The Structure of Subjective Wellbeing

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In his highly influential Psychological Bulletin article *Subjective Wellbeing* (SWB) Diener (1984) proposed that SWB has three distinct components: *life satisfaction* (LS), *positive affect* (PA), and *negative affect* (NA). More recently, Diener, Suh, Lucas, and Smith (1999) also included satisfaction in specific life domains (henceforth *domain satisfaction* [DS], e.g., satisfaction with health) in the definition of SWB. SWB researchers often distinguish cognitive and affective components of SWB (Diener, 1984; (Diener et al., 1999). Life satisfaction and domain satisfaction are considered cognitive components because they are based on evaluative beliefs (attitudes) about one's life. In contrast, positive affect and negative affect assess the affective component of SWB. PA and NA reflect the amount of pleasant and unpleasant feelings that people experience in their lives.

This chapter examines the structural relations among these components in three sections. First, I examine the structural relations among cognitive components of SWB. Specifically, I examine the relation between life satisfaction and domain satisfaction (LS-DS) as well as the relation among satisfaction in various domains (DS-DS; e.g., job satisfaction and marital satisfaction). Second, I review the controversial and inconsistent literature on the relation between the two affective components of SWB (i.e., PA & NA). Finally, I examine the relation between cognitive wellbeing and affective wellbeing.

The Structure of Cognitive Wellbeing

Structural research on CWB has two aims. First, it simply tries to establish general characteristics of structural relations among cognitive components of SWB. The second aim of structural research is to elucidate the causal processes that produce the structure of CWB. This chapter focuses on the causal processes that produce the structure of SWB. Figure 1 illustrates several potential causal processes that can produce a correlation between life satisfaction and domain satisfaction. Based on Diener's (1984) seminal article, a main distinction is between bottom-up theories and top-down theories of SWB. Bottom-up theories assume that life satisfaction judgments are based on an assessment of

satisfaction in a relatively small number of life domains (Andrews & Withey, 1976; Brief, Butcher, George, & Link, 1993; Heller, Watson, & Hies, 2004; Schimmack, Diener, & Oishi, 2002). Thus, these theories assume that LS-DS correlations reflect a causal influence of DS on LS. In Figure 1 bottom-up effects are illustrated by the direct links between DS and LS with the causal arrow pointing to LS. For example, an individual with high marital satisfaction has high life satisfaction because her marital satisfaction is an important aspect of her satisfaction with life as a whole. In contrast, top-down theories postulate the reverse direction of causality (i.e., LS causes DS). In Figure 1 top-down effects are illustrated by the direct links between LS and DS with the arrow pointing to DS. Somebody who is generally satisfied with life may also evaluate life domains more positively although general satisfaction is not based on satisfaction with particular domains.

It is noteworthy that I use the labels *top-down* and *bottom-up* only to distinguish between causal theories of the relation between LS and DS. Bottom-up theories can be further distinguished with regards to their assumptions about the determinants of DS. For example, Brief et al. (1993) proposed that domain satisfaction is also influenced by top-down processes. Specifically, the authors found that the personality trait *neuroticism* (i.e., a disposition to have more negative feelings & cognitions) predicted health satisfaction, which in turn predicted life satisfaction. Similar results have been obtained for marital satisfaction and job satisfaction (Heller et al., 2004). In the present context, these models are bottom-up models because they assume that a change in domain satisfaction will result in a change in life satisfaction. In contrast, top-down models assume that changes in domain satisfaction have no effect on life satisfaction.

Top-down and bottom-up theories are not the only causal models of LS-DS relations. Another possibility is that the correlation is caused by shared method variance because life satisfaction and domain satisfaction are often assessed with the same method, typically self-reports (see, e.g., Andrews & Whithey, 1976; Schimmack & Oishi,

2005). In Figure 1 this model is illustrated by causal paths from a method factor to life satisfaction and domain satisfaction. According to this model, correlations between life satisfaction and domain satisfaction exaggerate the strength of the causal influence of DS on LS or vice versa because shared method variance inflates these correlations.

It is also possible that the correlation is due to a substantial causal effect of another variable that independently influences DS and LS. For example, neuroticism could lead to more negative evaluations of domain satisfaction (e.g., health) and life satisfaction. In Figure 1 this model is illustrated by causal effects of personality traits on life satisfaction and domain satisfaction. Although the correlation between LS and DS would not be a method artifact, a common influence of personality would still imply that LS-DS correlations exaggerate the strength of direct causal effects of DS on LS or vice versa.

The nature of the causal processes that link DS and LS has great practical importance. Only bottom-up theories of SWB predict that changes in domain satisfaction (e.g., an increase in financial satisfaction) produce changes in life satisfaction. All other theories predict that changes in domain satisfaction have no consequences for individuals' life satisfaction.

The Stability of the Structure of Cognitive Well Being

Investigations of the structure of cognitive wellbeing (CWB) assume a relatively stable structure. In contrast to this assumption, Schwarz and colleagues have proposed that the relation between life satisfaction and domain satisfaction (LS-DS) is highly unstable (Schwarz & Strack, 1999). The authors propose that people use simple heuristics to deal with the difficult task of evaluating their whole life. As a result, they may rely on information that is temporarily accessible at the moment of the evaluation. For example, in a phone survey at home respondents rely on satisfaction with family, whereas in a survey at work they rely on job satisfaction to judge life satisfaction. The bleak implication of this theory is that structural research on SWB would be futile.

Recent evidence suggests that this model overstates the importance of temporarily accessible information on life satisfaction judgments (Fujita & Diener, 2005; Schimmack, Diener, & Oishi, 2002; Schimmack & Oishi, 2005). Life satisfaction judgments are much more stable than predicted by this model. Furthermore, experiments that manipulate the accessibility of different information have relatively weak effects on the correlations between domain satisfaction and life satisfaction (Schimmack & Oishi, 2005). This evidence suggests that life satisfaction judgments are heavily influenced by chronically accessible information that has considerable stability over intervals of several months or a year.

