

# Love, Work, and Changes in Extraversion and Neuroticism Over Time

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The present study examined individual differences in change in extraversion, neuroticism, and work and relationship satisfaction. Of particular interest were the correlations between changes. Data were from the Victorian Quality of Life Panel Study (B. Headey & A. Wearing, 1989, 1992), in which an overall 1,130 individuals participated (ages 16 to 70). Respondents were assessed every 2 years from 1981 to 1989. Four major findings emerged. (a) There were significant individual differences in changes in extraversion and neuroticism. (b) Change was not limited to young adulthood. (c) Development was systematic in that increased work and relationship satisfaction was associated with decreases in neuroticism and increases in extraversion over time; on average, the magnitude of the relation between changes in work and relationship satisfaction and traits was .40. (d) Cross-lagged models indicated traits had a greater influence on role satisfaction; however, marginal support emerged for work satisfaction leading to increased extraversion. Implications of correlated change are discussed.

*Keywords:* traits, personality development, longitudinal, life-span development, well-being

In recent years, several cross-sectional and longitudinal studies have converged on a general picture of personality development in which neuroticism decreases and agreeableness and conscientiousness increase with age (McCrae et al., 1999; Srivastava, John, Gosling, & Potter, 2003). Neuroticism, in particular, decreases with striking consistency with each year of life. In a recent meta-analysis of longitudinal studies of personality, Roberts, Walton, and Viechtbauer (2006) found evidence for change on every dimension of the Big Five, even well into old age. A major goal that remains for personality research is to account for the conditions under which these trait changes occur or are strongest.

Are changes in personality traits associated with life experiences? If so, do environmental influences have an impact on trait development only in young adulthood? We sought to address these questions by investigating individual differences in change, or intraindividual change, in extraversion and neuroticism. Specifically, we examined correlated change or the degree to which traits and other variables changed together over time. By focusing on individual differences in change, we hoped to gain a deeper understanding of the relation between important social domains and personality development in adulthood.

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This article is based in part on a dissertation by Christie Napa Scollon to fulfill the requirements of a doctoral degree at the University of Illinois at Urbana–Champaign. Considerable thanks are due to Bruce Headey and Alexander Wearing for use of their data. We are also indebted to Brent Roberts, C. Y. Chiu, Lawrence Hubert, and Laura King for their insightful comments and guidance. We also thank the Australian Social Science Data Archives.

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## Social Roles and Personality Development

Dynamic transactional perspectives highlight the codevelopment of the individual and his or her social relationships. For example, Neyer and Asendorpf (2001) found that neuroticism predicted feeling insecure in one's relationships, but the formation of a romantic partnership also led to decreases in neuroticism over time. More recently, Roberts, Wood, and Smith (2005) have elaborated on transactional views with the social investment model. According to social investment principles, individuals make commitments to important social institutions or roles such as work or marriage. Successful fulfillment of these roles often demands certain behaviors and characteristics, for example, increased emotional stability, agreeableness, and conscientiousness. By committing to and succeeding in these important social roles, over time, the person comes to assume the qualities that the roles promote. Thus, according to a transactional view of development, as role quality increases, individuals should exhibit increases in the corresponding traits that the role promotes.

## Important Social Roles: Work and Love

As Freud famously noted, the two most important roles in adult life are work and love. Not surprisingly then, a number of tests of transactional development have focused on these two major roles with evidence to suggest that happy work and close relationships may lead to long-term increases in psychological well-being. Roberts, Caspi, and Moffitt (2003), for instance, found that individuals who obtained higher status occupations increased in well-being and agency over time. For women in the 1960s, paid participation in the work force and occupational successes predicted increased agency (Roberts, 1997) and dominance (Roberts, Helson, & Klohnen, 2002) some 20 years later. Subjective aspects of work also predict well-being in that satisfying and engaging employment predicts increases in positive emotion and decreases in negative emotion (Roberts et al., 2003; Roberts & Chapman, 2000).

By contrast, unemployment leads to long-term decreases in life satisfaction, such that many individuals do not return to their preunemployment levels of well-being, even years after regaining employment (Lucas, Clark, Georgellis, & Diener, 2004).

Similar patterns have been noted with regard to close relationships. Widowhood leads to a precipitous decline in life satisfaction that does not return to baseline levels even 7 years after the event (Lucas, Clark, Georgellis, & Diener, 2003). In addition, Robins, Caspi, and Moffitt (2002) found that conflict, abuse, and poor relationship quality predicted increases in negative emotionality over time. Similarly, marital tension predicted increases in femininity, whereas divorce predicted decreases in dominance in an all female sample (Roberts et al., 2002). By contrast, increases in marital satisfaction correlated with increases in well-being and effective functioning and decreases in anxiety over time (Roberts & Chapman, 2000). Likewise, male veterans who married or remarried declined more in neuroticism after 12 years than those who remained single (Mroczek & Spiro, 2003). In some cases, the benefits of marriage extend beyond emotional rewards. Roberts and Bogg (2004) found that time spent married predicted increases in social responsibility, a facet of conscientiousness (see also Robins et al., 2002).

### Correlated Change

According to transactional views of development, we should expect changes in relationships to correspond to changes in personality. In other words, the two changes should correlate. However, the empirical evidence for correlated change has been somewhat inconsistent. Only one study has found that changes in relationships correlated with changes in personality (Roberts & Chapman, 2000), whereas two other studies (Asendorpf & Wilpers, 1998; Neyer & Asendorpf, 2001) found no relation between the two dynamic constructs.

The inability to find significant correlated change could be due to a number of factors other than the lack of a true relation between personality and social relationships. First, studies of correlated changes require a large sample size.<sup>1</sup> Second, previous studies have addressed changes at the observed level, in which measurement error can attenuate the correlation between two changes, a point to which we return later. Finally, a focus on relationship variables that provide minimal, if any, indication of the quality of participants' relationships may not capture the psychological significance of a role or its ongoing functioning. For instance, Asendorpf and Wilpers (1998) had participants record the number of interactions they had, the number of same- and opposite-sex peers, and so on. Roberts et al. (2005) have noted that psychological qualities, such as role satisfaction, are more important determinants of role investment than the mere acquisition of a role. After all, a good relationship might have the power to promote well-being, whereas a dysfunctional one might increase ill-being (Roberts, 1997; Robins et al., 2002). Thus, one goal of the present study was to test whether changes in personality traits correlated with changes in role satisfactions when examined at the latent level. Note that although examinations of correlated change are still quite rare in the personality literature, a number of examples on cognitive functioning can be found (e.g., Sliwinski, Hofer, & Hall, 2003).

### Implications of Correlated Change

Correlated change is essential to understanding development. A central feature of the present study is our focus on change at the individual level. Understanding individual differences in change is essential to understanding life-span development (Hertzog & Nesselroade, 2003). Although experiments are often considered the "gold standard" in psychological research, it is impossible and unethical to experimentally manipulate the long-term variables of theoretical interest to development such as love and work. However, by understanding the relation between changes in different variables, we can uncover important mechanisms that potentially shape development (Hertzog & Nesselroade, 2003; cf. Sliwinski et al., 2003). Our study investigates the relation between two underlying developmental trajectories, which cannot be obtained from simple concurrent correlations. Whereas concurrent correlations address time-specific relations between variables, correlated change provides evidence of personality and social roles enhancing one another over time.

