and subjective well-being remain uncertain. With such a model, however, we will start to grasp which essential constituents of personality are uniquely related to subjective well-being. We expect that what these personality predictors will have in common is a general tendency to evaluate circumstances along the dimension of good-bad.

NOTE

[1] The 6 items in the short version of neuroticism were selected from the 48 neuroticism items in the mail data in the following way. Mean score variables for each of the neuroticism facets were computed and entered as the dependent variables in six subsequent regression analyses. All items belonging to a facet were included as independent variables. The variable with the highest regression weight was selected as representing the facet in the short version of neuroticism. Similar procedures were followed for each facet in both the neuroticism and the extraversion inventory. In the mail sample the Pearson correlation coefficients between short scale and total scale were 0.80 and 0.84 for neuroticism and extraversion respectively.

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