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RESEARCH PAPER

The Genetic Overlap and Distinctiveness of Flourishing and the Big Five Personality Traits

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Abstract The growing evidence that subjective well-being (SWB) produces an array of beneficial outcomes has increased requests for recommendations on how to promote it. Evidence that all of SWB's genetic variance overlaps with personality led to the strong claim that it is a 'personality thing' and that personality is the strongest predictor of SWB. However, studies do not include a comprehensive assessment that reflects eudaimonic as well as hedonic SWB. We revisit the question of SWB's complete overlap with personality employing the tripartite model—emotional, psychological, and social—of SWB that, together, reflect Keyes' (2002) model of flourishing. Data are from the Midlife in the United States national sample of 1,386 twins. Analyses were done using Mx to test Cholesky decomposition models and a two latent factor common pathway model. One-third of the total (72 %) heritability of flourishing and 40 % of its environmental variability are distinct from the big-five personality traits. We also find a low phenotypic association (mean r = .22) between the three dimensions of SWB and big-five personality traits despite substantial shared genetic etiology. In addition to non-trivial amounts of distinctive genetic and environmental variance and low phenotypic correlation, we point to limited investigation of reciprocal causation of SWB and personality. Psychologist should not yet conclude that SWB is a 'personality thing' anymore than personality might be a 'well-being thing'.

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1 Introduction

Subjective well-being (SWB) represents individuals' evaluations of the quality of their lives and functioning in life. The nature of SWB has been divided into two streams of research. The first equates well-being with feeling good; the second equates well-being with functioning well in life. These two streams of research grew from distinct philosophical viewpoints on happiness—one reflecting the hedonic tradition that championed pleasure, or positive emotions, and the other reflecting the eudaimonic tradition that championed virtue, or trying to live up to standards of a good life as an individual and a citizen (Ryff 1989; Keyes et al. 2002).

The hedonic tradition is reflected in research on *emotional* well-being, where scholars use measures of satisfaction with life and positive affect (Kahneman et al. 2003). The tradition of eudaimonia is reflected in research on *psychological* well-being (PWB; Ryff 1989) and *social* well-being (Social WB; Keyes 1998) well-being. Here, scholars use multidimensional scales that ask individuals to evaluate how well they see themselves functioning in life as they do, or do not, strive to live up to secular standards of excellence such as purpose, contribution, integration, autonomy, intimacy, acceptance, and mastery in life. When subjective well-being is measured comprehensively, data support the tripartite model of emotional, psychological, and social well-being in general and specialized samples in the US and abroad (Gallagher et al. 2009; Joshanloo et al. 2013; Lamers et al. 2011).

Despite evidence of the multidimensional structure of SWB and that the combination of feeling good with functioning well produces better public health outcomes than simply feeling good, the experts (Diener and Seligman 2004; Helliwell et al. 2012) continue to recommend measuring only hedonic well-being in important national endeavors. This is unfortunate because the growing evidence that SWB is beneficial (Keyes and Simoes 2012; Lyubomirsky et al. 2005) has focused interest in its etiology for its promotion in communities and nations. Over 90 % of adults in the US and UK, for example, feel 'very' or 'quite happy' about life (Layard 2005), but feeling good without functioning well is not connected with as beneficial outcomes as flourishing—i.e., feeling good about a life in which one is functioning well (see Fredrickson et al. 2013; Keyes and Annas 2009; Keyes and Simoes 2012). Put simply, many people are now asking how they can promote more flourishing in their family, workplace, community, and nation.

1.1 Lines of Etiological Research

Two lines of etiological research are relevant to the current paper: behavioral genetics and personality. The literature on the genetic and environmental etiology of SWB has focused on the EWB (i.e., hedonic) components of satisfaction with life and positive affect, with evidence suggesting that common genes underlie life satisfaction and positive affect (Bartels and Boomsma 2009). Broad heritability estimates have ranged from 36 to 56 %. Hitherto, no study has found evidence for strong family environment effects, and only one has found support for gender-specific effects with slightly higher heritability among females (Røysamb et al. 2002).

