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Genetic and Environmental Influences on the Association between Subjective Well-Being and Marital Adjustment

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Abstract

This study was conducted to estimate the magnitude of genetic and environmental influences on the association between three indices of subjective well-being (i.e., life satisfaction, positive affect, negative affect) and positive and negative components of marital adjustment (i.e., spousal support, spousal strain) in a sample of adult married twin pairs ($N = 453$ pairs). Results indicated that subjective well-being and marital adjustment were significantly associated (particularly in women), that there were gender differences in the magnitude of genetic and environmental influences on this covariation, and that this association was largely influenced by genetic factors in women and genetic and nonshared environmental factors in men. These findings highlight the importance of using genetically informed research to evaluate the genetic and environmental influences on the covariation between marital adjustment and individual outcomes such as subjective well-being.

Keywords

subjective well-being; marital adjustment; positive affect; negative affect; life satisfaction

Relationship quality is an important aspect of a person's overall well-being (for reviews, see Fincham & Beach, 2010; Ryff & Singer, 2000). For example, very happy people report having more satisfying relationships and spending less time alone than their less happy counterparts (Diener & Seligman, 2002). In addition, when asked to think back over their life and provide some of the reasons life has gone well, 33% of survey respondents replied that their spouse contributed to their well-being (Markus, Ryff, Curhan, & Palmersheim, 2004).

Prior research has shown that better relationship quality is associated with higher reported subjective well-being, which refers to people's cognitive and affective evaluations of their lives (Diener, 1984). Subjective well-being consists of three components: life satisfaction (i.e., global judgments of one's life), positive affect (i.e., experiencing pleasant emotions and moods), and low levels of negative affect (i.e., experiencing few unpleasant emotions and moods) (Diener, 1984). Several structural models for conceptualizing these three

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components of subjective well-being have been advanced (for a review, see Busseri & Sadava, 2011), including Diener's (1984) perspective that they should be assessed and examined separately; we adopted this model in the current study to understand better the role of each component.

Prior research has found significant associations between marital adjustment and each of the components of subjective well-being. For example, a meta-analysis of 13 studies that evaluated the association between marital satisfaction and life satisfaction found an average correlation of .42, which was larger in magnitude than the association between life satisfaction and satisfaction in other domains (Heller, Watson, & Illies, 2004). Similarly, marital adjustment is positively associated with positive affect (e.g., Fincham & Linfield, 1997; Gordon & Baucom, 2009) and negatively associated with negative affect (e.g., Fincham & Linfield, 1997; Gordon & Baucom, 2009).

There are two primary models that can be advanced for understanding how relationship quality and well-being could be associated. In the *bottom-up* approach to well-being (Diener, 1984), satisfaction in specific domains such as marriage leads to satisfaction with life in general. Consistent with this perspective, Kamp Dush, Taylor, and Kroeger (2008) found that people high in marital happiness over time reported less of a decline in life happiness over time than people who were less happy with their marriage. In comparison, a *top-down* approach to well-being (Diener, 1984) proposes that people differ in the degree to which they have a propensity towards life satisfaction, and this difference influences the degree to which they interpret the domains of their life in a positive direction; accordingly, satisfaction with life leads to satisfaction in specific domains. Consistent with this perspective, Stanley, Ragan, Rhoades, and Markman (2012) found that premarital life satisfaction predicted marital adjustment six years into marriage.

The present study builds on prior research on relationship quality and subjective well-being by using a genetically sensitive design (i.e., a twin study) to evaluate genetic and environmental influences on the association between subjective well-being and marital adjustment. Although studies have evaluated the genetic and environmental influences on the association between marital adjustment and mental health outcomes such as depression (e.g., Beam et al., 2011; Spotts, Neiderhiser, Ganiban, et al., 2004) and internalizing spectrum syndromes (South & Krueger, 2008), we are aware of only one genetically informed study that has examined the genetic and environmental influences on the association between marital adjustment and well-being. Spotts et al. (2005) conducted a twin study of the association between interpersonal relationships (i.e., marital adjustment and social support) and well-being in a sample of 326 pairs of adult female twins from the Swedish Twin Registry who were in relationships; 613 twins were married and 39 twins were cohabiting. Their results suggested that the covariance among marital adjustment, social support, and well-being and global self-worth was only partially explained by genetic factors and substantially explained by nonshared environmental influences. Because similar results were found using either wives or husbands' reports of marital adjustment, the authors speculate that one's partner is an important source of the nonshared environmental influence.

The present study builds on the Spotts et al. (2005) study in several ways. First, whereas they operationalized well-being in terms of the Well-being subscale of the Center for Epidemiological Studies – Depression scale (CES-D; Radloff, 1977), we operationalized well-being in terms of Deiner's (1984) model (i.e., life satisfaction, positive affect, negative affect). Although the Well-being subscale of the CES-D is correlated with positive and negative affect (Teachman, Siedlecki, & Magee, 2007), the estimated heritability of the CES-D Well-being subscale (e.g., Gatz, Pederson, Plomin, & Nesselroade, 1992; Jang, Livesley, Taylor, Stein, & Moon, 2004) is smaller in magnitude than the estimated heritability of other measures of subjective well-being (e.g., Lykken & Tellegen, 1996; Stubbe, Posthuma, Boomsma, & De Geus, 2005). Therefore, the genetic and environmental influences on the association between marital adjustment and well-being may differ depending upon how well-being is assessed. In the current study, we included separate measures of life satisfaction, positive affect, and negative affect, which allowed us to examine the genetic and environmental influences on the associations between marital adjustment and each component of subjective well-being. The second way in which the study builds upon the Spotts et al. (2005) study is through examining the association between marital adjustment and subjective well-being in women and men. By conducting analyses in both women and men, we were able to ensure that the results obtained by Spotts and colleagues (2005) were not gender-specific, and were able to examine the degree to which there were gender differences in the genetic and environmental influences on the associations between marital adjustment and subjective well-being, as described below.