The Causal Influence of Shared Method Variance

It is fairly easy to examine the potential influence of shared method variance on the correlation between domain satisfaction and life satisfaction. For example, many studies demonstrated that DS-LS correlations vary across different domains (Andrews & Withey, 1976; Schimmack, Diener, & Oishi, 2002; Schimmack & Oishi, 2005). For example, satisfaction with family is more highly correlated with life satisfaction than satisfaction with weather or the national government. This finding is inconsistent with a pure method effect because domain satisfaction is assessed with the same method. Thus, method effects should produce the same correlations across domains. A more elaborate approach requires the assessment of life satisfaction and domain satisfaction with different methods. For example, Heller, Judge, and Watson (2002) obtained significant correlations between self-reports of life satisfaction and informant reports of job satisfaction as well as between self-reports of job satisfaction and informant reports of life satisfaction (*r*s = .27 to .39). The correlations were only slightly weaker than correlations between self-reports of life satisfaction and domain satisfaction (*r*s = .43 to .48).

A study by Schimmack, Diener, Oishi, and Suh (2006) provides further evidence on this issue. Students reported their life satisfaction and satisfaction with seven domains

(romantic, finances, family, grades, social life, recreation, & housing). In addition, family members and friends provided informant ratings of students' life satisfaction. Self-reports of domain satisfaction were averaged to obtain a measure of general domain satisfaction. Consistent with prior studies, self-reported LS and DS were highly correlated r = .60 (Andrews & Withey, 1976; Schimmack & Oishi, 2005; Schimmack, Oishi, & Diener, 2002). Importantly, self-reported DS also correlated significantly with informant ratings of LS, r = .50. Once more, this correlation was only slightly weaker than the correlation based on self-reports of life satisfaction and domain satisfaction. In short, there is consistent evidence that common method variance accounts only for a small portion of the correlation between DS and LS.

A common causal influence of personality

Numerous studies have examined the possibility that LS-DS correlations are due to the common influence of personality traits (Brief et al., 1993; Heller et al., 2002, 2004; Schimmack, Diener, & Oishi, 2002). These studies typically show that personality traits that correlate with life satisfaction also tend to be correlated with domain satisfaction. For example, neuroticism is a negative predictor of life satisfaction and job satisfaction. As a result, controlling for personality traits weakens correlations between domain satisfaction and life satisfaction. Nevertheless, domain satisfaction typically shares unique variance with life satisfaction.

A study by Schimmack (2006d) provides further evidence on this issue. A large sample of undergraduate students (N = 1241) completed measures of life satisfaction (i.e., the first three-items of the Satisfaction with Life Scale; e.g., "I am satisfied with my life"; (Diener, Emmons, Larsen, & Griffin, 1985), and three-item measures of satisfaction in 10 domains (academic, recreation, romantic, family/parents, friendships, health, housing, traffic, weather, & goal progress; see Schimmack & Oishi, 2005), and a short measure of the Big Five personality traits (see Schimmack, Oishi, Furr, & Funder, 2004; Study 4). Satisfactions in all domains except goal progress were averaged to obtain a

measure of domain satisfaction. Goal progress was excluded because it is a broad category and can reflect satisfaction in several more specific domains. The simple correlation between LS and average DS was r = .70 (N = 1241). All personality traits were significantly correlated with life satisfaction and domain satisfaction with correlations ranging from r = .13 to .27 (sign reversed for neuroticism) for LS and r = .15 to .29 for averaged DS. As a result, controlling for the shared variance with personality traits reduced the correlation between LS and DS, but the relation remained strong, *partial* r = .64. In sum, personality traits provide a partial explanation for LS-DS relations, but direct causal processes are likely to contribute to this relation as well.

A simple top-down Model of LS-DS Correlations

It is more difficult to determine whether LS-DS relations are due to bottom-up or top-down processes (Headey, Veenhoven, & Wearing, 1991). The simplest top-down model assumes that people who are generally satisfied with life are more satisfied with everything. This model makes several predictions that are inconsistent with the literature. First, it predicts strong correlations among domain satisfactions, but DS-DS correlations are generally small to moderate (Andrews & Withey, 1976; Heller et al., 2004), and a large number of respondents who report high satisfaction in one domain report low satisfaction in other domains. For example, Schimmack (2006d) obtained an average correlation of r = .28 (N = 1241) for the nine domains listed above. This finding also holds for changes in domain satisfaction. Headey, Holmstrom, and Wearing (1984) found that most people who report increased satisfaction in some domains also report decreased satisfaction in other domains.

The second prediction of a simple top-down model is that LS-DS correlations should be the same across various domains. In contrast, empirical studies consistently report stronger correlations for important domains than unimportant domains (Andrews & Withey, 1976; Schimmack, Diener, & Oishi, 2002). Schimmack (2006d) examined this issue by correlating life satisfaction with domain satisfaction in nine domains. In

addition, a smaller sample of students rated the importance of the nine domains. The correlation between LS-DS correlations and importance ratings of domains across the nine domains was nearly perfect, $r = .93$, $p < .01$. In short, a simple top-down model cannot account for the small to moderate DS-DS correlations and the systematic differences in LS-DS correlations across domains.

A Sophisticated Top-Down Model

It is possible, however, to construct more sophisticated top-down models that account for these findings. For example, a sophisticated top-down model could assume that (a) domain satisfaction is substantially influenced by domain-specific factors and (b) that general life satisfaction has a stronger impact on satisfaction in important domains (e.g., family) compared to unimportant domains (e.g., weather). The moderating effect of importance could be due to cognitive factors in the organization of beliefs about one's life. For example, the positive evaluation of life in general could spread more to central aspects of one's life than to peripheral aspects. It is possible to test this top-down model because it makes precise quantitative predictions about the correlations among domain satisfaction. For example, if life satisfaction were a strong cause of marital satisfaction ($r = .5$) and a moderate cause of job satisfaction ($r = .3$), the model predicts that the correlation between the two domain satisfactions is the product of the two effects (i.e., $r = .15$). This example illustrates two points. First, the sophisticated top-down model predicts only small to moderate DS-DS correlations. Second, it predicts that DS-DS correlations vary as a function of domain importance. Because important domains are more strongly influenced by LS, they also are more highly correlated with satisfaction in other domains.