Diener (1984) argued for more attention to "top-down" models for explaining SWB, because psychological characteristics, in general, and personality, in particular, explained more variance in SWB than "bottom-up" approaches that focus on external conditions like income and life events. Since that review, numerous studies have linked personality, and particularly the big five personality traits (McCrae and John 1992)—openness, conscientiousness, extraversion, agreeableness, and neuroticism—to SWB. Since Diener's (1984) review, studies have shown that "personality traits exhibit some of the strongest relations with SWB, and it appears that genes may be partly responsible for these relations" (Diener et al. 1999, p. 282).

The big five personality traits are also heritable, with broad heritability estimates in the range of 40–60 % (Loehlin et al. 1998), which is similar to broad heritability estimates for SWB. Weiss et al. (2008) tested the top-down hypothesis using the Midlife in the United States (MIDUS) sample of adult twins, the same dataset that is used in the current paper. In confirming the top-down hypothesis, Weiss and colleagues found that none of the genetic variance in their measure of SWB was unique from personality. This led them to conclude, as captured in the title of their paper, that "happiness is a personality thing."

However, Weiss et al. (2008) used a three-item measure that reflects the emotional dimension of SWB. Two items asked about satisfaction, one with life overall, the other with life at present. The third item asked about control over one's life. Weiss and colleagues claimed these three items conventionally represent SWB. Indeed, two of the three items (i.e., the satisfaction items) clearly represent the *hedonic* conception of SWB; the single item regarding control over life may appear to resemble Ryff's (1989) dimension of environmental mastery. However, a single item about but control over life does not drill down as deeply or broadly as the items that measure the psychological well-being (PWB) dimension of environmental mastery (e.g., "that I'm able to manage my daily responsibilities"). Moreover, evidence for shared genes between hedonic SWB and the big five personality traits may reflect shared genes for structural affectivity, because extraversion and neuroticism have been shown to represent structural sensitivity to positive and negative affect respectively (Watson and Clark 1992).

We therefore believe the genetic version of the top down hypothesis for personality and SWB needs to be revisited. We question if SWB, when measured comprehensively, completely reflects personality due to shared genetic variance. We predict moderate distinctiveness of genetic and environmental variance on the grounds that many aspects of flourishing reflect meaning in life (e.g., my life has purpose and direction; I am able to contribute something of value to my community). Yet, we would expect considerable genetic and environmental overlap of flourishing with personality because both constructs reflect individual's functioning in life. In general, personality reflects a characteristic way of functioning in life (e.g., conscientiously, agreeably, openly), while aspects of SWB reflect how well one is functioning relative to standards of living well (e.g., contribution to and integration in society, personal autonomy, mastery, and acceptance). Thus, personality and SWB share in common the process of functioning in life. Yet, there are distinctive facets between the two, with personality reflecting the "how" aspect of functioning while SWB reflecting the meaning in life that accrues from the "how well" one is functioning in life. We hypothesize distinctive as well as shared genetic and unique environmental variance between personality and the SWB that comprises flourishing.

2 Methods

2.1 Sample

About 50,000 households that were representative of the US population were screened to determine if they knew of immediate relatives who were members of twin pairs. Inclusion criteria included being first-degree relatives of the original contact or the contact's partner, being in the 25–74 age range, living in the continental United States, having a telephone, and being fluent in English. Among the screened households, 14.8 % had twin pairs, of which 60 % gave permission for the twins to be contacted. Zygosity was determined using self-report questions shown to have high accuracy (Lykken et al. 1990). The ethnic composition of the same-sex twin sample was 84.7 % White (non-Hispanic), 4.4 % Black, and 1.8 % other minority. The study complied with Institutional Review Board standards of the University of Wisconsin and Harvard Medical School. Informed consent was obtained from participants.

The twin sample examined in this report included a total of 1,386 twins from same-sex twin pairs. Given the low power to detect qualitative gender effects (Prescott and Gottesman 1993), we excluded opposite-sex dizygotic twins from this analysis. The resulting sample contained 670 complete pairs (46 individual twins without their co-twin). The 49 same-sex twin pairs (or 98 individual twins from a same-sex pair) that are missing from the present analyses come from 23 twin pairs (or 46 individual twins) without their co-twin and 26 twin pairs (or 52 individual twins) with missing data on at least one pertinent measure. The complete same-sex twin pairs comprised 186 female monozygotic (MZ), 198 female dizygotic (DZ), 163 male MZ, and 123 male DZ twins. Their mean age was 44.6 (SD = 12.2).