Although a handful of past studies have examined individual-level change in personality (e.g., Helson, Jones, & Kwan, 2002; Jones & Meredith, 1996; Robins, Fraley, Roberts, & Trzesniewski, 2001; Vaidya, Gray, Haig, & Watson, 2002), past research has mainly focused on estimating the number of people who change or on cohort or gender as predictors of change. Although this research has led to important discoveries such as few gender differences in adult development (Helson et al., 2002), the question of what predicts change remains largely underexplored. Our study focuses on the psychological variables associated with change.

The study of correlated change also has great potential to inform interventions and programs aimed at self-improvement. For instance, knowing that decreases in neuroticism over time are associated with increased work satisfaction might focus interventions on career counseling. Increases in extraversion are also likely to be salubrious given that extraversion and pleasant affect are consistently and moderately correlated (Lucas & Fujita, 2000). Even if correlated changes are small in magnitude, they may have enormous real-world consequences for an individual's well-being. In fact, a 1-point difference could be a matter of life or death according to one recent study; Mroczek and Spiro (2005) found that for every half standard deviation increase in neuroticism per decade, the result was a 40% increase in mortality! These results occurred even after they controlled for physical health and age. Clearly, knowing what factors are associated with changes in neuroticism is vital to enhancing physical and psychological well-being.

### Extending Previous Research

The extant literature on adult personality development leaves unanswered several intriguing questions that are amenable to the present research.

<sup>1</sup> Asendorpf and Wilpers (1998) had a sample size of 132 and therefore may have lacked the statistical power necessary to detect an association between the two changes, especially after the investigators controlled for initial status in both variables and made Bonferroni adjustments to avoid Type I error.

### *Is Development Limited to Young Adulthood?*

Many previous studies have examined either young or old participants but not both. Mroczek and Spiro (2003), for example, tracked male veterans initially 43 to 91 years of age. Small, Hertzog, Hultsch, and Dixon (2003) studied men and women initially 55 to 85 years of age. These studies are important because they have demonstrated that change remarkably occurs even well into old age. But given that the stability of personality traits reaches its maximum (at .74) between age 50 and 70 (Roberts & DelVecchio, 2000), a great deal of change in development might be overlooked by not sampling during young adulthood. On the other hand, an exclusive focus on young adults (e.g., participants 18 to 26 years of age in Roberts et al., 2003, and Robins et al., 2002) might fail to detect important changes that occur when one has established a career and a significant long-term partnership. The present study includes individuals as young as 16 and as old as 70 in the first wave of the study. This wide range of participant ages also allowed us to examine whether different age groups have different rates of change.

Most studies have focused on the relation between the social world and development with the assumption that the relation remains constant throughout the life course. At the same time, others have argued that personality development ceases or slows down after a particular age (Costa & McCrae, 1994, 2006). Most famous was William James's (1890/1918) claim that personality becomes "set like plaster" by age 30. Thus, it seems reasonable to test whether the relation between social roles and development differs before and after this important threshold. Although Srivastava et al. (2003) and others have investigated whether indeed personality becomes set by age 30, their study and most others have focused on mean levels or age differences in traits. Unlike past research, the present study addresses this question from the perspective of individual differences in change. Thus, the second goal of this study was to compare individuals under age 30 with those over age 30 to see whether (a) there is more variability in individual change in young adulthood and (b) correlations between changes in personality and changes in social roles are greater in young adulthood.

### *Latent Growth Modeling (LGM)*

Lack of correlated changes in previous studies may have been due to measurement error. The present study extends past research by measuring relationship variables and personality variables each on more than two occasions and using LGM to estimate change. Growth models offer more precise estimates of change because they are based on more than two assessments, and they do not require the same number of assessments for all participants in a study; in fact, growth models are tolerant of missing data, thereby allowing researchers to use more of the available data, rather than only complete case data. It is important to note that latent correlated change is unattenuated by measurement error.

### *Representative Samples*

Most previous studies have examined a small number of elite individuals who might not be representative of broader society. For example, Roberts (1997), Roberts and Bogg (2004), Roberts and

Chapman (2000), and Roberts et al. (2002) all relied on the Mills Longitudinal sample, which included women who attended Mills College in the 1950s.

### *Different Types of Change*

The study of individual differences in change represents a burgeoning area within the field of personality, although ours is not the first to examine this type of change. As early as the 1970s, Baltes and Nesselroade (1979) were pioneers in the study of individual differences in change, and their work continues to influence the theory and techniques behind studying change (see Hertzog & Nesselroade, 2003). In recent years, other investigators have established that individual differences in change exist for several traits (e.g., Jones & Meredith, 1996; Mroczek & Spiro, 2003; Small et al., 2003). Our study extends past findings by identifying predictors of change.

Relative to other types of change, however, investigations of individual differences in change are still in the minority. Most research on personality development has focused on group means or test-retest correlations (i.e., rank-order change; see Caspi & Roberts, 1999). Although population statistics can inform us of normative change, any attempts to address predictors of change must ultimately treat change itself as an individual difference. Thus, the question of why change occurs for some individuals and not for others remains vastly underexplored. By examining individual differences in change, we hope to clarify at least part of this process. At the same time, for the sake of comparison across the literature, we also report findings for mean-level and rank-order change.

### *Implications for a Theory of Traits*

Early representations of the five-factor theory (FFT; McCrae & Costa, 1990) strongly suggested that traits do not change in adulthood. For example, in 1994, McCrae and Costa stated that "Individual differences in personality traits, which show at least some continuity from early childhood on, are also essentially fixed by age 30" (p. 173). By 1999, however, McCrae and Costa claimed that "Traits develop throughout childhood and reach mature form in adulthood; thereafter they are stable in cognitively intact individuals" (p. 145). Such a view implied that traits change in childhood and as the result of dementing disorders in adulthood but that traits do not change in normal adults. More recently, these authors (Costa & McCrae, 2006; McCrae, 2002) have conceded that modest trait change after childhood may occur. Unlike the social investment model (Roberts et al., 2005), however, Costa and McCrae (2006) claimed that "changes are more pronounced early in adulthood than either before or after" (p. 26), a view that resonates with James's plaster hypothesis. Moreover, FFT states that traits are "insulated from the effects of the environment" (McCrae & Costa, 1999, p. 144). Traits are thought to influence characteristic adaptations such as social roles, but social roles clearly do not influence trait development in FFT (see McCrae & Costa, 1999, Figure 5.1). Consequently, the FFT attributes observable trait changes to intrinsic maturation, rather than environmental influences (Costa & McCrae, 2006; McCrae, 2002).