The present study, therefore, was conducted to evaluate the degree to which subjective well-being and marital adjustment are influenced by common genetic and environmental predispositions. Examining the degree to which subjective well-being and marital adjustment share common genetic and environmental influences is important in light of findings that subjective well-being has substantial heritability (e.g., Lykken & Tellegen, 1996; Stubbe et al., 2005), and that marital adjustment has at least modest heritability (e.g., South & Krueger, 2008; Spotts, Neiderhiser, Towers, et al., 2004; Spotts, Prescott, & Kendler, 2006). For example, if it were found that there were genetic influences on the associations between subjective well-being and marital adjustment, then there may exist a common underlying liability that influences both. Alternatively, genetic factors might influence subjective well-being, which in turn could influence marital adjustment (or that genetic factors might influence marital adjustment, which in turn could influence subjective well-being). Finally, genetic factors might influence a third factor that could then influence both subjective well-being and marital adjustment. On the other hand, common unique environmental influences may indicate individual-specific stressors affecting both subjective well-being and marital adjustment, or common measurement error, such as an individual's tendency to respond positively or negatively to all items.

A second objective of the study was to examine the degree to which there are gender differences in the genetic and environmental influences on the associations between subjective well-being and marital adjustment. As reviewed by Impett and Peplau (2006), there is evidence that compared to men's lives, relationships are more central to women's lives, as indicated by women's greater tendency to have an interdependent self-concept, to report greater relationship commitment, and to engage in more relationship maintenance

behaviors. Therefore, it may be expected that marital adjustment will more strongly impact and be impacted by subjective well-being for women than for men. Although there is some research evaluating gender differences in the association between marital satisfaction and life satisfaction (e.g., Williams, 2003), we are not aware of any research that has examined gender differences in the genetic and environmental influences on the associations between marital adjustment and the three components of subjective well-being.

In summary, the present study used a genetically informed design to examine the covariance between subjective well-being and marital adjustment in a United States twin sample. In addition, we examined the magnitude of genetic and environmental influences on marital adjustment that are shared in common with subjective well-being and those that are unique to marital adjustment. With respect to marital adjustment, it is generally assumed that social relationships such as marriage have both costs and benefits (e.g., Rook, 1984). Therefore, we examined positive and negative dimensions of marital adjustment independently of one another in order to evaluate the potential differential association that each might have with subjective well-being, which yields a more comprehensive assessment of marriage than can be provided by a global, unidimensional measure of marital adjustment. This perspective is in keeping with research that has found evidence for independent positive and negative dimensions of marital functioning (e.g., Orden & Bradburn, 1968) and subjective evaluations of marriage (e.g., Fincham & Linfeld, 1997), and with evidence that these two dimensions appear to be influenced by different genetic factors in women, although they seem to be influenced by the same factors in men (Spotts et al., 2006).

Methods

Participants

Data from the study comes from the National Survey of Midlife Development in the United States (MIDUS; Brim et al., 2007), a population-based national survey of Americans aged 25 to 74, conducted by the John D. and Catherine T. MacArthur Foundation network on Successful Midlife Development in 1995 to investigate the behavioral, psychological, and social factors of age-related differences in physical and mental health. The MIDUS included several samples: a general population sample ($n = 4,242$), siblings of these respondents ($n = 951$), and a twin sample ($n = 1,996$; 998 twin pairs). The present analyses are based on all of the MIDUS twin respondents in which both members of the twin pair were married, excluding those married twin pairs for whom one or both partners were (a) missing all MIDUS Phone Interview and Mail Questionnaire data, or (b) not classifiable due to missing or indeterminate information used to determine zygosity (e.g., eye and hair color, degree to which others were confused as to their identity during childhood). Participants in the twin sample were recruited using a two-part sampling design (screening of a representative national sample of approximately 50,000 households for the presence of a twin, followed by contact and recruitment of twins from these twin households). The final sample for this study included 453 twin pairs: 100 monozygotic (MZ) female pairs, 85 dizygotic (DZ) female pairs, 89 MZ male pairs, 75 DZ male pairs, 104 DZ opposite sex pairs. Given this sample size, there is adequate power (i.e., $> .80$) to detect a genetic correlation of .50 or higher between two variables with a heritability of .50 or higher. Participants were

administered a 30-minute telephone interview, followed by a self-administered questionnaire that was completed at home; all the measures used in the present study were included in the self-administered questionnaire.

The final sample included 474 (52%) women and 432 men, and participants had a mean age of 46.3 ($SD = 11.7$; range = 25 – 74) years. The racial distribution of the sample was 95% White, 2% Black, 1% Native American or Aleutian Islander or Eskimo, and 1% Other; 1% did not complete the item regarding race. Most participants (80%) were in their first marriage and most had at least one child (mean number of children = 2.5, $SD = 1.4$; range 0 – 8); participants had been married an average of 19.9 years ($SD = 13.2$; range = 0 – 56 years).