2.2 Measures

2.2.1 Subjective Well-Being

Table 1 provides the specific items for the three dimensions of SWB. Emotional well-being was a seven-item scale ($\alpha = .88$), comprising six items for positive affect and a single item of life satisfaction. Psychological well-being was the sum of the six subscales comprised of three items each ($\alpha = .76$; Ryff and Keyes 1995). Social well-being was the sum of the five subscales comprised of three items each ($\alpha = .72$; Keyes 1998).

2.2.2 Personality

The MIDUS used the adjective approach, which has shown good reliability and validity (Briggs 1992; Goldberg 1992). In the self-administered questionnaire, respondents were asked to rate how well an adjective described them, with these options: 1 (*a lot*), 2 (*some*), 3 (*a little*), to 4 (*not at all*). We reversed the scoring except for items that loaded negatively on their trait. The adjectives used were *creative, imaginative, intelligent, curious, broad-minded, sophisticated*, and *adventurous* (openness to experience); *organized, responsible, hardworking*, and *careless* (conscientiousness), *outgoing, friendly, lively, active*, and *talkative* (extraversion); *caring, helpful, warm, sympathetic*, and *soft-hearted* (agreeableness); and *moody, worrying, nervous*, and *calm* (neuroticism). Internal reliabilities of all

Table 1 Items measuring the dimensions of the of the tripartite model of subjective well-being

Emotional well-being	Psychological well-being	Social well-being
Positive affect During the last 30 days, how much of the times—"all," "most," "some," "a little," or "none of the time"—did you feel … (1) Cheerful, (2) In good spirits, (3) Extremely happy, (4) Calm and peaceful, (5) Satisfied, and (6) Full of life	*Self-acceptance* I like most parts of my personality When I look at the story of my life, I am pleased with how things have turned out so far In many ways, I feel disappointed about my achievements in life. (–)	*Social acceptance* People who do a favor expect nothing in return People do not care about other people's problems. (–) I believe that people are basically kind
Life satisfaction Rate your life overall these days on a scale from 0 to 10, where 0 = "worst possible life overall" and 10 = "the best possible life overall."	*Personal growth* For me, life has been a continuous process of learning, changing, and growth I think it is important to have new experiences that challenge how I think about myself and the world I gave up trying to make big improvements changes in my life a long time ago. (–)	*Social growth* The world is becoming a better place for everyone. Society has stopped making progress. (–) Society isn't improving for people like me. (–)
	Purpose in life Some people wander aimlessly through life, but I am not one of them I live life one data at a time and don't really think about the future. (–) I sometimes feel as if I've done all there is to do in life. (–)	*Social contribution* I have something valuable to give to the world My daily activities do not create anything worthwhile for my community I have nothing important to contribute to society. (–)
	Environmental mastery The demands of everyday life often get me down. (–) In general, I feel I am in charge of the situation in which I live I am good at managing the responsibilities of daily life	*Social coherence* The world is too complex for me. (–) I cannot make sense of what's going on in the world. (–) I find it easy to predict what will happen next in society
	Autonomy I tend to be influenced by people with strong opinions. (–) I have confidence in my own opinions, even if they are different from the way most other people think I judge myself by what I think is important, not by the values of what others think is important	*Social integration* I don't feel I belong to anything I'd call a community. (–) I feel close to other people in my community My community is a source of comfort

Table 1 continued

Emotional well-being	Psychological well-being	Social well-being
	Positive relations with others	
	Maintaining close relationships has been difficult and frustrating for me. (–)	
	People would describe me as a giving person, willing to share my time with others	
	I have not experienced many warm and trusting relationships with others. (–)	

A negative sign in parenthesis indicates this item is reverse coded before summed together with the remaining items. Response options for the Psychological and Social Well-Being scales ranged from strongly disagree (1), moderately disagree (2), or slightly disagree (3) to neither agree nor disagree (4), slightly agree (5), moderately agree (6), to strongly agree

personality scales were $\geq$.74 except for conscientiousness ($\alpha = .58$). We computed the mean score for each trait scale.