Large samples are needed to conduct empirical tests of these predictions because the predicted correlations are small. Some data are available from a meta-analysis of the relation between life satisfaction, job satisfaction, and marital satisfaction (Heller et al., 2004). Life satisfaction was moderately correlated with job satisfaction ($N = 19{,}811$, $r = .35$) and marital satisfaction ($N = 7{,}540$, $r = .42$). Based on these correlations, the top-

down model predicts a small correlation of r = .15 between job satisfaction and marital satisfaction. The observed correlation in the meta-analysis is consistent with this prediction (N = 6,248, r = 14).

Stronger evidence can be obtained by examining the pattern of correlations among several domains. Schimmack (2006d) tested the predicted DS-DS correlations among 9 domains (see list of domains above) in a large undergraduate sample. First, domain satisfactions in the 9 domains were correlated with life satisfaction. Second, domain satisfaction in one domain was correlated with satisfaction in the other 8 domains. These correlations were averaged for each domain. These analyses produced two new variables that contained information about each domain's relation with (a) life satisfaction and (b) its relation to the other domains. A top-down model predicts a high correlation between these two variables, which was indeed the case, $r(9) = .80$, $p < .05$. Both variables were also correlated with domain importance. For example, an important domain (e.g., family) had higher correlations with life satisfaction and with other domains than an unimportant domain (e.g., weather).

Schimmack (2006d) also used structural equation modeling to test how well observed DS-DS correlations conform to the DS-DS correlations predicted by the sophisticated top-down model. The model was based on 30 variables with three items for each domain and three items for life satisfaction. The first model fitted a pure measurement model, in which each of the three items for each construct loaded on a single factor. All factors were allowed to covary freely with each other. Model fit was evaluated based on (Hu & Bentler, 1999) recommendation that Root Mean Square Error of Approximation (RMSEA) should be below .06, although others consider even a fit of .08 as adequate (Browne & Cudeck, 1993). The Standardized Root Mean Square Residual (SRMR) should be below .05 for good fit, although values up to .10 may be adequate (Hu & Bentler, 1995). Accordingly, the measurement model had a good fit to the data; χ^2 (360, N = 1241) = 974, $p < .05$, *SMSR* = .019, *RMSEA* = .037. The top-down

model imposed a single second-order factor with causal paths onto each of the nine domain factors. The model also included a causal path from life satisfaction to the second-order domain satisfaction factor. Overall fit of the top-down model was still good, although it did not fit the data as well as the measurement model; χ^2 (395, N = 1241) = 1284; *SMSR* = .046, *RMSEA* = .043. As predicted by the top-down model, life satisfaction was a strong predictor of the second-order factor of domain satisfaction, r = .87. The acceptable fit of the top-down model is remarkable and suggests that a sophisticated top-down model has the potential to account for the structure of CWB. This model would still imply that domain satisfaction has no causal effect on life satisfaction.

Empirical tests of bottom-up and top-down models

Correlations between LS and DS are insufficient to test the direction of causality. One solution to this problem is to include a third variable that has a direct effect on one construct, but not the other. In this case, the causal direction between LS and DS can be inferred by examining whether the third variable has an indirect effect on the other construct. For example, objective income is likely to have a direct effect on financial satisfaction. A bottom-up model predicts that income also influences life satisfaction because it assumes a causal effect of financial satisfaction on life satisfaction. In contrast, the top-down model assumes that an influence of income on financial satisfaction does not influence life satisfaction because domain satisfaction has no causal effect on life satisfaction. Subsequently, I discuss two studies that use this approach to test top-down and bottom-up models. One study includes a potential direct cause of global life satisfaction. The other study includes a potential direct cause of domain satisfaction.

An empirical test of the top-down model: Positive Illusions

One problem of the top-down model is the elusive nature of individual differences in life satisfaction under the assumption that individual differences in life satisfaction are not caused by domain satisfaction, personality, or method artifacts. Why are some people more satisfied with their lives independent of their satisfaction with important life

domains? One popular hypothesis in psychology is that individual differences in SWB are based on illusory self-perceptions (Taylor & Brown, 1988). However, support for this hypothesis is often based on questionable measures of illusions (Colvin & Block, 1994). To address this limitation, Schimmack and Sidhu (2006) developed a new measure of biased self-perceptions. This measure is based on the assumption that biases can only be assessed in comparison to an objective standard. Furthermore, biases in a single domain may be inappropriate measures of self-evaluative biases for two reasons. First, most of the variance in self-reports of a single domain may be due to measurement error. Second, even a single objective measure is influenced by measurement error. As a result, it is an imperfect measure to control for valid variance in self-ratings. To solve this problem it is necessary to measure biases in self-perceptions across a variety of independent attributes. To the extent that biases are positively correlated across independent attributes, it is highly probable that they reflect general self-evaluative biases. Schimmack and Sidhu (2006) obtained self-reports for four specific attributes (facial attractiveness based on a photo, jumping, intelligence, & trivia knowledge). In addition, objective measures of the four attributes were also obtained.

Initial analysis showed that individual differences in objective attributes were unrelated to each other and unrelated to life satisfaction. The finding for attractiveness replicates a study by Diener, Wolsic, and Fujita (1995). Bias measures were obtained by regressing self-ratings onto the objective measures and retaining standardized residuals. Bias scores were significantly correlated with each other and formed a single factor. This finding reveals the influence of a general self-evaluative bias on ratings of self-attributes. To obtain a measure of general self-evaluative biases, the four specific bias measures were averaged. The general evaluative bias was significantly correlated with life satisfaction, $r(98) = .28$, $p < .05$. Furthermore, life satisfaction was again highly correlated with averaged domain satisfaction, $r(98) = .60$. Based on these correlations, the top-down model predicts a correlation of $r(98) = .17$ between the bias measure and

domain satisfaction. The actual correlation was very similar, $r(98) = .16$. However, due to the small sample size, the confidence interval for the observed correlation is large. Furthermore, in a second study, that did not include the objective measures, but assessed evaluative bias several months prior to the assessment of life satisfaction and domain satisfaction, the correlations were identical, $r(163) = .21$. This finding suggests that the bias measure is a direct predictor of domain satisfaction. Furthermore, the strength of the correlation is weak. As a result, global evaluative biases account only for a small portion of the variance in LS, and of the correlation between LS and DS. Thus, the nature of the individual differences in life satisfaction remains elusive. In short, these results provide only modest support for the top-down model.