The present study examined two important points of scientific contention from the FFT. First, we examined the claim that trait



changes are more pronounced in early adulthood rather than in later adulthood. As mentioned in the previous section and elaborated on in the analyses section, if development is limited to young adulthood, older adults should exhibit low or zero variability in within-person trait changes (i.e., lower variances around the slopes of extraversion and neuroticism). Unfortunately, our data did not permit an examination of how development differs for young adults compared with children. Second, we addressed whether traits are insulated from the effects of the environment by examining the correlation between changes in traits and changes in role satisfactions. A nonzero correlation between changes in extraversion or neuroticism and changes in work or marital satisfaction would challenge this view of traits. It would be especially convincing if specific traits change more with specific roles, in other words, if changes in personality and social roles do not conform to a pattern of global increases in positivity. Of course, the direction of causality cannot be determined from correlated changes. It is possible for intrinsic maturation to cause changes in both traits and role satisfactions. Thus, a stronger test of causal direction comes from a cross-lagged model in which the influence of traits on changes in role satisfaction can be separated from the influence of roles on trait changes.

### *Do Satisfying Social Roles Lead to Increased Emotional Stability or Does Increased Emotional Stability Cause People to Enjoy Their Social Roles More?*

Of studies that have explicitly compared the directionality of paths, Wood and Roberts (2006) found no support for trait effects on roles but significant support for role effects on traits. On the other hand, Neyer and Asendorpf (2001) found evidence for trait effects on social relationships but not vice versa. Thus, the third goal of the present study was to explore the causal relation between roles and changes in personality with a cross-lagged design.

### Study Overview

We examined mean-level, rank-order, and individual-level changes in extraversion and neuroticism over time. Consistent with theories of transactional development, we focused on work and close relationships as important life domains that relate to increased well-being. We also used high extraversion and low neuroticism as proxies for increased well-being, given the well-replicated relations between extraversion and pleasant affect (Lucas & Fujita, 2000) and neuroticism and unpleasant affect (Costa & McCrae, 1980).

The aims of the present study were three-fold. First, we sought to replicate the finding that despite high rank-order stability, significant individual differences in change in extraversion and neuroticism exist (Jones & Meredith, 1996; Mroczek & Spiro, 2003; Small et al., 2003). In addition, we examined whether trait changes correlate with changes in work and relationship satisfaction. Second, the present study examined whether individual differences in trait changes are more likely to occur among individuals under age 30. If development ceases by age 30, older individuals should show less (or no) individual-level change in traits and a smaller relation (or no relation) between life experiences and development. Third, the present study explored the directionality of changes in traits and social roles. In other words, do satisfying social roles

lead to changes in personality traits or do traits lead to changes in role satisfaction? We examined this final question with a cross-lagged path model.

## Method

### *Victorian Quality of Life Panel Study*

The sample consisted of participants in an 8-year longitudinal study in Victoria, Melbourne, Australia. Pioneers in quality of life research, Bruce Headey and Alexander Wearing, in consultation with the Australian government, established the Victorian Quality of Life Panel Study in 1981 and tracked the subjective well-being of Australian residents every 2 years until 1989, for a total of five waves of assessment (see Headey & Wearing, 1989, 1992). The original panel consisted of 941 participants who were selected as a representative sample of Victoria's population. The sample represented a wide range of socioeconomic statuses and a balance between rural and urban dwellers. In the first wave of the study, participants ranged in age from 16 to 70 ( $M = 37.2$ ,  $SD = 13.3$ ). In 1983, 189 participants joined the study, replacing participants who dropped out of the study, bringing the total sample size to 1,130 (mean age in 1983 = 39.9,  $SD = 13.3$ ). We excluded 1 person from the analyses because she did not provide age information at any of the assessments. Unfortunately, the panel experienced substantial attrition over the 9 years, leaving available complete data on 33% of participants. Fifty-two percent of participants completed four or more assessments. Sixty-five percent completed three or more assessments, and 74% completed two or more assessments. Headey and Wearing (1992) noted that younger participants and those of lower socioeconomic status were somewhat more likely to drop out of the study. It is important to note that the longitudinal sample did not significantly differ from nonlongitudinal samples on the major variables of interest (see the Results section). Participants responded in interviews in 1981, 1983, and 1985, whereas in 1987 and 1989, respondents completed survey measures. Table 1 shows the number of male and female respondents in each category in the first wave of assessment.<sup>2</sup>

### *Measures*

*Extraversion and neuroticism.* Participants completed the Eysenck Personality Inventory (Form B; Eysenck & Eysenck, 1968), which consisted of 24 items designed to measure extraversion and 24 items designed to measure neuroticism. Scores on the Neuroticism scale had a theoretical range of 0 to 24. Alphas for the Neuroticism scale ranged from .81 (in 1981 and 1983) to .83 (in 1989). For the Extraversion scale, we omitted 6 items that had low interitem correlations (below .30) and conceptually were closer to impulsivity than extraversion. Internal consistencies for the 18-item Extraversion scale ranged from .61 (in 1981) to .68 (in 1989). Extraversion scores had a theoretical range of 0 to 18. Unfortunately, respondents did not complete extraversion and neuroticism measures in 1985.

*Work satisfaction.* Participants responded to questions about their satisfaction with work using a 1 (*terrible*) to 9 (*delighted*) scale. Six items measured satisfaction with work, including "How do you feel about the chance you have to use your skills and abilities at work?" and "How do you feel about your job in general?" Alphas ranged from .80 (in 1985) to .86 (in 1989).

*Relationship satisfaction.* Five items assessed satisfaction with one's romantic relationship. Respondents who were married or living with their romantic partner answered these questions, even if they were not legally married ( $n = 653$  in 1981;  $n = 622$  in 1983;  $n = 547$  in 1985;  $n = 490$  in

<sup>2</sup> Assignment to age groups was based on age in 1981. For individuals who joined in 1983, we estimated age in 1981 as age in 1983 minus 2.

Table 1  
Number of Participants by Gender and Age

Age group <sup>a</sup>	Male	Female	Total
Under 20	28	34	62
20–29	160	178	338
30–39	134	147	281
40–49	95	91	186
50–59	86	98	184
60+	35	43	78
Not reporting age	0	1	1
Total	538	592	1,130

<sup>a</sup> Age group assignment was based on participant’s age in 1981. For individuals who joined the study in 1983, age in 1981 was estimated as age in 1983 minus 2.

1987;  $n = 361$  in 1989). Sample items included “How do you feel about the extent to which your husband/wife understands you?” and “How do you feel about your marriage?” Alphas ranged from .86 (in 1981) to .94 (in 1989).

Analyses

**LGM.** In the present study, we chose to model changes using structural equation models of latent growth curves (see McArdle, 1989, 2005). We elected to use LGM because it takes into account measurement error and uses more of the available data than alternative methods such as within-person regression (Willett, 1988). With missing data, as is common in longitudinal studies, models cannot be fit to simple covariance matrices. Instead, full information maximum likelihood (FIML) or “direct estimation” procedures must be used to fit models to the raw data. In other words, an algorithm estimates the model using all available data on all cases (Hox, 2000). The structural equation modeling software Amos 5.0 (Arbuckle, 2003) includes this feature. Thus, even participants who provide only one data point can contribute to the modeling of means and variances. Hierarchical linear modeling (HLM) is also capable of this. In contrast, within-person regression requires an individual to have at least three data points in order to create a meaningful regression for that person. Note that FIML procedures differ from those using only complete case data or data imputation, both of which can lead to biased estimates (Wothke, 2000). Hox (2000) has also shown that in handling missing observations, LGM with FIML is efficient and yields accurate estimates. Additionally, LGM can simultaneously model multiple dynamic variables (e.g., McArdle, 1989), thus allowing for an examination of interrelationships in change or correlations of change components, a major goal of the present study.