2.3 Analytic Plan

We use structural equation models to determine the genetic and environmental sources of personality traits and well-being levels. The phenotypic variance in traits and well-being comprises three factors: additive genetic effects (A), shared environmental effects (C), and unique environmental effects (E) (Kendler and Prescott 2006). Additive genetic effects reflect the cumulative influence of genes only. Shared environment reflects family and community experiences that increase similarity in twins who are raised together. Unique environment includes environmental experiences not shared by members of a twin pair and item-specific measurement error.

Our multivariate twin model examined personality and well-being as outcomes. The three measures of SWB were modeled using a single latent factor with additive and non-common environmental sources (Kendler et al. 2011; Keyes et al. 2010). For computational convenience, all the continuous variables in these analyses were converted to five-category polychotomies. First, we fit a bivariate model (see Fig. 1, Model A) between each personality trait and the latent common factor of SWB, with the phenotypic correlation between SWB and personality decomposed into genetic and environmental components.

Next, we fit a six variable Cholesky decomposition model (see Fig. 1, Model B). The first five variables were the personality traits (in the order—OCEAN), and the sixth variable was the latent SWB common factor. This approach enables the calculation of the proportion of genetic and environmental variance in SWB that was unique versus shared with the big five personality traits factors, considered one at a time. Last, we fit a bivariate model that included two latent variables: a common personality factor and a common SWB factor (see Fig. 1, Model C). In this model, the A and E paths to SWB reflect variance that impacts on SWB and that is not shared with genetic and environmental influences on the common personality factor.

In studying both same-sex male and female twins, we investigated quantitative gender effects, enabling estimation of gender differences in genetic and environmental parameters. Twin-model fitting was done in Mx (Neale et al. 2003). The purpose of model fitting is to

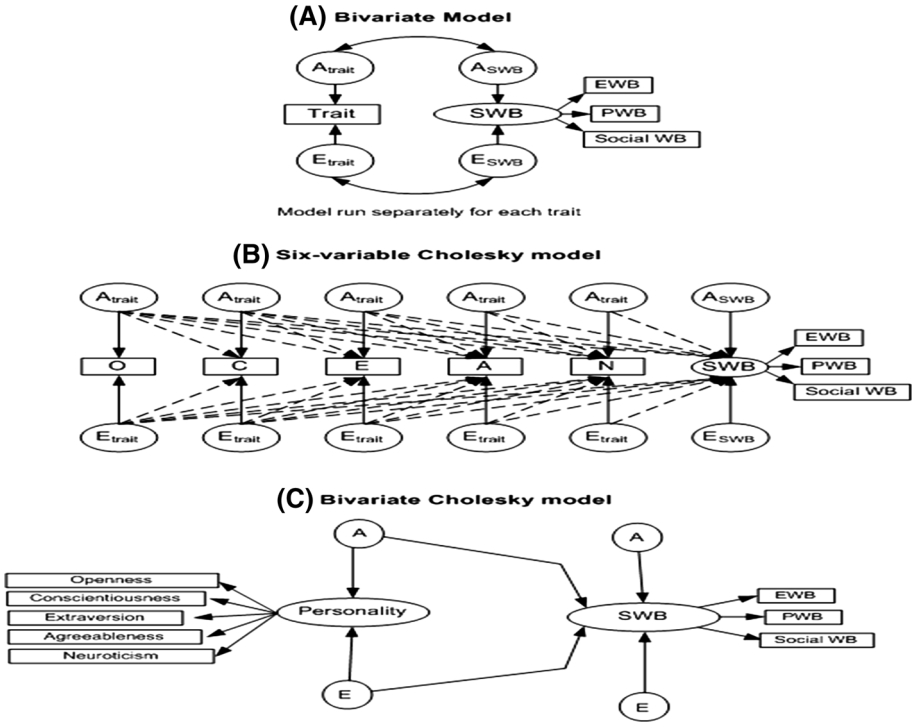

Fig. 1 Structural equations models used to test for shared and unique variance

Table 2 Phenotypic correlations and descriptive statistics of subjective well-being and the big five personality traits with twin correlations in the diagonal (r_{MZ}/r_{DZ})