An empirical test of the bottom-up model: Income

Compared to the difficulty of finding direct predictors of global life satisfaction, it is easier to find objective characteristics of domains that influence domain satisfaction. However, once more large samples are needed to test the bottom-up model because a single objective characteristic will only have a small to moderate effect on global life satisfaction. One of the most extensively studied objective measures is income. Numerous studies show that income is correlated with financial satisfaction, and financial satisfaction correlates with life satisfaction (e.g., Diener & Oishi, 2000). However, both correlations are moderate. As a result, the bottom-up model predicts only a small effect of income on life satisfaction. Existing data are consistent with this prediction (Diener & Biswas-Diener, 2002; Hsieh, 2004). To further test this hypothesis, Schimmack (2006a) analyzed data from the 1999-2002 wave of the World Value Survey (Inglehart, Basanez, & Diez-Medrano, 2004). Over 60,000 respondents from 48 nations provided information about their life satisfaction, financial satisfaction, and relative income compared to the national average. Schimmack (2006a) standardized scores within nations to remove the influence of national differences on the results. Income was a moderate predictor of financial satisfaction, $r = .27$, and financial satisfaction was a strong predictor of life

satisfaction, r = .55. Based on these findings, a bottom-up model predicts a correlation of r = .15 (.55 x .27) between income and life satisfaction. The actual correlation was close to this prediction (r = .18). Separate analysis for each nation showed that the results were quite consistent across nations. The largest discrepancies were obtained in Serbia and South Africa. In both countries income was a stronger predictor of life satisfaction than predicted by the bottom-up model. Only one country (Brazil) showed a notable discrepancy that failed to support the bottom-up model.

An alternative explanation of the relation between income and life satisfaction could be that happy individuals earn more money (Diener & Biswas-Diener, 2002). As a result, a top-down model would also predict a correlated between income and financial satisfaction because life satisfaction influences both income and financial satisfaction. However, this model predicts only a correlation of r = .10 (.55 * .18) between income and financial satisfaction, whereas the actual correlation is significantly stronger (r = .27).

Further support for the bottom-up model stems from longitudinal evidence that income changes at least temporarily produce changes in life satisfaction (Di Tella, Heisken De New, & MacCulloch, 2006). These results suggest that LS-DS correlations are at least partially due to bottom-up processes.

An empirical test of the bottom-up model: A Dyadic Approach

Although the inclusion of objective predictors of domain satisfaction can be very informative, it is often difficult to specify or measure these variables. To address this problem, I proposed a dyadic approach to indirectly estimate the effect of objective domain characteristics on domain satisfaction (Schimmack, 2006). The dyadic approach is based on the familiar logic of twin studies that rely on dyadic similarity of twins to make inferences about genetic effects on SWB (Roysamb, Harris, Magnus, Vitterso, & Tambs, 2002). While dyadic similarity between twins reveals genetic influences, dyadic similarity between individuals who share the same environment, but are not genetically related reveals environmental influences. The indirect approach has two advantages over

the approach of directly measuring objective domain characteristics. First, it reveals effects of domain characteristics on domain satisfaction without the need to know *a priori* what these objective characteristics are. Similarly, twin studies reveal genetic effects without specifying the genes that produce these effects. Second, the indirect approach reveals the combined effects of several objective characteristics. As a result, the effects are stronger and it is possible to test bottom-up and top-down theories in smaller samples. Similarly, twin studies reveal strong genetic effects, while single genetic markers have much weaker relations to observable individual differences (Greenberg et al., 2000).

Married couples provide an ideal opportunity to test top-down and bottom-up models of SWB for several reasons. First, spouses are not genetically related (i.e., they are not blood-relatives). Thus, similarity between married couples cannot be due to genetic relatedness. Second, married couples share many objective determinants of domain satisfaction (e.g., household income, housing). Thus, one would expect high dyadic similarity for domain satisfaction. This is indeed the case, especially for marital satisfaction (e.g., Spotts et al., 2004). The bottom-up and the top-down model make different predictions about dyadic similarity in life satisfaction. The bottom-up model predicts that the common determinants of domain satisfaction that produce similarity in domain satisfaction produce spousal similarity in life satisfaction. In contrast, the top-down model assumes that domain satisfaction has no causal influence on life satisfaction. As a result, the objective factors that produce similarity in domain satisfaction do not produce similarity in life satisfaction. Consistent with the bottom-up model, numerous studies have reported moderate to high spousal similarity in life satisfaction (Bookwala & Schulz, 1996; Schimmack & Lucas, in press; Schimmack, Pinkus, & Lockwood, 2006).

One possible alternative explanation for spousal similarity in life satisfaction is positive assortative mating. Positive assortative mating assumes that spouses with similar traits are more likely to marry each other. Empirical data suggest that this is an unlikely

explanation for spousal similarity in life satisfaction. For example, spouses show similar changes in life satisfaction over a time interval of 20 years (Schimmack & Lucas, in press). While assortment can explain initial similarity, it fails to explain why changes in life satisfaction of one spouse predict similar changes in life satisfaction of the other spouse. Thus, spousal similarity in life satisfaction provides further support for bottom-up influences of domain satisfaction on life satisfaction.

An empirical test of the bottom-up model: An Introspective Approach

Schimmack, Diener, and Oishi (2002) used another approach to determine the causes of life satisfaction. The authors examined what respondents were thinking when they answered questions about life satisfaction. It is plausible that satisfaction in a particular domain has a causal influence on life satisfaction if respondents think about this domain during the judgment of life satisfaction. Consistent with bottom-up theories, respondents reported thinking about important domains (e.g., family) more than about unimportant domains (e.g., weather). Furthermore, participants' thoughts about domains moderated DS-LS correlations. That is, domain satisfaction predicted life satisfaction when respondents thought about a domain. This finding is consistent with bottom-up theories. In addition, the DS-LS correlations were low and not significant when participants did not think about a domain. This finding suggests weak top-down effects on DS-LS correlations because top-down effects do not require activation of domain knowledge during life satisfaction judgments.