Measures

Subjective Well-Being—Positive emotions were measured with the 6-item Positive Affect Scale (PAS), whereas negative emotions were measured with the 6-item Negative Affect Scale (NAS), developed for the MIDUS by culling items from existing well-known and valid measures of affect (Mroczek & Kolarz, 1998). Participants were asked, *During the past 30 days, how much of the time did you feel . . . ?*; sample items were *cheerful* and *in good spirits* for positive affect and *nervous* and *hopeless* for negative affect. Items were answered on a 5-point scale and recoded so that higher scores indicated higher positive or negative affect. Affect scales were created by calculating item means, and the resulting scales had good internal consistency ($\alpha = .90$ for the PAS; $\alpha = .86$ for the NAS). The PAS and the NAS correlated highly with the corresponding scales from the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) ($r = .77$ and $.81$, respectively, $ps < .001$) in 1,791 people (981 women, 810 men; age: $M = 56.8$ years; $SD = 12.6$) from the MIDUS II general population sample. Life satisfaction was assessed with a single item 11-point scale, in which they were asked to *rate your life overall these days*, with 0 anchored with the description *the worse possible life overall* and 10 anchored with the description *the best possible life overall*. Single-item measures have been used in prior epidemiologic research on life satisfaction (e.g., Suh, Diener, Oishi, & Triandis, 1998), and this single-item correlated $.56$ ($p < .001$) with the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen & Griffin, 1985) in 635 people (335 women, 300 men; age $M = 56.3$ years; $SD = 11.8$) from the MIDUS II Biomarker Project general population sample.

Marital Adjustment—Positive aspects of marital adjustment was assessed with a 6-item scale measuring supportive interactions with spouse (e.g., *cares about you, understands the way you feel about things*), whereas negative aspects of marital adjustment was assessed with a 6-item scale measuring unsupportive or strained interactions with spouse (e.g., *makes too many demands on you, criticizes you*). Prior research with the MIDUS general population sample indicates these items load onto two separate factors (Walen & Lachman, 2000). Items were rated on a 4-point scale, and spousal support and spousal strain scales were constructed by calculating the mean of the items, with higher scores reflecting higher standing on each scale. Good internal consistency was found for the support ($\alpha = .91$) and strain ($\alpha = .88$) scales in the present sample. Because the item content of these scales is

similar to that found in commonly used measures of marital adjustment, the spousal support and spousal strain scales were conceptualized as measuring relationship adjustment.

Analyses

Results of preliminary exploratory factor analyses indicated that there are two separate factors underlying the subjective well-being items (positive and negative affect) and the marital adjustment items (spousal support and spousal strain). Results of confirmatory factor analyses indicated a two-factor model fit significantly better than a one-factor model for the affective components of subjective well-being, $\chi^2(1) = 263.75, p < .01$, and for marital adjustment, $\chi^2(1) = 217.94, p < .01$. Therefore, we examined positive and negative affect and spousal support and spousal strain separately.

The spousal strain variable was normally distributed, but the spousal support, positive affect, negative affect, and life satisfaction variables were significantly skewed. Derks et al. (2004) and Stallings et al. (2001) found that when skewed data are analyzed after conducting transformations (e.g., square root transformation), the parameter estimates were biased; in contrast, when analyses are conducted on data categorized into ordinal variables, with the assumption that there is an underlying normal liability distribution, the correct parameter estimates were recovered. Therefore, positive affect, negative affect, life satisfaction, and spousal support variables were categorized into ordinal variables with three levels (0 = low, 1 = medium, 2 = high), with the assumption that a normal liability distribution underlies the ordinal variables, and the number of categories chosen to avoid small cells. The categorizations into ordinal variables and the number of participants in each category are described in Table 1.

Analyses were conducted using Mplus (Muthén, 1998–2010). Mplus is ideal for analyses of these data, as it allows the examination of a combination of continuous and ordinal variables. The weighted least square mean and variance (WLSMV) estimation method was used, as several ordinal variables were examined. Pairwise deletion is used in Mplus when WLSMV is used (although there were only two data points missing in this sample). The parameters' statistical significance was determined by their p values, which are based on a z statistic yielded by the ratio of each parameter to its standard error. Given the sensitivity of χ^2 to sample size, we also examined the comparative fit index (CFI; Bentler, 1990) and the root mean square error of approximation (RMSEA; Browne & Cudeck, 1993) to assess model fit. A CFI greater than .95 and RMSEA less than .06 indicate good model fit (Hu & Bentler, 1998).

Table 2 presents the results of preliminary regression analyses examining the effects of age, gender, number of children, and remarriage on each variable. The number of children and remarriage were not associated with any of the variables, whereas increasing age was associated with higher positive affect, lower negative affect, and higher life satisfaction, and women reported higher negative affect, lower spousal support, and higher spousal strain than men. Therefore, we controlled for the effects of age and gender in all analyses. The effects of age and gender were regressed out from the spousal strain score (which was a continuous variable) prior to analyses. For the ordinal variables (i.e., positive affect,

negative affect, life satisfaction, and spousal support), gender-specific thresholds were estimated, and age was included as a covariate in all analyses.

Potential gender differences in the parameter estimates were tested by examining the fit of a model where parameter estimates were free to vary across gender and a model where parameter estimates were constrained to be equal across gender. Difference in fit of these two models was tested by conducting a χ^2 difference test (via the Mplus “difftest” command).

Three sets of correlations were estimated. First, phenotypic correlations (i.e., correlations among different variables within the same individual) between subjective well-being (positive affect, negative affect, life satisfaction) and marital adjustment (spousal support, spousal strain) were estimated in all individuals. Second, within-trait cross-sibling correlations (i.e., correlations between the same variable in twin 1 and twin 2) were estimated in MZ and DZ twin pairs. Third, cross-trait cross-sibling correlations (i.e., correlations between variable 1 in twin 1 and variable 2 in twin 2, and vice versa) for the six pairs of correlations between subjective well-being and marital adjustment (correlations between positive affect and spousal support, positive affect and spousal strain, negative affect and spousal support, negative affect and spousal strain, life satisfaction and spousal support, and life satisfaction and spousal strain) were estimated in MZ and DZ twin pairs. Based on the assumption that MZ twins share 100% of their genes and DZ twins share 50% of their genes on average, comparing the magnitude of cross-trait cross-sibling correlations can provide information about genetic and environmental influences on the covariation between marital adjustment and subjective well-being. When correlations are greater in MZ twins than DZ twins ($r_{MZ} > r_{DZ}$), there is evidence of genetic influences. If r_{MZ} is greater than twice r_{DZ} , this suggests the influence of dominant genetic effects, whereas if r_{MZ} is less than twice r_{DZ} , there is evidence of shared environmental effects.