**The basic latent growth model.** Figure 1 illustrates a basic linear latent growth model. As is common in structural equation models, circles denote latent variables, and squares denote observed variables. The observed variables, T1 to T5, refer to the repeated measurements taken every 2 years over the course of the study (extraversion in 1981, extraversion in 1983, etc.). Two-headed arrows represent correlations, and single-headed arrows represent regression coefficients or directed paths. A latent slope was modeled with directed paths from the latent variable to the observed variables or measurement occasions. We constrained these paths or factor loadings to equal the number of years that had passed at each assessment since the beginning of the study (e.g., 0, 2, 4, 6, and 8). This is the same as centering at the beginning of the study in HLM and represents linear change over time. Because 1985 assessments of extraversion and neuroticism were not available, we omitted the T3 variable and its associated path (denoted “4” in Figure 1) for these measures. The loadings of the repeated measures on the intercept factor were constrained to unity. In addition, given that previous studies have demonstrated cross-sectional age differ-

ences in traits (e.g., Roberts et al., 2006; Srivastava et al., 2003), we included the covariate of age (centered at beginning of the study) in our model. We did this because we were specifically interested in changes over time above and beyond age effects or simple maturation.

Two important parameters are associated with the latent slope: mean slope ( $M_S$ ) and variance or deviance around the slope ( $D_S$ ). The mean component is equivalent to a fixed effect in HLM, whereas the variance is a random effect. Therefore, the mean of the slope addresses normative change. If the mean departs from zero, this gives an indication of how the sample as a whole changed. It is possible for the mean to be zero, indicating no normative change, while having a nonzero variance component (i.e., a nonzero random effect). Nonzero variance around the slope indicates significant individual differences in change, so testing whether this component is nonzero determines whether further analyses are possible—a procedure that is also common in analyses using HLM.

The intercept is also characterized by a mean intercept ( $M_I$ ) and a variance around the intercept ( $D_I$ ). The mean refers to the average intercept

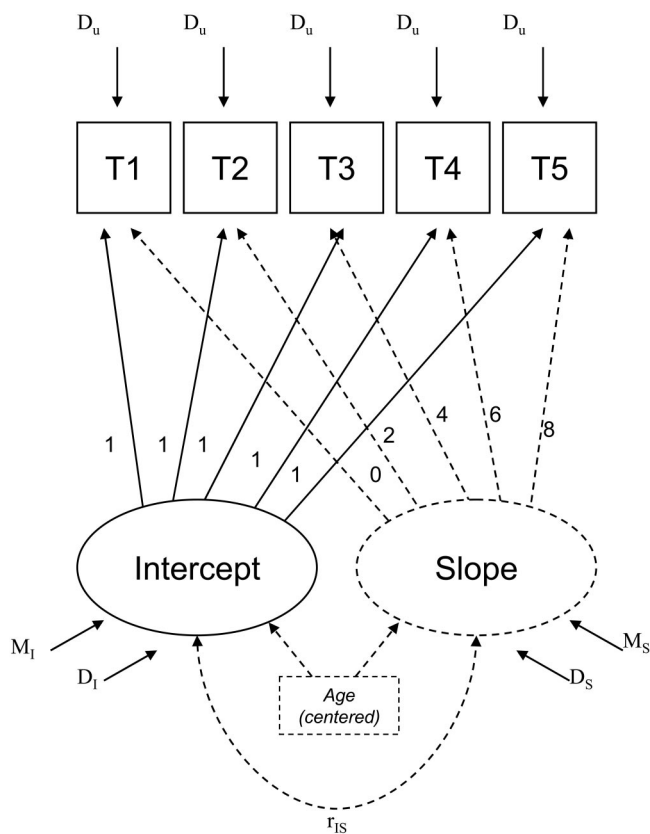


Figure 1. Univariate latent growth model. Circles denote latent variables, and squares denote observed variables. The observed variables, T1 to T5, refer to the repeated measurements taken every 2 years over the course of the study. Two-headed arrows represent correlations, and single-headed arrows represent regression coefficients or directed paths. A latent slope was modeled with directed paths from the latent variable to the observed variables or measurement occasions. We constrained these paths or factor loadings to equal the number of years that had passed at each assessment since the beginning of the study (e.g., 0, 2, 4, 6, and 8). Paths from the latent intercept to the observable variables were constrained to unity. Solid lines refer to an intercept-only or no-growth model. We tested a growth model by adding the variables and paths represented by the dashed lines.  $D_u$  = unaccounted variation;  $M_I$  = mean intercept;  $D_I$  = variance around the intercept;  $M_S$  = mean slope;  $D_S$  = deviance around the slope.

for the group as a whole (fixed effect), whereas the variance component describes individual differences in initial level (random effect). Finally,  $D_U$  represents unaccounted variation, or error variance. The model constrains error variances to be equal across measurement occasions, rather than “free.” McArdle (2005) noted that using different sized error at different occasions has no substantive or logical basis and has the potential to capitalize on chance in the data.

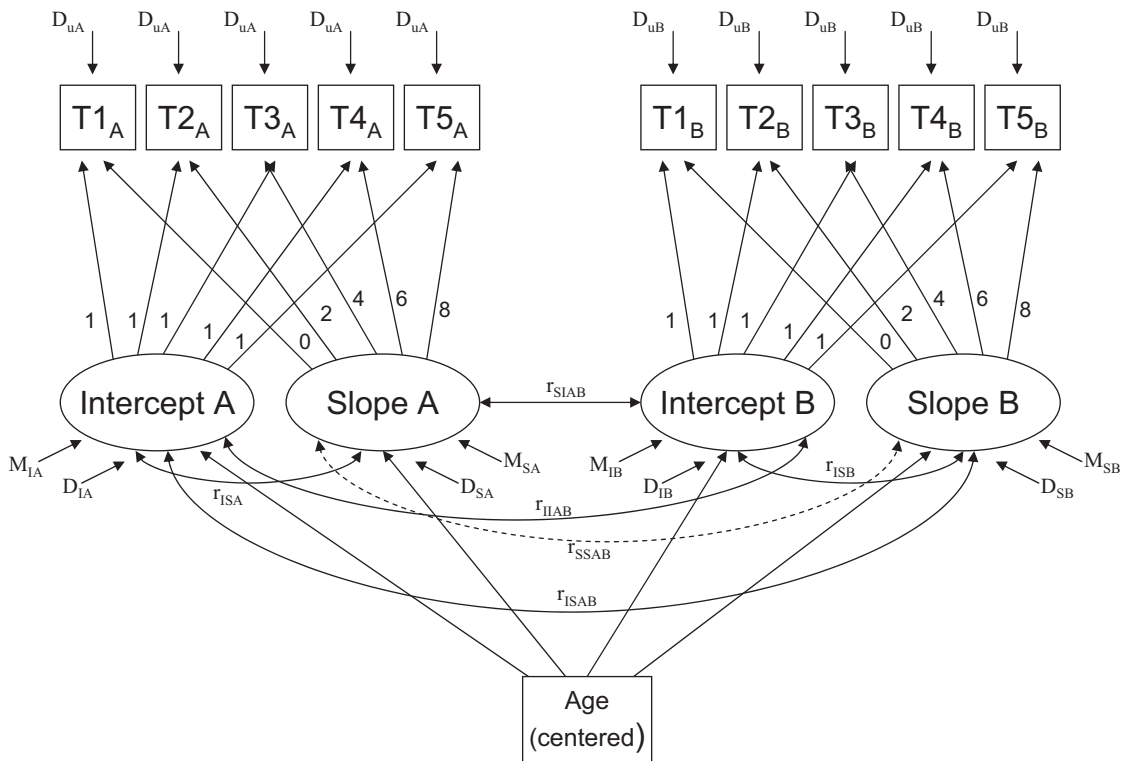
Although we recognized that the possibility of nonlinear growth existed, we elected to examine linear instead of more complex (e.g., quadratic) growth for several reasons. First, with five assessments and no theoretical rationale for nonlinear effects, a linear model seemed reasonable. Second, it is possible to estimate the factor loadings from the latent slope (known as a latent basis model). When we did this, the latent basis models tended not to fit much better than the linear growth models, suggesting that linear growth was a reasonable approximation of the development of these constructs. Third, when we used latent basis models and compared them with linear models, the interrelationships among change components that were of primary interest remained virtually unchanged. Fourth and most important, the meaning of the correlation between two slopes becomes difficult to interpret when the slope functions are nonlinear.