Conclusion

In sum, studies of CWB have produced some fairly robust findings that any structural model of CWB needs to address. Most of these findings are consistent with bottom-up theories: (a) the significant effect of domain importance on LS-DS correlations, (b) reliable effects of objective domain characteristics assessed directly or indirectly on life satisfaction, and (c) reports that people are thinking about important life domains when judging life satisfaction. However, another reliable finding is that domain

satisfactions are systematically correlated, and that top-down models do a fairly good job at predicting these correlations. Thus, it is possible that a complete theory of CWB will include both bottom-up and top-down processes. Andrews and Withey (1976) proposed that both processes operate over time in a feedback loop. For example, an increase in salary may first boost financial satisfaction and in turn life satisfaction. As a result of the increased life satisfaction, satisfaction in other domains may increase without objective changes in these domains. Future research needs to test this hypothesis.

The Structure of Affective Wellbeing (AWB)

In 1969, Bradburn published his classic book titled *The structure of psychological well being*. The book laid the foundation for the distinction between positive affect (PA) and negative affect (NA) as independent components of SWB (Diener, 1984; Schimmack, in press; Schimmack, Bockenholt, & Reisenzein, 2002). Bradburn (1969) distinguished three types of independence, which I call *structural independence*, *causal independence*, and *momentary independence*. Structural independence means that "within a given period of time, such as a week or two, one may experience many different emotions, both positive and negative, and that in general there is no tendency for the two types to be experienced in any particular relation to one another" (Bradburn, 1969, p. 225). Structural independence is most often implied when PA and NA are distinguished in the SWB literature. Causal independence means that PA and NA are influenced by different causes. Finally, momentary independence means that momentary experiences of positive affect are independent of momentary experiences of negative affect.

Structural Independence of PA and NA

Bradburn (1969) provided first evidence for structural independence of PA and NA. He assessed PA and NA with five questions about experiences of positive affect (e.g., "I felt on the top of the world") and negative affect ("I felt depressed or very unhappy") over the past few weeks. Responses were made on a dichotomous yes/no scale. Correlations among these items show a pattern that has been replicated in numerous studies: (a)

positive correlations among positive affect items, (b) positive correlations among negative affect items, and (c) correlations close to zero between positive affect and negative affect items.

Diener's (1984) influential review of the literature noted several limitations of Bradburn's work. The main limitations were (a) the failure to control for the potential influence of response styles such as acquiescence biases, (b) the confounding of valence and arousal in measures of PA and NA, (c) the use of items that measure affect in specific situations rather than pure affect, and (d) the use of a dichotomous response format that records the simple occurrence of affect. Subsequently, I will review the evidence regarding the influence of these factors on tests of the structural independence of PA and NA.

Response Styles

Some researches have argued that the independence of PA and NA is a method artifact due to the influence of response styles on affect ratings (Green, Goldman, & Salovey, 1993). Rorer (1965) defined response styles as content-free tendencies to choose certain response categories. If some respondents consistently check yes independent of the item content, observed correlations will be biased in a positive direction. The yes/no response-format used by Bradburn may be especially susceptible to response biases. In an empirical test of this hypothesis, Green et al. (1993) observed a weak negative correlation between checklist measures of PA and NA (r = -.25), while other measures yielded much stronger negative correlations (r = -.84, after controlling for random measurement error). Based on these findings, Green et al. (1993) concluded that (a) checklists are heavily contaminated by response styles, and (b) PA and NA are not structurally independent.

It did not take long for Diener and colleagues to respond to this challenge. Diener, Smith, and Fujita (1995) conducted a multi-trait multi-method analysis of the structure of affective traits. The study used retrospective self-reports of affect in the past month, averaged daily diary ratings of affect over a six-week period, and aggregated informant

ratings by three or more family members and friends. The main finding of this study was that the method-free correlation between PA and NA was considerably weaker than the one obtained by Green et al. (1993), r = -.44. In addition, there was no evidence that self-ratings were contaminated by response styles (Schimmack et al., 2002). Subsequent studies have provided further evidence that response styles are too weak to account for the structural independence of PA and NA (Schimmack, 2003, in press; Schimmack et al., 2002; Watson & Clark, 1997).

Influence of Arousal

Numerous authors have proposed that the relation between PA and NA varies as a function of the specific items that are used to measure PA and NA (e.g., Russell & Carroll, 1999). The argument is that some measures of PA and NA are limited to arousing PA (e.g., excited) and arousing NA (e.g., nervous). Structural independence for these measures is the result of a strong negative correlation for the valence component (positive vs. negative) and a strong positive correlation for the shared arousal component (Schimmack & Reisenzein, 2002). In contrast, measures that do not share a common arousal component (e.g., happy, sad) should be highly negatively correlated. Empirical support for this hypothesis is modest. Watson (1988) found that structural independence of PA and NA varied with the item content of different PA and NA measures, but the effect was moderate. This finding has been replicated in numerous studies (Diener, Smith, & Fujita, 1995; Schimmack, Oishi, & Diener, 2002; Schimmack, 2003). For example, Schimmack (2003) averaged momentary ratings of happiness, sadness, excitement, and worry in an experience sampling study. Whereas the correlation for excitement and worry was slightly positive r = .12, the correlation for happiness and sadness was slightly negative, r = -.12.

Additional evidence stems from a study by Schimmack (2006c) that administered the *Positive Affect Negative Affect Schedule* scales (PANAS, Watson et al., 1988), the *Hedonic Balance Scale* (HBS; Schimmack, Diener, & Oishi, 2002), and the *Satisfaction*

with Life Scale (SWLS, Diener et al., 1985). The PANAS is considered a measure of high arousal PA and NA (Watson, Wiese, Vaidya, & Tellegen, 1999). In contrast, the HBS was developed to measure pure valence of affective experiences. The HBS assesses PA and NA with three items each (PA = positive, pleasant, good; NA = negative, unpleasant, bad). Respondents were asked to report how they typically feel (e.g., I tend to feel distressed). PANAS and HBS measures of PA and NA demonstrated convergent validity (PA $r(111) = .71$; NA $r(111) = .64$). The PANAS scale showed perfect structural independence of PA and NA $r = -.06$. In contrast, the HBS measures of PA and NA were slightly negatively correlated, $r = -.23$. However, the HBS scales had higher predictive validity of life satisfaction. The HBS scales accounted for 23% of the variance in life satisfaction and the PANAS scales added 1% of unique variance, which was not significant. PANAS scales accounted for 17% of the variance, and the HBS scales added 7%, which was a significant increase. Lucas, Diener, and Suh (1996) obtained similar findings of better discriminant validity, but lower predictive validity for the PANAS measure than for other measures of PA and NA. In sum, there is some support for the hypothesis that measures that include arousal provide better support for structural independence than purer measures of hedonic valence. However, even pure measures that are not contaminated with arousal support the hypothesis of structural independence of PA and NA.