	1	2	3	4	5	6	7	8
1. Emotional WB	.39/.21							
2. Psychological WB	.59	.54/.19						
3. Social WB	.41	.51	.44/.22					
4. Agreeableness	.17	.20	.11	.18/.02 ns				
5. Extraversion	.30	.32	.22	.70	.29/.04 ns			
6. Neuroticism	−.35	−.43	−.28	.36	.29	.37/.17		
7. Conscientiousness	.21	.28	.16	.55	.58	.30	.23/.12	
8. Openness	.18	.27	.23	.63	.74	.30	.62	.22/.04 ns
M	11.44	33.46	21.66	3.56	3.26	2.29	3.48	3.01
SD	2.04	4.75	4.42	.63	.73	.86	.61	.72

WB well-being, *MZ* monozygotic twin pairs, *DZ* dizygotic twin pairs

All correlations, $p < .05$ unless noted as non-significant (ns)

achieve a balance between explanatory power and simplicity. This goal is to minimize the Akaike information criterion (AIC) value, an appropriate fit-testing statistic for these kinds of models (Akaike 1987).

3 Results

3.1 Descriptive, Phenotypic Findings

Table 2 contains the descriptive statistics and bivariate correlations between all measures of personality and SWB.

Two patterns should be noted: the within-construct correlations are moderately high, and the between-construct correlations are low. The average correlations (using z-transformed *r*'s) between the big five personality traits and each type of well-being are .15 with EWB, .20 with Social WB, and .30 with PWB. The average correlation across all measures of SWB with the big five personality traits is .22. Our findings here are in line with DeNeve and Cooper's (1998) meta-analytic finding that the typical personality–SWB correlation is .19. In short, the association of SWB with personality is sufficiently low as to conclude there is little variance shared at the phenotypic level.

However, the correlations of each measure of SWB with the personality traits for MZ twin pairs are almost twice as high as the correlations for DZ twin-pairs. These findings strongly suggest a heritable component of all measures in this study. We therefore turn to analyses that investigate the shared variance of genetic and environmental causes between personality and SWB.

3.2 Model Fitting of SWB and Individual Personality Dimensions

We began by examining, in a bivariate twin model, the relationship between SWB and each of the big five personality traits. Beginning with Openness and SWB, our first twin model (model 1) included A, C and E components as well as gender effects (see Table 3). In model 2, we eliminated the gender effects by constraining all the parameter estimates to equality in males and females. This caused a substantial improvement in AIC. In models 3 and 4, we eliminated all shared environmental and all genetic effects, respectively. As indexed by AIC, model 3 was substantially better fitting than model 2, and model 4 was worse. Model 3 was therefore the best fit.

We found the same pattern of results in Table 3 for bivariate models of conscientiousness, extraversion, agreeableness, and neuroticism with SWB. That is, in each case, the best fitting model was model 3, which included only additive genetic effects and individual specific environment with no quantitative gender difference.

Of greatest interest were the genetic and environmental correlations between the personality traits and the latent common factor of SWB. The genetic correlations with SWB ranged from a low of .42 for agreeableness (openness = .50, neuroticism = −.53, and conscientiousness = .55) to a high of .62 for extraversion. The unique environmental correlations with SWB were similar and ranged from a low of .40 for openness (conscientiousness = .45, agreeableness = .46, and extraversion = .51) to a high of −.58 with Neuroticism. Our estimated heritability of each big five personality trait (ranging from a low of 29 % for Agreeableness to a high of 52 % for Neuroticism) is well within the range reported in prior studies (Jang et al. 1996; Riemann et al. 1997).