**Bivariate latent growth model.** Figure 2 illustrates a bivariate latent growth model in which two constructs change together over time. For example, this figure might represent a latent slope and intercept for Variable A, extraversion, and a latent slope and intercept for Variable B,

work satisfaction. The model also includes estimates of the mean slope for each variable, A and B ( $M_{SA}$  and  $M_{SB}$ ), and an estimate of the mean intercept for each variable, A and B ( $M_{IA}$  and  $M_{IB}$ ).  $D_{SA}$  and  $D_{SB}$  capture deviations or variability around the respective slopes, and  $D_{IA}$  and  $D_{IB}$  capture deviations around the respective intercepts.  $D_{UA}$  and  $D_{UB}$  represent error variances, which were constrained to be equal across measurement occasions, but not across the different constructs. The path  $r_{SSAB}$  represents the correlation between slopes. For example, this path might represent the relation between change in extraversion and change in work satisfaction. We included other paths such as the relation between slopes and intercepts to control for these associations. Because rate of change is often correlated with initial status, it is important to include these control features in the model. Again, we included age in the model as a covariate to control for cross-sectional age differences.

**Correlated change.** Do extraversion and neuroticism changes accompany work or relationship satisfaction changes over time? A correlation between two slopes (i.e.,  $r_{SSAB}$ ) would suggest that experience shapes personality development to some degree and vice versa. The dotted line in Figure 2 highlights this path.

**Group differences.** Does development differ for younger and older adults? If personality becomes less malleable or “set like plaster” with age, then we should expect less variability in the slopes of extraversion and neuroticism in an older compared with younger sample. In addition, correlated changes should be smaller in magnitude among older adults.



**Figure 2.** Bivariate latent growth model. Circles denote latent variables, and squares denote observed variables. The observed variables, T1 to T5, refer to the repeated measurements taken every 2 years over the course of the study. Two-headed arrows represent correlations, and single-headed arrows represent regression coefficients or directed paths. A latent slope was modeled with directed paths from the latent variable to the observed variables or measurement occasions. We constrained these paths or factor loadings to equal the number of years that had passed at each assessment since the beginning of the study (e.g., 0, 2, 4, 6, and 8). Paths from the latent intercept to the observable variables were constrained to unity. The dashed line represents the correlation between slopes (i.e., correlated change). A and B represent the two variables.  $D_u$  = unaccounted variation;  $M_I$  = mean intercept;  $D_I$  = variance around the intercept;  $M_S$  = mean slope;  $D_S$  = deviance around the slope.

That is, satisfying work and relationships should be less correlated with changes in personality with age (i.e., smaller  $r_{SSAB}$ ). To determine whether developmental patterns differ by age group, we split the sample into two groups: individuals who were under age 30 in 1981 ( $n = 400$ ) versus individuals who were age 30 and up in 1981 ( $n = 729$ ; see Footnote 2). Of course, because the study spanned a period of 8 years, individuals who were, for example, 24 years old at the first wave of assessment would reach age 32 by the end of the study. According to the plaster hypothesis, fewer or no changes should occur for those individuals who turned 30 before the end of the study, making it more difficult to detect changes in both groups. The decision to split the groups at age 30 at the beginning of the study is, therefore, a conservative test. Presumably, we would detect greater group differences if we split the groups at a younger age. For the under-30 group, on average 143 respondents answered the relationship satisfaction items at each assessment from 1981 to 1989. An average of 200 respondents under age 30 answered the items with regard to work satisfaction each year. There were more responses in the over-30 group for both variables. Approximately 390 adults age 30 and up responded to the relationship satisfaction items at each assessment, and on average 313 responded to the work satisfaction items.

We used the multiple-groups feature of Amos 5.0 to simultaneously compare parameters across the two groups. We compared several nested models beginning with the most restrictive model in which all parameters were constrained to be equal across groups. At each subsequent step, we freed a set of parameters (e.g., means, variances, covariance), that is, allowed them to differ between the groups. A significant increase in fit of the model would indicate that the freed parameters differed between the groups, whereas no increase in fit would indicate that the parameters were the same across groups. We were mainly interested in whether the variance around slopes and the correlation between slopes were the same for both groups. Because cross-sectional differences in means (or initial levels) have been documented elsewhere (Roberts et al., 2006; Srivastava et al., 2003), we expected the groups would differ in their mean intercepts. To test whether development differs in young and old adulthood, we compared the variance of the slopes of the two groups.

*Cross-lagged model.* Figure 3 illustrates a cross-lagged model. The diagonal paths marked “t” represent the trait effects on role satisfaction.

The diagonal paths marked “r” represent role satisfaction effects on personality. To control for the temporal stability of traits and roles over time, we included horizontal paths labeled “ $a_t$ ” and “ $a_r$ .” Because intervals are of equal length, we assume that stability and trait and role effects remain constant across lags. Because observations of traits in 1985 were missing for all participants, we modeled this variable as latent or “phantom” (see McArdle, 1994) and represented it in Figure 3 with the customary circle. We correlated the error terms for variables measured in the same year (e.g., extraversion in 1983 and work satisfaction in 1983). These correlated residuals also represent correlated change, but because they are computed at the observed level (because we only had one indicator of each variable at each wave of assessment), they are not free of measurement error. Furthermore, the correlated residuals do not examine change over the entire study but instead represent change over the shorter time frame (e.g., 2 or 4 years). We examined four models: (a) extraversion and satisfaction, (b) neuroticism and work satisfaction, (c) extraversion and relationship satisfaction, and (d) neuroticism and relationship satisfaction.