Figure 1 presents the bivariate Cholesky decomposition model, which decomposes the variance of the dependent variable (i.e., marital adjustment) into that which is shared in common with the independent variable (i.e., subjective well-being) and that which is specific to the dependent variable. Subjective well-being is influenced by A1, C1, and E1, and the total variance of subjective well-being due to genetic influences (a^2), shared environmental influences (c^2), and nonshared environmental influences (e^2) can be estimated by squaring a_{11} , c_{11} , and e_{11} , respectively. In contrast, marital adjustment is influenced by A1, C1, and E1, which influence subjective well-being also, and by A2, C2, and E2, which influence marital adjustment only. The total variance of marital adjustment is divided into two components: (a) the genetic (a_{21}^2), shared environmental (c_{21}^2), and nonshared environmental (e_{21}^2) influences that are shared in common with subjective well-being; and (b) the genetic (a_{22}^2), shared environmental (c_{22}^2), and nonshared environmental (e_{22}^2) influences that are unique from subjective well-being and are specific to marital adjustment. Also, the bivariate Cholesky decomposition model can be used to estimate the covariance between marital adjustment and subjective well-being that is due to genetic ($a_{11} \times a_{21}$), shared environmental ($c_{11} \times c_{21}$), and nonshared environmental ($e_{11} \times e_{21}$) influences. The total covariance is: $(a_{11} \times a_{21}) + (c_{11} \times c_{21}) + (e_{11} \times e_{21})$. The significance

of each parameter estimate was determined by the p value of the standardized parameter estimate divided by the standard error.

Results

A model estimating the phenotypic correlations, the within-trait cross-twin correlations, and the cross-trait cross-twin correlations was tested. A model constraining these correlations to be equal in women and men fit significantly worse than a model allowing these correlations free to vary in women and men for the model examining the correlations between positive and negative affect and marital adjustment, $\chi^2(39) = 66.52, p < .01$, and for the model examining the correlations between life satisfaction and marital adjustment, $\chi^2(21) = 35.95, p = .02$. Therefore, separate results are shown for women and men.

Table 3 presents the correlations among the subjective well-being and marital adjustment variables. As noted above, given results indicating two separate factors underlying the subjective well-being items and the marital adjustment items, we examined positive and negative affect and spousal support and strain separately. Correlations among the subjective well-being variables and between the marital adjustment variables were mostly moderate.

Positive affect and life satisfaction were positively correlated with spousal support and negatively correlated with spousal strain, whereas negative affect was negatively correlated with spousal support and positively correlated with spousal strain. In general, the correlations between subjective well-being and marital adjustment were higher in women than in men. This gender difference in the phenotypic correlations was significant, as fixing the phenotypic correlations shown in Table 3 to be equal across the two genders led to a significant decrement in fit both in the model examining the associations between positive affect, negative affect, spousal support, and spousal strain, $\chi^2(4) = 12.05, p = .02$, and in the model examining the associations between life satisfaction, spousal support, and spousal strain, $\chi^2(2) = 6.20, p = .05$.

Table 4 presents the twin correlations. In women, each MZ within-trait and cross-trait correlation was higher than the DZ counterpart. In men, the MZ correlation was higher than the DZ correlation for negative affect and life satisfaction. However, the within-trait cross-twin correlations for spousal support and spousal strain, and the cross-trait cross-twin correlations (between marital adjustment and subjective well-being) were similar and statistically non-significant for both MZ and DZ twin pairs for men. Exceptions were statistically significant MZ cross-trait cross-twin correlations for men for (a) negative affect and spousal strain, and (b) life satisfaction and spousal support.

Table 5 presents the standardized parameters, standard errors, and statistical significance of the parameters from the Cholesky decomposition models. All models fit the data well (all $p > .05$, CFI $> .95$, RMSEA $< .05$; see Supplementary Table for fit indices). The model constraining parameters to be equal in men and women fit significantly worse than a model allowing parameters free to vary in men and women in several cases (positive affect and spousal strain, $\chi^2(9) = 26.29, p < .01$; negative affect and spousal support, $\chi^2(9) = 16.94, p = .05$; negative affect and spousal strain, $\chi^2(9) = 17.91, p = .04$; life satisfaction and spousal

strain, $\chi^2(9) = 20.25, p = .02$., and there was a trend of a gender difference for the model examining the covariance between positive affect and spousal support, $\chi^2(9) = 16.16, p = .06$. An exception was the model examining the covariance between life satisfaction and spousal support, $\chi^2(9) = 6.72, p = .66$. Given these results and the results suggesting that the phenotypic, within-trait cross-twin and cross-trait cross-twin correlations could not be equated between men and women, the results from models estimating separate parameters for men and women are presented.

Tables 6 and 7 present the contribution of genetic, shared environmental, and nonshared environmental influences on subjective well-being, marital adjustment, and the covariance between subjective well-being and marital adjustment in women and men, respectively. These were derived from parameter estimates shown in Table 5, as described above.

The Cholesky model estimated the total variance of subjective well-being. In women, there were moderate genetic and nonshared environmental influences and zero to modest shared environmental influences on positive and negative affect and life satisfaction ($a^2 = .39$ to $.50$, $c^2 = .00$ to $.08$, $e^2 = .47$ to $.53$). In men, the magnitude of genetic influences is lower and the magnitude of nonshared environmental influences is higher on positive affect ($a^2 = .12$ to $.19$, $c^2 = .06$ to $.11$, $e^2 = .74$ to $.75$) and life satisfaction ($a^2 = .24$ to $.25$, $c^2 = .09$ to $.11$, $e^2 = .59$ to $.60$) than on negative affect ($a^2 = .39$ to $.43$, $c^2 = .09$ to $.13$, $e^2 = .44$ to $.45$).