Response Formats

Arguably, the most important moderator of the correlation between PA and NA is the response format that researchers use to assess PA and NA (Schimmack, in press; Schimmack, Bockenholt, et al., 2002). Correlations range from -.9 with bipolar response formats (e.g., strongly disagree to strongly agree; Green et al., 1993) to +.6 for open-ended questions about absolute frequencies (Schimmack et al., 2000). The influence of response formats on structural analysis was first noticed by Meddis (1972), who distinguished symmetrical and asymmetrical response formats. He observed that

symmetrical formats produce stronger negative correlations between PA and NA than asymmetrical formats. Researchers have interpreted this finding differently. Russell (1980) relied on Meddis's response format to argue that PA and NA are bipolar opposites rather than independent affective states. Others have proposed that symmetrical formats are interpreted by respondents as bipolar response formats, which renders them useless for structural analysis of affect (Russell & Carroll, 1999; Schimmack, Bockenholt et al., 2002).

Variations in the interpretation of response formats may also explain other findings in structural analyses of the affective component of SWB. Warr, Barter, and Brownbridge (1983) changed Bradburn's original response format from a simple yes/no format to a four-point format that asked about the proportion of time these experiences were experienced (i.e., 1 = little or none of the time to 4 = most of the time). As a result, PA and NA were negatively correlated (r = -.54). In contrast, Andrews and Withey (1976) changed the dichotomous format to a frequency format. If participants answered yes, they also were asked how often the experience occurred. This format essentially replicated Bradburn's (1969) original finding of structural independence. Similar results were obtained in a study that compared ratings of the amount of affect (very slightly, very much) with Warr et al.'s (1983) proportion-of-time measure (Watson, 1988). Once more the proportion of time measure produced a stronger negative correlation (r = -.48) than the other format (r = -.13). It is possible that some respondents interpret the proportion-of-time measure as a bipolar scale (i.e., "How much of your time do you experience positive affect *in proportion* to the time that you experience negative affect?"). As a result, the PA measure would be contaminated with NA and the NA measure would be contaminated with PA, which will bias the correlation in a negative direction.

Even frequency formats do not guarantee pure assessments of PA and NA. Retrospective reports of affect are difficult because people do not know the objective quantity of their past affective experiences (Schimmack, 2002). As a result, most studies

rely on vague quantifiers to assess frequencies (e.g., often, rarely, very little, very much). Schimmack et al. (2000) suggested that vague quantifiers produce contaminated measures of PA and NA because respondents need a comparison standard to use vague quantifiers. What does it mean to experience happiness *often*? One way to define this question is to judge the frequency of one emotion in comparison to other emotions. This comparison leads to contaminated measures of PA and NA because the rating of PA relies on the amount of NA as a standard of comparison.

Schimmack et al. (2000) provided some evidence for this hypothesis. Two studies examined frequency judgments of prototypical emotions (e.g., happiness, pride, affection, sadness, anger, disappointment). Some ratings were based on absolute frequency estimates (e.g., five times a week) whereas others were based on vague quantifiers (e.g., vary rarely to very often). Vague quantifier ratings systematically produced more negative correlations than the absolute estimates. Additional evidence was provided by a regression analysis of retrospective ratings of emotions onto aggregated absolute daily estimates over a three-week period. Regression analyses revealed that vague quantifier ratings were not only positively related to daily frequencies of the same affect, but also negatively related to daily frequencies of the other affect. However, this effect was weak to moderate suggesting that it has a relatively weak effect on structural analysis of AWB.

The contamination of PA and NA measures may also explain cultural variation in the correlation between PA and NA (Schimmack, Oishi, & Diener, 2002). The moderate negative correlation observed in many North American studies is also observed in many collectivistic cultures, but is weaker in East Asian cultures. This difference may be due to dialectic thinking in Asian cultures. Dialectic thinking sees opposites as complementary rather than contradictory, which makes it less likely that people contrast PA with NA. As a result, PA and NA measures should be less contaminated with the opposing affect, leading to weaker negative correlations. This interpretation is consistent with the finding that ratings of momentary experiences do not show the same cultural bias (Scollon,

Diener, Oishi, & Biswas-Diener, 2005). In conclusion, these findings suggests that asymmetric response formats with vague quantifiers are suitable to examine the structure of trait affect, but that this method is likely to produce a negative bias. In other words, PA and NA may appear to be negatively related if they are in fact structurally independent.

Discrete Emotional Experiences versus Mood

Emotion researchers increasingly distinguish between emotions and moods (Frijda, 1993; Reisenzein & Schonpflug, 1992; Schimmack & Crites, 2005; Schimmack, Oishi, Diener, & Suh, 2000). Schimmack et al. (2000) pointed out that structural analyses of affect may produce different results for emotions and moods. One main reason is that emotional episodes are rare and elicited by events. As a result, the times people experience positive emotions does not limit the time people can experience negative emotions.

In contrast to emotional experiences, moods are more common. This is especially true for positive moods. Most people are happy rather than unhappy, and at any moment in time, most people reports being in a positive mood without unpleasant feelings (Diener & Diener, 1996). As discussed in more detail below, positive moods and negative moods are also inversely related at any moment in time. As a result, the amount of unpleasant moods is likely to restrict the amount of pleasant moods, which would produce an inverse relation between PA and NA for measures of pleasant and unpleasant mood. Empirical studies support this prediction. Schimmack et al. (2000) used a multi-method study with retrospective and daily assessments of the time participants were in a pleasant and an unpleasant mood. Eid (1995) assessed momentary ratings of pleasant mood and unpleasant moods on four different occasions several weeks apart and estimated the general tendency to be in a good or bad mood using latent variable analysis. Both studies yielded substantial negative correlations (*r*s = -.58 to -.92). In sum, positive mood and negative mood are not strictly independent. However, even positive mood and negative mood are distinct dimensions of AWB.