Results

Descriptive Statistics

Table 1 describes the composition of our sample by age and gender at the beginning of the study. Consistent with Helson et al. (2002), we found few gender differences. At the start of the study, women were higher than men in neuroticism ( $M = 12.03$  vs.  $10.40$ ),  $t(1126) = 2.33, p < .05$ , and lower in extraversion ( $M = 10.75$  vs.  $11.15$ ),  $t(1127) = 5.83, p < .01$ . Gender did not predict change over time (i.e., slopes); therefore, we omitted gender from further analyses.

Table 2 shows the means for all variables at all time periods. In general, the sample decreased in extraversion and neuroticism over time. However, these descriptives obscure age differences because people of all ages participated in each wave. Furthermore, attrition may have influenced the means for later waves of assessment.

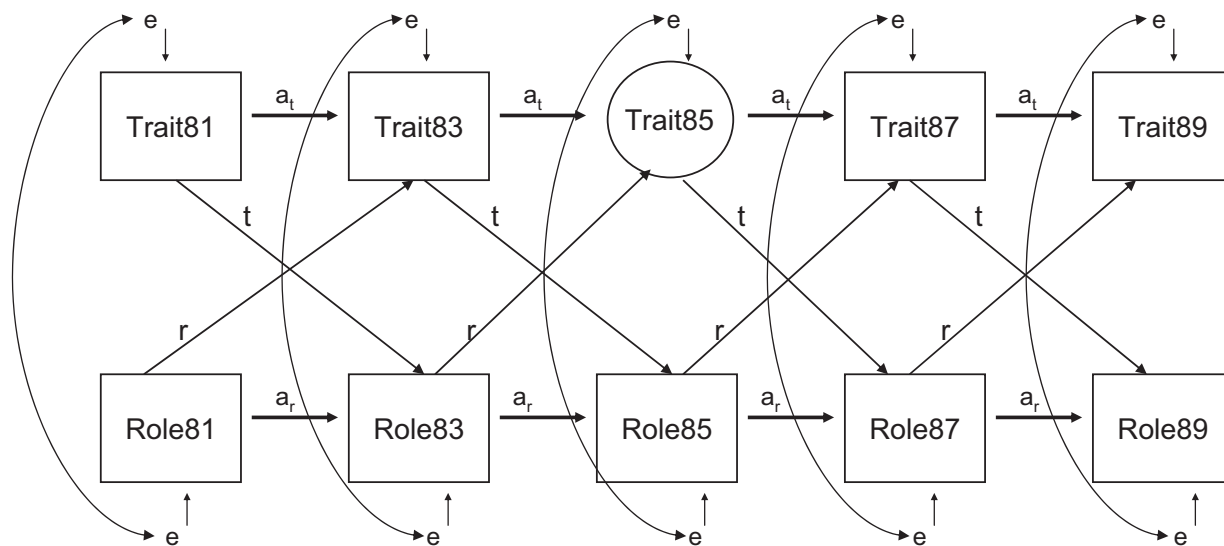


Figure 3. Cross-lagged model. The diagram shows traits (neuroticism and extraversion) and roles (relationship and work satisfaction) measured in 1981, 1983, 1985, 1987, and 1989. The circle denotes a latent variable, and squares denote observed variables. The horizontal paths  $a_t$  and  $a_r$  control for the temporal stability of traits and roles over time.  $t$  = trait effects on role satisfaction;  $r$  = role satisfaction effects on personality;  $e$  = error.



Table 2  
Means, Standard Deviations, and Sample Sizes for the Full Sample and for the Sample Including Only Complete Case Data

Year	Extraversion			Neuroticism			Relationship satisfaction			Work satisfaction		
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>
Full sample												
1981	11.00	2.9	941	11.20	4.8	939	7.00	1.5	653	6.68	1.5	672
1983	10.66	2.9	865	11.31	4.8	862	7.20	1.3	623	6.85	1.2	588
1985							7.16	1.2	543	6.86	1.1	500
1987	10.93	3.1	649	10.26	4.8	649	7.01	1.3	490	6.83	1.2	450
1989	10.44	3.1	482	10.31	5.0	482	6.73	1.3	361	6.61	1.4	352
Complete case data												
1981	10.81	3.0	374	10.73	4.8	372	7.07	1.4	273	6.84	1.4	266
1983	10.54	3.1	374	10.95	4.9	373	7.09	1.3	267	6.80	1.2	262
1985							7.15	1.2	272	6.85	1.2	266
1987	10.77	3.0	374	10.34	4.8	374	6.96	1.2	277	6.79	1.3	268
1989	10.56	3.0	374	10.32	5.0	374	6.76	1.3	274	6.56	1.5	275

*Mean-Level and Rank-Order Changes in Extraversion and Neuroticism*

To gain another perspective on the sample as a whole, we created Table 3, which shows cross-sectional age differences in extraversion and neuroticism. We classified participants by age categories in 1981.<sup>3</sup> Participants could be classified into one of six categories: under age 20 (*n* = 57), age 20 to 29 (*n* = 333), age 30 to 39 (*n* = 277), age 40 to 49 (*n* = 195), age 50 to 59 (*n* = 182), and age 60 to 70 (*n* = 85).

A one-way analysis of variance revealed significant age differences in neuroticism,  $F(5, 1122) = 4.35, p < .01$ , consistent with previous studies showing that neuroticism decreases with age (e.g., Srivastava et al., 2003). Consistent with previous cross-sectional studies, extraversion also exhibited steady decline with age,  $F(5, 1123) = 9.97, p < .001$ . It's interesting to note that post hoc tests (Tukey's least significant difference) revealed no significant differences among the over-30 groups. Post hoc tests showed that the over-30 groups differed from the under-30 groups, although the age-40 group unexpectedly did not differ significantly from the age-20 group. Thus, at the group level, there did appear to be moderate support for the idea that normative development slows after age 30.

Tables 4 and 5 show the stability coefficients for neuroticism and extraversion. The cells below the diagonal of each table report stability coefficients on all available data. The cells above the diagonal show the stability coefficients for complete case data only. Consistent with previous studies (Costa & McCrae, 1988; Robins et al., 2001), both traits exhibited high rank-order consistency even across the 8-year period.

*Did the Longitudinal Sample(s) Differ From the Start?*

We created a simple variable that reflected the number of waves completed. More complex patterns distinguishing people who completed the first two waves from people who completed, for example, the first and third waves of assessment are possible. Our

variable does not take into account such fine distinctions because we did not have enough data points to support more complex analyses. A regression predicting completeness from the major variables of interest yielded no significant effects. Identical results emerged when we included the 189 individuals who joined the study in 1983 (using their 1983 scores). However, zero-order correlations revealed a slight relation between completeness and neuroticism scores ( $r = -.09, p < .05$ ).