The variance of marital adjustment was decomposed into two sets of variances: those shared in common with subjective well-being and those that were unique to marital adjustment. In women, the majority of the variance of marital adjustment that was shared in common with subjective well-being was due to genetic influences ($a^2 = .17$ to $.34$, $c^2 = .00$ to $.03$, $e^2 = .00$ to $.08$). The variance unique to marital adjustment included zero to modest genetic influences, zero shared environmental influences, and substantial nonshared environmental influences ($a^2 = .00$ to $.09$, $c^2 = .00$, $e^2 = .60$ to $.72$). A similar conclusion was reached when examining the covariance between subjective well-being and marital adjustment, with greater genetic influences (absolute value = $.29$ to $.37$) than shared (absolute value = $.00$ to $.03$) or nonshared environmental (absolute value = $.03$ to $.19$) influences on the covariance.

In men, the variance of marital adjustment shared in common with subjective well-being was lower overall, and more evenly distributed among genetic and nonshared environmental influences ($a^2 = .01$ to $.10$, $c^2 = .00$ to $.03$, $e^2 = .04$ to $.13$). The variance unique to marital adjustment was mostly attributed to nonshared environmental influences ($a^2 = .00$ to $.02$, $c^2 = .00$ to $.06$, $e^2 = .77$ to $.89$). The covariance between subjective well-being and marital adjustment was also more evenly distributed among genetic (absolute value = $.03$ to $.20$) and nonshared environmental (absolute value = $.14$ to $.28$) influences.

Discussion

Our first aim was to evaluate the association between subjective well-being and marital adjustment. We found that all three measures of subjective well-being (i.e., positive affect, negative affect, and life satisfaction) were significantly associated with both positive and negative components of marital adjustment (i.e., spousal support and spousal strain). We

also found that compared to men, subjective well-being was more strongly associated with marital adjustment for women. This gender difference may be due, in part, to women's greater tendency to have an interdependent self-concept, to report greater relationship commitment, and to engage in more relationship maintenance behaviors (reviewed by Impett & Peplau, 2006).

Our second interest was to evaluate the relative importance of genetic and environmental influences on subjective well-being, marital adjustment, and their co-occurrence. We found that these influences varied by gender. Consequently, the results will be discussed first for women and then for men. For women, the covariation between subjective well-being and marital adjustment was largely due to genetic influences, and these influences were statistically significant. Similarly, Spotts et al. (2005) found that genetic factors contributed to the common variances between wives' reports of marital adjustment and their global self-worth and the well-being subscale of the CES-D. Because we used different measures of well-being than those used by Spotts et al. (2005), these results suggest that the genetic influences on the covariation between marital adjustment and well-being is significant across different measures of well-being.

There are several possibilities of how genetic factors might influence both marital adjustment and individual well-being (cf. Spotts, Neiderhiser, Ganiban, et al., 2004; Spotts et al., 2005). First, there may be direct genetic influences on one variable (e.g., subjective well-being) that then impact the other variable (e.g., marital adjustment). For example, individuals with a genetic propensity for high levels of subjective well-being may seek out positive marital relationships, which feedback on and sustain their sense of subjective well-being. In support of this perspective, longitudinal studies on relationship adjustment and life satisfaction, one component of subjective well-being, have shown that relationship adjustment is associated with subsequent life satisfaction (Kamp Dush et al., 2008), life satisfaction is associated with subsequent relationship adjustment (Stanley et al., 2012), and relationship adjustment and life satisfaction are associated with one another in a directional or recursive pattern (BE, Whisman, & Uebelacker, 2013; Headey, Veenhoven, & Wearing, 1991). The finding that the magnitude of genetic influences on the covariation between subjective well-being and marital adjustment was higher for women than for men suggests that genetically-influenced characteristics such as personality should be more strongly associated with subjective well-being and marital adjustment for women than for men. In support of this perspective, Watson, Hubbard, and Wiese (2000) found that neuroticism was a significantly stronger predictor of marital adjustment in women than in men.

Second, marital adjustment may trigger genetic susceptibilities (e.g., personality traits) that are already in place. For example, poor marital adjustment may interact with genetically influenced personality traits, resulting in lower levels of subjective well-being. Indirect support for this perspective comes from a study by South and Krueger (2008), who found that genetic influences on internalizing problems increased in magnitude with lower levels of marital adjustment. Future research is needed to evaluate whether marital adjustment moderates genetic and environmental influences on subjective well-being and whether this association is greater for women than for men. In a study on within-subject associations between marital adjustment and depressive symptoms, greater neuroticism was associated

with smaller effects of depressive symptoms on marital adjustment in men (Davila, Karney, Hall, & Bradbury, 2003). These findings are consistent with the perspective that the moderating role of genetically influenced personality traits on the association between marital adjustment and subjective well-being may be greater for women.

Finally, insofar as subjective well-being and marital adjustment were measured by self-report, genetics may contribute to responding in certain ways to questions about well-being and marriage. However, it is unclear why genetic influences on responses styles would be stronger for women than for men. This potential explanation for the observed results could be ruled out in future research through collecting multi-method and multi-informant data on subjective well-being, marital adjustment, or both.