3.3 Model Fitting of Subjective Well Being and Personality Traits

We modeled the relationship between all of the big five personality traits and SWB in two different and complimentary ways. In our first approach, we utilized the Cholesky

Table 3 Model fit statistics for the big five personality traits

Personality trait	Model	Gender effect	Δ −2LL	Δ DF	Δ AIC	Best fit
Openness	ACE[a]	+	–	–	–	
	ACE	–	13.65	15	−16.35	
	AE	–	21.04	21	−20.96	√
	CE	–	26.22	21	−15.78	
Conscientiousness	ACE[a]	+	–	–	–	
	ACE	–	14.07	15	−15.93	
	AE	–	21.06	21	−20.94	√
	CE	–	29.55	21	−12.45	
Extraversion	ACE[a]	+	–	–	–	
	ACE	–	14.88	15	−15.12	
	AE	–	22.76	21	−19.24	√
	CE	–	29.12	21	−12.88	
Agreeableness	ACE[a]	+	–	–	–	
	ACE	–	16.35	15	−13.65	
	AE	–	24.24	21	−17.76	√
	CE	–	28.31	21	−13.69	
Neuroticism	ACE[a]	+	–	–	–	
	ACE	–	12.82	15	−17.18	
	AE	–	21.83	21	−20.17	√
	CE	–	31.24	21	−10.76	

A = additive genetic effects, C = shared environmental effects; E = unique environmental effects. Δ −2LL = change in −2 Log Likelihood, Δ DF = change in degrees of freedom, and Δ AIC = change in the Akaike Information Criterion

[a] ACE model statistics: Openness Model 1: −2LL = 13,378.673, DF = 5,048, AIC = 3,282.673; Conscientiousness Model 1: −2LL = 12,896.537, DF = 5,050, AIC = 2,796.537; Extraversion Model 1: −2LL = 13,351.657, DF = 5,049, AIC = 3,253.657; Agreeableness Model 1: −2LL = 13,007.693, DF = 5,050, AIC = 2,907.693; Neuroticism Model 1: −2LL = 13,724.011, DF = 5,049, AIC = 3,626.011

decomposition model for the big five personality traits with the latent trait of SWB as the dependent variable. Model fitting results are seen in Table 3. Again, our first twin model (model 1) included A, C, and E components as well as quantitative gender effects. In model 2, we constrained the parameter estimates to equality in males and females, thereby producing a significantly better fit. In models 3 and 4, we eliminated all shared environmental and all genetic effects, respectively. While the AIC of model 3 produced a large improvement over that of model 2, the fit of model 4 was only moderately worse. Model 3 was therefore the best fitting model.

The most interesting feature of model 3 is that it decomposes the genetic and environmental contribution to SWB into those shared with the big five personality trait factors versus those unique to SWB. For genetic effects, the total heritability of SWB was 72 % (see Keyes et al. 2010), 64 % of which was shared with personality and 36 % of which was unique. Individual-specific environmental effects account for 28 % of the variance in SWB, of which 63 % is shared with our personality measures and 37 % was unique.

We also modeled the big five personality traits as a single common factor, analogous to our approach to SWB. That is, we investigated the fit of a two latent factors common

Table 4 Model fit statistics for the Cholesky decomposition and a two-factor common pathway model of the big five personality traits and subjective well-being

Model	Gender effect	Δ −2LL	Δ DF	Δ AIC	Best fit
Cholesky decomposition					
ACE[a]	+	–	–	–	
ACE	–	44.66	61	−77.34	
AE	–	57.92	85	−112.08	√
CE	–	100.85	85	−69.15	
Common pathway					
ACE[a]	+	–	–	–	
ACE	–	28.13	31	−33.87	
AE	–	35.93	42	−48.07	√
CE	–	53.36	42	−30.64	

A = additive genetic effects, C = shared environmental effects; E = unique environmental effects. Δ −2LL = Change in −2 Log Likelihood, Δ DF = Change in degrees of freedom, and Δ AIC = Change in Akaike Information Criterion