We also tested whether attrition was related to slopes and intercepts of and neuroticism. Number of waves completed was unrelated to extraversion. However, number of waves completed was related to the slope of neuroticism ( $\beta = .05, p < .01$ ) and the initial level of neuroticism ( $\beta = -.24, p < .01$ ), suggesting that people who completed more assessments were lower in neuroticism to begin with and exhibited less steep declines in neuroticism over time. The effect is not surprising given that the intercept and slope of growth functions are often related. People who start out lower in neuroticism do not decline as much over time. Thus, we do not claim the participants in the longitudinal sample were randomly selected from the entire sample; however, the effects of attrition were small relative to the correlation between changes that later emerged. Nevertheless, our findings should be considered within this context. Wherever possible we performed analyses on complete case data and on all available data, and few differences in results emerged.

*Personality Growth Trajectories*

*Univariate model.* As a baseline, we first fit a no-growth model to the data. This model estimates only the intercepts and is represented by only the solid lines in Figure 1. We then added the slope and its associated components (represented by the dashed

<sup>3</sup> For the participants who joined the study in 1983, we subtracted 2 from their age in 1983 to calculate their age in 1981. However, in Table 3 we report their 1983 age and 1983 scores.



Table 3  
*Cross-Sectional Age Differences in Neuroticism and Extraversion in 1981*

Age group	Neuroticism			Extraversion		
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>
Under 20	13.0 <sub>a</sub>	4.6	57	12.5 <sub>a</sub>	2.7	57
20–29	11.9 <sub>a,b</sub>	4.7	333	11.5 <sub>a,b</sub>	2.9	333
30–39	10.7 <sub>c</sub>	4.8	277	10.9 <sub>c</sub>	2.8	277
40–49	11.1 <sub>b,c</sub>	4.8	194	10.4 <sub>b,c</sub>	2.9	195
50–59	10.8 <sub>c</sub>	4.7	182	10.4 <sub>c</sub>	2.7	182
60+	10.5 <sub>c</sub>	4.5	85	10.1 <sub>c</sub>	3.0	85
Total	11.3	4.8	1,128	10.9	2.9	1,129

*Note.* Neuroticism:  $F(5, 1122) = 4.35, p < .01$ . Extraversion:  $F(5, 1123) = 9.97, p < .01$ . For the 189 participants who entered the study in 1983, their 1983 age and scores were used. Differing subscripts denote significant post hoc differences between groups.

lines) and compared the fit of the models (e.g.,  $\Delta\chi^2$ ). We performed these analyses and comparisons on the entire sample, on the under-30 group, and on the over-30 group separately. If normative changes cease to occur after age 30, the no-growth model should fit just as well as the growth model for the older group. However, in all cases, the linear growth model fit better than a no-growth model that only had an intercept,  $\Delta\chi^2(4) > 11, ps < .05$ .<sup>4</sup>

We compared the under-30 and over-30 groups to see if they differed in their parameters (e.g.,  $M_S$ ). To test whether the groups had different parameters, we compared a model in which both groups were equated on all parameters (most restrictive model) with a model in which the parameter of interest was allowed to vary between the two groups. Thus, each test of each parameter was a 1-*df* test. Table 6 reports the final parameter estimates from the linear growth models. When the groups had differing parameter estimates, we allowed the parameter estimate to vary across groups in the final model, and two estimates are provided in the table. When the groups had identical parameters, the parameter was constrained to be equal across the two groups in the final model, and only one parameter is reported in the table.

As Table 6 shows, the main differences between the two age groups were in mean intercepts ( $M_I$ ). This is no surprise given the cross-sectional differences that other studies have found (Srivastava et al., 2003). A crucial test is whether the variance around the slopes ( $D_S$ ) was nonzero, because it is this parameter that indicates the presence of individual differences in change. All slope variances were nonzero. In only one instance did the groups differ in their variance around slopes, and this was for the variable of relationship satisfaction. Although the younger sample had non-

zero variance around the slope of relationship satisfaction ( $D_S = .01, SE = .004$ ), the variance was significantly lower than that of the older sample ( $D_S = .02, SE = .003$ ). Note that the direction of differences in slope variances directly contradicts the hypothesis that changes slow down with age.

Also worth noting were group differences in the relation of age to intercepts. For the under-30 group, the age covariate had a  $-.16$  relation to the intercept of neuroticism and a  $-.13$  relation to the intercept of extraversion, whereas these associations were virtually zero for the over-30 group. The negative covariate indicates that older individuals within that group had a tendency to have lower initial levels of neuroticism and extraversion. Again, this pattern is consistent with cross-sectional differences in traits (Srivastava et al., 2003).

*Cohort effects.* Although not the main focus of our study, we also tested for the presence of cohort effects. We accomplished this by examining whether the path from the age covariate to slope was different from the mean of the slope. If these parameters are not equal, this suggests the presence of cohort effects. Furthermore, we tested this equality constraint for the entire sample, the under-30 group, and the over-30 group. We found the equality constraint for extraversion was not met for the under-30 group,  $\Delta\chi^2(1) = 4.1, p < .05$ , whereas it was met for the over-30 group,  $\Delta\chi^2(1) = 1.5, ns$ , and sample as a whole,  $\Delta\chi^2(1) = 0.9, ns$ . Thus, there appeared to be cohort effects for extraversion, especially among the younger group. This finding is consistent with Twenge (2001), who noted cohort effects in extraversion. For neuroticism, the equality constraint was met for the under-30 group,  $\Delta\chi^2(1) = 0.7, ns$ , whereas it was not met for the over-30 group,  $\Delta\chi^2(1) = 9.6, p < .05$ , and the sample as a whole,  $\Delta\chi^2(1) = 12.6, p < .05$ . Thus, there may have been cohort effects for neuroticism, especially among the older sample, consistent with Twenge (2000), who found cohort differences in neuroticism. Despite the presence of potential cohort effects, however, other studies have noted that trajectories of change across cohorts are similar (Helson et al., 2002).

*Reliability of change.* Variability in responses over time can be due to true change or measurement error. Therefore, it is

Table 4  
*Stability Coefficients for Neuroticism*

Year	1981	1983	1987	1989
1981	—	.75	.75	.68
1983	.73	—	.76	.71
1987	.73	.75	—	.76
1989	.66	.68	.74	—

*Note.* Values below the diagonal are for all available data. Values above the diagonal were computed on complete case data.

<sup>4</sup> For chi-square analyses on the entire sample,  $N = 1,129$ ; for chi-square analyses on the under-30 group,  $N = 400$ ; and for chi-square analyses on the over-30 group,  $N = 729$ .

Table 5  
Stability Coefficients for Extraversion

Year	1981	1983	1987	1989
1981	—	.68	.65	.62
1983	.65	—	.70	.66
1987	.62	.68	—	.73
1989	.61	.65	.73	—

Note. Values below the diagonal are for all available data. Values above the diagonal were computed on complete case data.

important to know how reliably individual differences in change can be measured over the 8-year period. Using parameter estimates from the growth model, we calculated the reliability of change (McArdle, 1986; McArdle, Prescott, Hamagami, & Horn, 1998; McArdle & Woodcock, 1997). These values are similar to alphas for internal consistency of scales administered on a single occasion, but they reflect the precision with which change was measured. In general, the reliabilities of change were quite good, ranging from .63 to .88. Compared with reliabilities that can be obtained from difference scores (see Cronbach & Furby, 1970), the growth models captured change with very high precision. Reliabilities remained virtually unchanged when we excluded the age covariate from the model.