Compared to the findings obtained for women, a different pattern of results emerged for men. For men, the covariation between subjective well-being and marital adjustment was more evenly split between genetic influences and nonshared environmental influences, and only the influence of nonshared environmental influences on the covariance was statistically significant. One potentially important source of nonshared environmental influences that could contribute to both subjective well-being and marital adjustment is the spouse (cf. Spotts et al., 2005). Pasch, Bradbury, and Davila (1997) examined gender difference in social behavior of spouses during marital interaction and found that when husbands scored high on depressive symptoms and neuroticism (a genetically influenced personality trait which, as described in the preceding paragraph, may interact with marital adjustment in predicting subjective well-being), wives responded with higher levels of emotional support; this patterns was not found for husbands' behavior towards wives. Therefore, the association between marital adjustment and depressive symptoms (and potentially subjective well-being) may be weaker among husbands scoring higher on neuroticism because their spouses respond to the neuroticism in a supportive fashion that maintains their level of relationship adjustment. Furthermore, our finding for greater nonshared environmental influences on the covariation between subjective well-being and marital adjustment for men relative to women suggests that *partner* effects for characteristics such as personality should be stronger for husbands' functioning relative to wives' functioning. In support of this perspective, Watson et al. (2000) found that partners' level of neuroticism was more strongly related to marital adjustment for men than for women.

Although our primary interest was the genetic and environmental influences on the covariation between subjective well-being and marital adjustment, we also examined the genetic and environmental influences on subjective well-being and marital adjustment examined independently. First, concerning subjective well-being, there were moderate genetic and nonshared environmental influences on positive and negative affect and life satisfaction for women, but in men, the magnitude of genetic influences was lower and the magnitude of nonshared environmental influences was higher on positive affect and life satisfaction than on negative affect. Furthermore, the finding that genetic influences on subjective well-being were somewhat greater for women than for men is consistent with the results of one other study that found higher heritability for subjective well-being in women than in men (Røysamb et al., 2003).

Turning next to the results of the relative importance of genetic and environmental influences on marital adjustment, results suggest that genes account for 26–34% of the variance in marital adjustment in women and 3–10% of the variance in men. The results are consistent with studies that have found modest genetic influences on marital adjustment (e.g., South & Krueger, 2008; Spotts, Neiderhiser, Towers, et al., 2004; Spotts et al., 2006). The measure of marital adjustment used in the current study was based on a person's report of their partner's behavior. As such, the genetic influences measured in this study may best be conceptualized as evocative or active gene-environment correlations (i.e., r_{GE} ; Plomin, DeFries, & Loehlin 1977), in which individuals evoke responses from their environment that complement their genetic makeup or select, modify, construct, or reconstruct environments that are correlated with their genetic propensities. As applied to marriage, this suggests that genetic influences may reflect people's genetically influenced characteristics and behaviors that (a) impact their choice of their partner, (b) influence their perceptions of their partner's behavior, or (c) encourage particular behaviors or elicit particular behavioral responses from their partner. These options are not, however, mutually exclusive.

We also found evidence that compared to men, there was greater heritability for women in marital adjustment, measured in terms of both spousal support and spousal strain. In comparison, a genetically informed study on marital adjustment by Spotts et al. (2006) found women showed higher heritability for spousal support than men, whereas men showed higher heritability for spousal strain than women. It is unclear why Spotts et al.'s (2006) findings regarding gender differences differed from ours. It may be that demographic differences between the two studies contributed to the different findings (e.g., participants were 10 years younger on average in the Spotts et al. [2006] study). Given the differences between the two studies, additional research is needed in evaluating gender differences in the genetic and environmental influences of marital adjustment. Although our results indicate that genes account for a significant percentage of the variance in marital adjustment in women, most of the variance was due to nonshared environmental influences, particularly in men. Our finding of substantial nonshared environmental influences on marital adjustment is consistent with studies of other American (Spotts et al., 2006) and Swedish (Spotts, Neiderhiser, Towers, et al., 2004) samples. As discussed by Spotts et al. (2006), spouses may explain a majority of the nonshared environmental variance in marital adjustment.

In interpreting the results of this study, it is important to consider several limitations. First, the sample size was modest, resulting in limited power to detect subtle effects, although the small sample size did not preclude our ability to detect statistically significant different parameters across gender in several models and a statistically significant genetic covariance between subjective well-being and marital adjustment in women. Second, the sample was predominately White and future research is needed to examine whether our results generalize to samples that are more representative with respect to race and ethnicity and that differ from the current sample in age. Third, the measure of life satisfaction was based on a single item, and even though it was highly correlated with the SWLS, future research would benefit from the use of a multi-item measure of life satisfaction such as the SWLS. Also, all measures were assessed via self report, so the covariation between subjective well-being and

marital adjustment could partially be due to method covariance. Method covariance would inflate both the MZ and DZ cross-trait cross-twin correlations, and potentially inflate the influence of shared environmental influences (although this is unlikely, as the magnitude of shared environmental influences was negligible). Finally, the findings are based on cross-sectional analyses and research is needed to evaluate the genetic and environmental influences on the longitudinal associations between subjective well-being and marital adjustment.

These limitations notwithstanding, results from the current study build on prior research on genetic and environmental influences on the association between marital adjustment and well-being (Spotts et al., 2005) by using a comprehensive assessment of subjective well-being that included life satisfaction, positive affect, and negative affect. Although prior research has demonstrated that relationship quality is an important aspect of a person's overall well-being (for reviews, see Fincham & Beach, 2010; Ryff & Singer, 2000), research on the cross-sectional and longitudinal association between relationship quality and subjective well-being has generally not addressed the role that genetic influences may have on this association. In finding that genetic and environmental factors contribute to the covariation between subjective well-being and marital adjustment, the current results suggest that a comprehensive understanding of the association between relationship and individual functioning will need to include both genetic and environmental influences. Continued use of genetically informed research into the genetic and environmental influences on the covariation between marital adjustment and subjective well-being, therefore, should help advance understanding of how these variables are related. Similarly, clinicians working to promote positive relationship and individual functioning should be aware of the potential influences that genes and the environment have on both marital adjustment and subjective well-being. Findings also suggest the importance of evaluating potential gender differences in these associations, as there was evidence that genetic influences were more strongly associated with the covariation between subjective well-being and marital adjustment for women relative to men. Finally, in finding shared genetic influences on the covariation between subjective well-being and marital adjustment for women, the results highlight a point of convergence between interpersonal and genetic perspectives on subjective well-being.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