[a] ACE model statistics: Cholesky Decomposition Model 1: −2LL = 21,162.022, DF = 10,050, AIC = 1,062.022; Common Pathway Model 1: −2LL = 21,392.651, DF = 10,110, AIC = 1,172.651

pathway model. Results of model fitting for this approach are also seen in Table 4. The pattern was very similar to that seen in the prior model fitting. Again, there was no evidence for quantitative gender effects or shared environment effects. Model 3 was the best-fit model. The single latent personality factor had strong positive loadings on Extraversion, followed by Agreeableness and Openness, and a weaker negative loading on Neuroticism. The model contained genetic and environmental influences specific to each personality dimension. The genetic and environmental correlations between the latent personality factor and SWB were high, estimated at .84 and .75, respectively. We re-parameterized this model (i.e., as a bivariate Cholesky model) to directly calculate the percent of genetic and environmental effects of SWB that is shared with the single common personality genetic factor versus unique to SWB. Of the total heritability of SWB (i.e., 72 %), 70 % was shared with personality and 30 % was unique to SWB. Individual-specific environmental effects accounted for 28 % of the variance in SWB, of which 57 % was shared with personality traits and 43 % was unique to SWB.

4 Discussion

Prior research on the nexus of personality and well-being has led many to conclude that the big five personality traits and SWB are overlapping. In particular, the results of Weiss et al. (2008) using a narrower measure of SWB (i.e., emotional well-being) from the MIDUS twin sample led them to conclude that "happiness is a personality thing" because their measure of SWB shared all of its genetic variance with personality. This is extremely strong support for the top-down model of SWB. That is, to increase SWB, the recommendation would therefore be to change personality. However, evidence for shared genes between emotional SWB and the big five personality traits may reflect shared genes for structural affectivity, because extraversion and neuroticism have been shown to represent structural sensitivity to positive and negative affect (Watson and Clark 1992). We relied on

a more comprehensive assessment, which reflects hedonic and eudaimonic approaches, and arrive at a more nuanced conclusion. While shared variance outweighs distinctive variance between the constructs of personality and SWB, there is still a non-trivial amount of variance in SWB that is neither genetically nor environmentally shared with personality.

The amount of shared genetic variance between personality traits and SWB ranged from 64 % using the Cholesky model to 70 % using the common pathway model. This leaves a range of 30–36 % of genetic variation in SWB that is distinct from personality traits. Splitting the difference between estimates, we conclude that approximately one-third of genetic variation in SWB is distinctive from the genetic variation in personality. The amount of shared variance between unique environmental effects on personality traits and SWB ranged from 57 % using the common pathway model to 63 % using the Cholesky model. This leaves a range of 37–43 % of environmental variation in SWB that is distinct from personality traits. Splitting the difference in estimates, we conclude that about 40 % of the unique environmental variation in SWB is distinct from the environmental causes of personality traits.

As such, we conclude that while there is substantial shared genetic and environmental variation in SWB and personality traits, there is sufficient distinctiveness in the genetic and environmental causes of SWB. Our findings warrant the tempering of conclusions made by others that personality traits and SWB overlap so much that SWB is "a personality thing." It is true that some facets of the tripartite model of SWB fall with the domain of personality. In fact, dimensions of PWB can be traced to personality constructs such as Gordon Allport's *mature personality* (see Ryff 1989). Yet, we find non-trivial distinctiveness of SWB from personality traits in terms of SWB's genetic and environmental etiology.

Recent research shows that trait change predicts specific well-being outcomes (Hill et al. 2012). Thus, well-being may reflect, but only partially, levels and trajectories of traits. Conversely, personality trait levels and change may reflect, if only partially, levels and trajectories of well-being (Specht et al. 2013). In a process we call *positive reciprocity*, improvements in SWB such as increasing self-acceptance (liking most parts of your personality) and social integration (feeling like you belong to a community) may cause improvements in personality as reflected in increased extraversion and less neuroticism. As individuals become more outgoing and less fearful, they may increasingly engage in activities that increase SWB, promoting life satisfaction (EWB), meaningfulness (PWB), and greater acceptance of others (Social WB).