Structural Independence: Summary

The existing evidence leads to the following conclusions. First, response styles have a small influence on structural analyses of PA and NA. Second, item content influences the results. The more items assess pure valence and focus on pervasive moods rather than emotional episodes, the more negative is the correlation between PA and NA. Third, bipolar interpretations of response formats introduce negative biases that lead to an overestimation of the negative dependence between PA and NA. Finally, PA and NA are clearly separable components of affective wellbeing, although they may not be strictly independent as originally postulated by Bradburn (1969).

Causal Independence of PA and NA

Bradburn (1969) provided the first evidence that positive affect and negative affect are related to different predictors. Illness was more strongly related to NA than to PA. In contrast, positive social interactions were positively related to PA and unrelated to NA. These findings have been replicated in numerous studies with different measures of PA and NA (e.g., (Clark & Watson, 1988). In an experience sampling study, Schimmack, Coleman, and Diener (2000) found that this was also the case when PA and NA were assessed with pure indicators of hedonic tone, namely feeling pleasant and feeling unpleasant.

Another common finding is that PA and NA are related to different personality traits. Whereas neuroticism is more strongly related to NA than PA, extraversion is often a better predictor of PA than NA (Costa & McCrae, 1980; Diener & Emmons, 1984; Schimmack, 2003; Watson, 2000; Watson & Clark, 1992), although some studies find that extraversion is equally strongly related to PA and NA (Flory, Manuck, Matthews, & Muldoon, 2004). The relations of PA and NA to extraversion and neuroticism are particularly important for SWB researchers due to the extensive literature on the genetic and biological determinants of these personality traits. This literature can be useful in the search for the distinct neurological substrates of PA and NA. Behavioral genetics studies

of neuroticism and extraversion reveal different genetic dispositions for extraversion and neuroticism (McCrae, Jang, Livesley, Riemann, & Angleitner, 2001). Recent studies of genetic markers suggest that a gene that influences the neurotransmitter serotonin in the brain is more strongly linked to neuroticism than extraversion (Greenberg et al., 2000). Pharmacological interventions that influence the serotonergic system often show effects on neuroticism and extraversion, but the effect on neuroticism is stronger (Bagby, Levitan, Kennedy, Levitt, & Joffe, 1999; De Fruyt, Van Leeuwen, Bagby, Rolland, & Rouillon, 2006; Du, Bakish, Ravindran, & Hrdina, 2002).

A few studies have directly linked PA and NA to biological measures. The most comprehensive study so far assessed levels of PA and NA in a daily diary study over one week (Flory et al., 2004). Serotonin levels were assessed with an indirect biological challenge. Serotonin levels predicted PA and not NA. Although this finding is consistent with causal independence of PA and NA, it is inconsistent with the hypothesis that serotonin makes a unique contribution to NA. In sum, there is considerable evidence for causal independence of PA and NA from psychological studies, but the evidence for distinct neurological substrates of PA and NA is mixed.

Momentary Independence

Momentary independence refers to the relation between PA and NA at one moment in time. Numerous authors have pointed out that structural independence and momentary independence examine different questions (Bradburn, 1969; Diener & Emmons, 1984; Russell & Carroll, 1999; Schimmack & Diener, 1997). PA and NA can be independent over extended time periods, even if they are fully dependent at each moment. For example, even if love and hate were mutually exclusive at one moment in time, some individuals could experience more love and more hate over extended periods of time than others (Bradburn, 1969; Schimmack & Diener, 1997).

Diener and Iran-Nejad (1986) conducted the first rigorous study of momentary independence. Participants reported the intensity of various emotions in response to

everyday events in an event-sampling study. The study revealed a pattern that has been replicated in numerous studies (e.g., Larsen, McGraw, & Cacioppo, 2001; Larsen, McGraw, Mellers, & Cacioppo, 2004; Schimmack, 2001, 2005; Schimmack, Coleman, & Diener, 2000). Participants reported PA and NA in response to the same event, but only at low to moderate intensities. Reports of intense PA and intense NA were virtually absent. Diener and Iran-Nejad (1986) proposed a neurobiological model to account for this pattern. Accordingly, PA and NA are based on different neurobiological processes, but momentary activation of one system momentarily inhibits activation of the other system.

Other factors may also account for the absence of intense PA and intense NA. Schimmack (2001) explained reports of concurrent pleasant and unpleasant experiences as a function of different baseline levels of the two affects. Typically people are in a moderately good mood. In response to a negative event, negative mood is elicited and pre-existing pleasant mood is reduced, but not eliminated.

Another potential mechanism is attention (Schimmack & Colcombe, 1999). Intensity of affective experiences increases with attention to the eliciting stimulus (Diener, Colvin, Pavot, & Allman, 1991). As attention is limited, it is impossible to attend fully to positive and negative aspects of the same situation. As a result, conflicting responses to positive and negative aspects are less intense than responses to a single positive or negative aspect.

Finally, some affective cues are intrinsically bipolar. These cues can still elicit mixed responses if they are paired with another bipolar cue. For example fast music elicits happiness, whereas slow music elicits sadness. Similarly, music in major mode elicits happiness, whereas music in minor mode elicits sadness. Music that combines conflicting cues (e.g., fast music in minor mode) elicits mild happiness and mild sadness (Hunter, Schellenberg, & Schimmack, 2006). However, it is impossible to elicit intense

happiness and intense sadness with music, because fast tempo reduces sadness and minor mode reduces the intensity of happiness.

The postulated inhibition processes have interesting implications for SWB research. Many situations are complex and may elicit PA or NA (e.g., having a headache at a party). In these situations, the inhibitory processes will determine whether an individual experiences relatively more PA or NA. Thus, these processes contribute to the amount of PA and NA that individuals experience over time. For example, some studies link neuroticism to a tendency to attend more to negative, especially threatening stimuli (Derryberry & Reed, 1994). Thus, one reason for the link between neuroticism and NA could be a tendency of neurotics to attend more to the negative stimuli in their environments (Diener et al., 1999).