A1 = genetic influences on subjective well-being, C1 = shared environmental influences on subjective well-being, E1 = nonshared environmental influences on subjective well-being, A2 = genetic influences unique to marital adjustment, C2 = shared environmental influences unique to marital adjustment, E2 = nonshared environmental influences unique to marital adjustment. a_{11} = effect of A1 on subjective well-being, c_{11} = effect of C1 on subjective well-being, e_{11} = effect of E1 on subjective well-being, a_{21} = effect of A1 on marital adjustment, c_{21} = effect of C1 on marital adjustment, e_{21} = effect of E1 on marital adjustment, a_{22} = effect of A2 on marital adjustment, c_{22} = effect of C2 on marital adjustment, e_{22} = effect of E2 on marital adjustment.

Table 1

Categorization into Ordinal Variables

	Original Value	Ordinal Value	Number of Observations in Each Category
Positive Affect	3	0	212
	> 3 to < 4	1	424
	4	2	270
Negative Affect	1	0	283
	1 to 1.5	1	359
	> 1.5	2	264
Life Satisfaction	7	0	227
	8	1	286
	9	2	392
Spousal Support	3.5	0	262
	> 3.5 to < 4	1	266
	4	2	378

Table 2
Regression of Age and Gender on Subjective Well-being and Marital Adjustment Variables

Correlate	Positive Affect	Negative Affect	Life Satisfaction	Spousal Support	Spousal Strain
Age	$\beta = .10, p = .01$	$\beta = -.14, p < .01$	$\beta = .16, p < .01$	$\beta = .05, p = .25$	$\beta = -.03, p = .39$
Gender	$\beta = -.02, p = .68$	$\beta = .10, p = .02$	$\beta = .07, p = .10$	$\beta = -.10, p = .01$	$\beta = .08, p = .03$
Number of Children	$\beta = .02, p = .65$	$\beta = .01, p = .75$	$\beta = .03, p = .46$	$\beta = -.02, p = .59$	$\beta = .05, p = .20$
Remarriage	$\beta = -.02, p = .57$	$\beta = .02, p = .58$	$\beta = -.03, p = .46$	$\beta = .02, p = .62$	$\beta = -.06, p = .54$

Table 3

Phenotypic Correlations

Measure	Gender	Positive Affect	Negative Affect	Life Satisfaction	Spousal Support
Negative Affect	Women	-.58**			
	Men	-.57**			
Life Satisfaction	Women	.62**	-.44**		
	Men	.58**	-.38**		
	Women	.43**	-.42**	.53**	
Spousal Support	Men	.31**	-.28**	.46**	
	Women	-.43**	.43**	-.51**	-.82**
Spousal Strain	Men	-.26**	.30**	-.34**	-.64**

* $p < .05$.

** $p < .01$.

Table 4

Within-trait Cross-twin and Cross-trait Cross-twin Correlations

	MZ Women	DZ Women	MZ Men	DZ Men	DZ Opposite Sex
Within-trait Cross-twin Correlations					
Positive Affect	.48**	.19	.22	.17	.26*
Negative Affect	.52**	.27*	.55**	.30*	.16
Life Satisfaction	.50**	.29*	.42**	.17	.16
Spousal Support	.41**	-.09	-.03	.04	.12
Spousal Strain	.43**	-.07	.08	.08	.07
Cross-trait Cross-twin Correlations					
Positive Affect- Spousal Support	.41**	.04	.02	.12	.20*
Positive Affect- Spousal Strain	-.38**	-.10	-.01	-.09	-.07
Negative Affect- Spousal Support	-.39**	-.21*	-.11	.04	-.16
Negative Affect- Spousal Strain	.36**	.18 ⁺	.18*	.07	.09
Life Satisfaction- Spousal Support	.40**	-.01	.23*	.04	.09
Life Satisfaction- Spousal Strain	-.38**	-.05	-.13	.02	-.06

* $p < .05$.** $p < .01$.

Table 5
Parameters (Standard Errors) from Bivariate Cholesky Decomposition Models for Women and Men

Women										
Variable 1	Variable 2	Variable 1			Shared between Variables			Specific to Variable 2		
		A	C	E	A	C	E	A	C	E
Positive Affect	Spousal Support	.62(.21)**	.28(.39)	.72(.06)**	.58(.32)*	-.02(.54)	.10(.10)	.00(274.21)	.00(251.40)	.81(.07)**
	Spousal Strain	.64(.18)**	.24(.39)	.73(.06)**	-.51(.22)*	.04(.44)	-.11(.10)	.13(.96)	.03(.83)	.84(.04)**
	Spousal Support	.68(.15)**	.25(.34)	.69(.06)**	-.55(.13)**	-.09(.32)	-.05(.12)	.13(.93)	.00(826.48)	.82(.06)**
Negative Affect	Spousal Strain	.70(.12)**	.17(.39)	.68(.06)**	.43(.11)**	.09(.30)	.11(.09)	.27(.13)*	.00(15.27)	.85(.04)**
	Spousal Support	.68(.15)**	.19(.42)	.70(.07)**	.54(.27)*	-.17(.59)	.28(.11)*	.03(6.62)	.00(1609.30)	.78(.07)**
	Spousal Strain	.71(.07)**	.02(.47)	.69(.07)**	-.42(.12)**	.09(.47)	-.24(.09)**	.30(.22)	.00(918.25)	.82(.04)**
Men										
Variable 1	Variable 2	Variable 1			Shared between Variables			Specific to Variable 2		
		A	C	E	A	C	E	A	C	E
Positive Affect	Spousal Support	.43(.30)	.24(.42)	.86(.07)**	.16(.48)	.16(.60)	.23(.11)*	.00(274.18)	.00(250.53)	.94(.07)**
	Spousal Strain	.35(.45)	.34(.38)	.87(.07)**	-.09(.60)	-.09(.55)	-.26(.09)**	.16(.88)	.24(.44)	.91(.06)**
	Spousal Support	.65(.18)**	.31(.33)	.67(.06)**	-.21(.21)	.18(.30)	-.28(.12)*	.02(10.09)	.00(196.27)	.92(.06)**
Negative Affect	Spousal Strain	.62(.23)**	.36(.36)	.67(.06)**	.32(.19)	-.04(.32)	.20(.11)	-.01(13.23)	.12(1.02)	.92(.06)**
	Spousal Support	.50(.28)*	.30(.37)	.77(.07)**	.30(.52)	.05(.77)	.36(.11)*	.00(68.18)	.00(270.46)	.88(.07)**
	Spousal Strain	.49(.36)	.33(.43)	.77(.08)**	-.30(.32)	.16(.59)	-.33(.09)**	.03(6.17)	.00(177.86)	.88(.06)**