Notwithstanding the high genetic overlap of SWB and personality, the phenotypic correlations between SWB and personality are quite low (Mean $r = .22$). The expressed forms of SWB and personality are clearly not the same thing. Compare, for instance, the phenotypic correlations between measures of internalizing psychopathology (IP; e.g., major depression) and facets of SWB, which range from $-.40$ to $-.60$ (see Keyes 2005). Phenotypically, IP and SWB are more of the same thing than SWB and personality. Yet, using the same sample and measures of SWB as in the present paper, exactly half of the genetic variance of IP is shared with SWB (Kendler et al. 2011), and the amount dropped over time to 41 % as the MIDUS twins aged (Kendler et al. 2011). In sum, the observed associations of personality and SWB are quite low while the associations between SWB and mental illness are much higher, yet personality and SWB share much more genetic variance than SWB shares with internalizing psychopathology. In short, more genetic variance is shared between SWB and personality than between SWB and IP, and yet the phenotypic correlations are markedly higher between SWB and IP than between SWB and personality. How or why is the expression of SWB and IP more strongly associated despite

emanating from more distinctive sources of genetic variance compared with SWB and personality, which are weakly associated despite emanating from a more common source of genetic variance?

As Schmutte and Ryff (1997) have shown, some aspects of personality correlate with only some aspects of PWB [see also DeNeve and Cooper (1998), for the same conclusion with measures of SWB reflecting emotional well-being and a variety of personality traits, including the big five personality traits]. Controlling for problems related to construct overlap (blurred item content) and source overlap (using the same respondents to assess both personality and well-being), Schmutte and Ryff (1997) found that neuroticism, extraversion, and conscientiousness emerged as strong and consistent predictors of multiple aspects of psychological well-being, particularly self-acceptance, environmental mastery, and purpose in life. Autonomy was predicted by multiple traits, but most strongly by neuroticism. However, other aspects of PWB revealed distinctive personality correlates. Openness to experience and extraversion were strongly predictive of the personal growth dimension of PWB, while agreeableness predicted positive relations with others.

The distinctive associations of dimensions with personality traits and PWB may reflect new findings on the genetic structure of the PWB dimensions. Using the MIDUS twin sample, Archontaki et al. (2013) investigated whether the six scales of PWB belonged to a single common latent factor. Their best fitting model contained one single general factor and four specific factors. One relatively substantial general genetic factor is associated with all six dimensions. In addition, four specific factors are linked with specific PWB dimensions. There was one specific genetic factor linked only to positive relations with others, a second linked to purpose in life and personal growth, a third linked to personal growth and autonomy, and the fourth linked autonomy and environmental mastery. Such distinctiveness at the dimensional level may help to explain our findings, using the three SWB factors, that there is more unique genetic variance to SWB at the single latent common factor level than previous research has shown.

4.1 Limitations

We were unable with the present data to directly test the theory that motivated the hypothesis of overlapping but also distinctiveness between SWB and the big five personality traits. We argued that personality and SWB share in common the process of functioning in life. However, we also posited distinctive facets between the two, with personality reflecting the "how" aspect of functioning while SWB reflecting the meaning in life that accrues from the "how well" one is functioning in life. Future research may benefit from seeking to more directly investigate these and other hypothesized sources of overlapping and distinctive sources of genetic variance between SWB and personality.

Methodological limitations of the present study include the low twin-pair sample size that may have reduced the power to detect gender differences, to discriminate between genetic and environmental sources of twin resemblance, and to discriminate between additive and non-additive genetic effects (Kendler and Prescott 2006). Small sample sizes and contrast effects may account, in part, for differences in the magnitude of genetic influences across twin studies (Carey 2003). The presence of contrast effects, which may inflate heritability estimates and mask shared environmental influences. Many of the existing studies on SWB were not only limited to hedonic well-being but were conducted using smaller sample sizes; they likely lacked sufficient power to detect shared environmental influences.

In short, low power has been an issue in most twin studies of SWB. While this may be true of the MIDUS twin sample, we found moderate and sometimes substantial differences in fit between competing models, and our findings lead to a modified conclusion to Weiss et al. (2008), who used the same MIDUS sample. The primary difference, then, between Weiss et al. (2008) and the current paper is that our findings are based on using the comprehensive, tripartite model of SWB. Despite attempts to reduce personality to a single, perhaps overarching, dimension, studies continue to support models like the Big Five in which personality is a multidimensional construct. Despite attempts to reduce it to feeling good, evidence indicates that SWB too is a multidimensional construct. Failure to embrace the need for more comprehensive assessments of SWB in future research places psychological science in a poor situation for the important task of recommending how to promote this valuable resource for living longer and better lives.

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