Conclusion

Structural theories of SWB assume that PA and NA are independent. Empirical research is broadly consistent with this assumption. Although PA and NA are sometimes not strictly independent or orthogonal (r = .00), negative correlations are often weak to moderate. Furthermore, PA and NA have distinct causes and can even co-occur at the same moment, although not at full intensity. The main implication of this finding is that an individual with high PA does not necessarily have low NA and vice versa. Therefore, a full understanding of SWB requires an assessment of PA and NA. Furthermore, interventions that influence one component may have no effect or even opposing effects on the other component. Future research needs to examine both the separate causes of PA and NA as well as the causes that influence both affects.

The Relation Between Cognitive and Affective SWB

The cognitive component and the affective component of SWB correlate positively with each other. The magnitude of this correlation varies widely from .1 to .8 (Lucas et al., 1996; Schimmack, Diener, & Oishi, 2002; Schimmack, Radhakrishnan, Oishi, Dzokoto, & Ahadi, 2002; Suh, Diener, Oishi, & Triandis, 1998). Some of this variability

is due to methodological factors. Less reliable scales like Bradburn's (1969) Affect Balance Scale produces weaker correlations than other measures of affect, and correlations that control for random measurement error are higher than observed correlations (e.g., Schimmack, Radhakrishnan, et al., 2002; Suh et al., 1998). However, methodological factors do not fully account for the lack of a perfect correlation between the two components. Multi-method studies generally demonstrate discriminant validity of the two component of SWB (Lucas, Diener, & Suh, 1996). That is, measures of the same construct (e.g., life satisfaction & life satisfaction) correlated more highly with each other than measures of different constructs (e.g. life satisfaction & affect) across different methods (e.g., self-ratings & informant ratings).

Suh, Diener, Oishi, and Triandis, (1998) provided a theoretical explanation for this finding. They proposed that people in part directly rely on the affective component to judge life satisfaction. In addition, people can rely on other information (e.g., cultural norms, domain satisfaction) to judge life satisfaction. The correlation between the affective and cognitive component depends on the weight that people attach to the different types of information when they judge life satisfaction. This model accounts for cultural variation in the relation between the affective and cognitive component. The correlation is stronger in more individualistic, developed, and modern cultures (e.g., r = .57 in Western Germany) than in less individualistic, less developed, and more traditional cultures (e.g., r = .22 in India). This finding is consistent with evidence that development leads to a change in people's value orientation from materialism (i.e., fulfillment of basic needs) to post-materialistic values such as the maximization of SWB (Inglehart, 1997).

The affective component and the cognitive component are also influenced by different causes. Headey et al. (1984) found that changes in domain satisfaction were a better predictor of changes in the cognitive component of SWB than in the affective component of SWB. One possible explanation for this finding could be shared method variance between judgments of domain satisfaction and life satisfaction. To explore this

possibility, Schimmack (2006d) examined the relation between life satisfaction, hedonic balance, and domain satisfaction in a sample of college students. Average domain satisfaction was more highly correlated with life satisfaction, r = .69, than with hedonic balance, r = .55. To control for method effects, satisfaction with weather and traffic were entered before entering the other domains. This hierarchical regression analysis revealed that hedonic balance accounted for 34% of the variance, weather and traffic added 2%, and the remaining domains added 22%. This finding suggests that objective determinants of domain satisfaction (e.g., income) should have a stronger influence on life satisfaction than on the affective component of wellbeing. Future research needs to test this hypothesis.

Other studies have identified stronger predictors of the affective than the cognitive component of SWB. Schimmack, Diener, and Oishi (2002) proposed that personality traits, especially extraversion and neuroticism, primarily influence the affective component of SWB. They influence the cognitive component only to the extent that people rely on the affective component to evaluate their lives. This model predicts that personality measures correlated more strongly with the affective component than the cognitive component of SWB. This prediction has been confirmed in several studies (Schimmack, Diener, & Oishi, 2002; Schimmack, Radhakrishnan, et al., 2002). Further evidence stems from Schimmack's (2006d) study of a large college sample (N = 1241). Neuroticism and extraversion were stronger predictors of affective balance, r = -.54, .39, than life satisfaction, r = -.27, .26, respectively.

This pattern may be partially explained by the inclusion of affective items in measures of Extraversion and Neuroticism (Pytlik Zillig, Hemenover, & Dienstbier, 2002). However, affective items are only included in measures of Extraversion and Neuroticism because these items are highly related to other indicators of these traits. Thus, the strong relationship between personality and affect is not a mere artifact. Rather it suggests that there exist stable affective dispositions. These dispositions have a direct

effect on the affective component of SWB, but only an indirect effect on the cognitive component of SWB. This model accounts for two other findings in the SWB literature. First, personality is a weaker predictor of life satisfaction in cultures that rely less on the affective component to judge life satisfaction Schimmack, Radhakrishnan, et al., 2002). Second, the cognitive component is less stable over time than personality traits (Fujita & Diener, 2005).

Conclusion

This chapter examined the structural relations between various components of SWB. These components can be roughly divided into cognitive components (life satisfaction & domain satisfaction) and affective components (positive affect & negative affect). This chapter revealed numerous robust structural relations among these components. Domain satisfaction and life satisfaction are highly correlated even after controlling for shared method effects and common influences of personality traits. At least some of this relation is due to bottom-up influences of domain satisfaction on life satisfaction. Thus, changes in domain satisfaction are likely to produce changes in life satisfaction. It is also possible that top-down processes contribute to the LS-DS correlation, although evidence for top-down effects is less conclusive. On the affective side, positive affect and negative affect are separable components of SWB with distinct causes, although they may not be strictly independent, especially in momentary assessments of affect. Personality traits, especially neuroticism and extraversion, appear to have a stronger influence on the affective component of SWB than the cognitive component of SWB. Indeed, the relation between personality and the cognitive component of SWB is often fully mediated by the affective component, presumably because people rely on the affective component to judge life satisfaction. In contrast, domain satisfaction is a stronger determinant of life satisfaction than affective wellbeing. The review also revealed the need for more powerful research designs to elucidate the causal processes underlying the structure of SWB. Longitudinal studies that reveal

changes in wellbeing in combination with dyadic designs that allow separating personality/genetic from situational/environmental influences are especially promising (Nes, Roysamb, Tambs, Harris, & Reichborn-Kjennerud, 2006; Schimmack & Lucas, in press).

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Figure 1

Causal models of the relation between life satisfaction and domain satisfaction.