Note. There were moderate correlations among the subjective well-being measures and the marital adjustment measures, which should be considered when interpreting the significance of these parameters.
A = genetic influences, C = shared environmental influences, E = nonshared environmental influences.

*
p < .05.

**
p < .01.

Table 6

Variance of Subjective Well-Being, Marital Adjustment, and the Covariance Between Subjective Well-Being and Marital Adjustment due to A, C, E, and Age in Women

Positive Affect			Spousal Support		Covariance
Total Variance	Common with Positive Affect	Unique to Spousal Support	Total Variance		
A	.34	.00	.34		.36
C	.00	.00	.00		-.01
E	.01	.65	.66		.07
Age	--	--	.00		.00

Positive Affect			Spousal Strain		Covariance
Total Variance	Common with Positive Affect	Unique to Spousal Strain	Total Variance		
A	.26	.02	.28		-.32
C	.00	.00	.00		.01
E	.01	.71	.72		-.08
Age	--	--	--		--

Negative Affect			Spousal Support		Covariance
Total Variance	Common with Negative Affect	Unique to Spousal Support	Total Variance		
A	.30	.02	.32		-.37
C	.01	.00	.01		-.02
E	.00	.67	.67		-.03
Age	--	--	.00		.00

Negative Affect			Spousal Strain		Covariance
Total Variance	Common with Negative Affect	Unique to Spousal Strain	Total Variance		
A	.19	.07	.26		.30
C	.01	.00	.01		.01
E	.01	.72	.73		.07
Age	--	--	--		--

Life Satisfaction			Spousal Support		Covariance
Total Variance			Common with Life Satisfaction	Unique to Spousal Support	Total Variance
A	.46	.29		.00	.29
C	.04	.03		.00	-.03
E	.49	.08		.60	.19
Age	.01	--		--	.00

Life Satisfaction			Spousal Strain		Covariance
Total Variance			Common with Life Satisfaction	Unique to Spousal Strain	Total Variance
A	.50	.17		.09	-.29
C	.00	.01		.00	.00
E	.48	.06		.67	-.17
Age	.02	--		--	--

Note. The total variance due to A, C, and E for each variable is similar but not identical across different models because parameters are estimated to minimize the difference between the observed and expected covariance matrices in each model. A = genetic influences; C = shared environmental influences; E = nonshared environmental influences.

Table 7

Variance of Subjective Well-Being, Marital Adjustment, and the Covariance Between Subjective Well-Being and Marital Adjustment due to A, C, E, and Age in Men

Positive Affect					Spousal Support		Covariance	
Total Variance		Common with Positive Affect		Unique to Spousal Support		Total Variance		
A	.19		.03		.00	.03	.07	
C	.06		.03		.00	.03	.04	
E	.74		.05		.89	.94	.20	
Age	.01		--		--	.00	.01	

Positive Affect					Spousal Strain		Covariance	
Total Variance		Common with Positive Affect		Unique to Spousal Strain		Total Variance		
A	.12		.01		.02	.03	-.03	
C	.11		.01		.06	.07	-.03	
E	.75		.06		.84	.90	-.22	
Age	.02		--		--	--	--	

Negative Affect					Spousal Support		Covariance	
Total Variance		Common with Negative Affect		Unique to Spousal Support		Total Variance		
A	.43		.04		.00	.04	-.14	
C	.09		.03		.00	.03	.05	
E	.44		.08		.84	.92	-.19	
Age	.04		--		--	.01	-.02	

Negative Affect					Spousal Strain		Covariance	
Total Variance		Common with Negative Affect		Unique to Spousal Strain		Total Variance		
A	.39		.10		.00	.10	.20	
C	.13		.00		.01	.01	-.02	
E	.45		.04		.85	.89	.14	
Age	.03		--		--	--	--	

Life Satisfaction			Spousal Support		Covariance
Total Variance			Common with Life Satisfaction	Unique to Spousal Support	Total Variance
A	.25	.09	.09	.00	.15
C	.09	.00	.00	.00	.01
E	.60	.13	.13	.77	.28
Age	.06	--	--	--	.00

Life Satisfaction			Spousal Strain		Covariance
Total Variance			Common with Life Satisfaction	Unique to Spousal Strain	Total Variance
A	.24	.09	.09	.00	-.15
C	.11	.03	.03	.00	.05
E	.59	.11	.11	.77	-.25
Age	.06	--	--	--	--

Note. The total variance due to A, C, and E for each variable is similar but not identical across different models because parameters are estimated to minimize the difference between the observed and expected covariance matrices in each model. A = genetic influences; C = shared environmental influences; E = nonshared environmental influences.