### Correlated Change

*Work satisfaction and neuroticism.* Does neuroticism decrease as work becomes more satisfying? Does this relation vary by age group? Because we already compared the two groups on parameters such as mean intercept in the univariate models, we combined the final univariate models to form bivariate models and allowed the slopes and intercepts of both variables to correlate. All comparisons are based on a 1-*df* test.<sup>5</sup> The correlation between the two slopes answers our first question of whether neuroticism and work satisfaction change together. To determine whether the groups differed in this relation, we compared a model in which the two groups had equal correlations,  $\chi^2(102) = 202.0$ , with a model in which the correlation between the slopes was allowed to vary between the two groups,  $\chi^2(101) = 201.9$ . As indicated by a nonsignificant increase in fit of the latter model, the different age groups did not differ in this correlation,  $\Delta\chi^2(1) = 0.1$ , *ns*. Table 7 shows that the final estimate of the correlation between changes in work satisfaction and neuroticism was  $-.64$  ( $p < .01$ ). As work satisfaction increased, neuroticism decreased for both young and old. We obtained similar results when we performed the same analyses on complete case data only. The correlation between changes in work satisfaction and changes in neuroticism dropped but was still significant at  $-.43$  ( $p < .05$ ).

*Work satisfaction and extraversion.* Does extraversion increase as work becomes more satisfying? Does this relation vary by age group? We first tested a model in which the correlation between the slopes of work satisfaction and extraversion was constrained to be the same for both groups,  $\chi^2(103) = 208.0$ , with a model in which the correlation between slopes was freed between the two groups,  $\chi^2(102) = 208.0$ . The latter model did not fit any better than the former,  $\Delta\chi^2(1) = 0$ , *ns*, indicating that the two groups had the same degree of correlated change. Regardless

of age group, as work satisfaction increased over time, so did extraversion ( $r = .58$ ,  $p < .01$ ). Analysis of only complete case data revealed a similar correlation between slopes ( $r = .56$ ,  $p < .05$ ).

*Relationship satisfaction and neuroticism.* Does increased relationship satisfaction correlate with decreased neuroticism? The restricted model in which correlated change was equated across both groups,  $\chi^2(101) = 214.2$ , yielded an almost identical fit to a less restricted model in which the magnitude of correlated change was allowed to vary across the groups,  $\chi^2(100) = 214.1$ , indicating the two groups did not differ in their degree of correlated change,  $\Delta\chi^2(1) = 0.1$ , *ns*. Increases in relationship satisfaction corresponded to decreases in neuroticism for both samples ( $r = -.42$ ,  $p < .05$ ). Analysis of only complete case data revealed a consistent, though slightly higher, correlation ( $r = -.51$ ,  $p < .05$ ).

*Relationship satisfaction and extraversion.* Do changes in relationship satisfaction correspond to changes in extraversion? Again, first we fit a model in which the correlation between slopes was constrained to be the same for both groups,  $\chi^2(102) = 226.0$ , and compared this with a model in which the correlation between slopes was freed,  $\chi^2(101) = 223.8$ . The lack of increased fit in the latter model,  $\Delta\chi^2(1) = 2.2$ , *ns*, indicated correlated change was the same for both age groups. Changes in relationship satisfaction were marginally related to increases in extraversion ( $r = .26$ ,  $p < .10$ ;  $r = .41$ ,  $p < .10$ , for complete case data only).

### Cross-Lagged Model

We examined four models: (a) extraversion and work satisfaction, (b) neuroticism and work satisfaction, (c) extraversion and relationship satisfaction, and (d) neuroticism and relationship satisfaction. Of primary interest were trait effects versus role effects, as shown in Figure 3. For extraversion and work satisfaction, trait effects emerged as significant ( $\beta = .07$ ,  $p < .01$ ) and role effects emerged as marginally significant ( $\beta = .09$ ,  $p = .11$ ). Using only complete case data for this model resulted in significant trait ( $\beta = .10$ ,  $p < .001$ ) and role effects ( $\beta = .09$ ,  $p < .01$ ). For neuroticism and work satisfaction, only trait effects emerged as significant ( $\beta_s = -.07$  and  $-.09$ , both  $p_s < .01$ , for all data and complete cases only). For extraversion and relationship satisfaction, no paths emerged as significant when we used all the data. However, among complete cases only, role effects emerged as marginally significant ( $\beta = .05$ ,  $p = .08$ ), whereas trait effects remained nonsignificant. Finally, for neuroticism and relationship satisfaction, trait effects emerged as marginally significant in analyses on all data ( $\beta = -.04$ ,  $p = .08$ ) and significant in analyses on complete case data ( $\beta = -.06$ ,  $p < .05$ ).

### Discussion

Does personality change over time? In what contexts do people increase in psychological well-being? Is personality development limited to young adulthood? The present study addressed these

<sup>5</sup> The degrees of freedom vary among the models because the two groups differed on some parameters (e.g., mean intercept for neuroticism) but not others (e.g., variance around the slope of extraversion). However, the comparison test is always based on a 1-*df* test and is the same for all comparisons.

Table 6  
Parameter Estimates and Standard Errors From Linear Growth Models Including Age as a Covariate

Variable	$M_1$		$D_1$		$M_S$		$D_S$		$r_{1S}$		$D_U$		$Cov_1$		$Cov_S$		Fit		
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	$\chi^2$	df	RMSEA
Neuroticism					<b>-.11</b>	<b>.02</b>	<b>.05</b>	<b>.02</b>	-.15	.10	<b>6.10</b>	<b>0.25</b>			-.01	.002	41.9	25	.02
Under 30	<b>11.99<sup>a</sup></b>	<b>0.23</b>	<b>16.81<sup>b</sup></b>	<b>1.46</b>									<b>-.16<sup>c</sup></b>	<b>.06</b>					
Over 30	<b>10.98</b>	<b>0.17</b>	<b>16.46</b>	<b>1.11</b>									-.01	.02					
Extraversion			<b>5.43</b>	<b>0.34</b>	-.02	.01	<b>.03</b>	<b>.01</b>	-.10	.04	<b>2.80</b>	<b>0.11</b>			.00	.001	54.04	26	.03
Under 30	<b>11.51<sup>d</sup></b>	<b>0.14</b>											<b>-.13<sup>e</sup></b>	<b>.04</b>					
Over 30	<b>10.56</b>	<b>0.10</b>											<b>-.03</b>	<b>.01</b>					
Work satisfaction			<b>1.16</b>	<b>0.10</b>	.001	.01	<b>.02</b>	<b>.003</b>	<b>-.65</b>	<b>.02</b>	<b>0.82</b>	<b>0.03</b>	<b>.02</b>	<b>.01</b>	.001	.001	165.7	41	.05
Under 30	<b>6.62<sup>f</sup></b>	<b>0.07</b>																	
Over 30	<b>6.92</b>	<b>0.06</b>																	
Relationship satisfaction	<b>7.16</b>	<b>0.05</b>			-.05	.01					<b>0.57</b>	<b>0.02</b>	.01	.01	.00	.001	167.8	39	.05
Under 30			<b>1.30<sup>g</sup></b>	<b>0.17</b>			<b>.01<sup>h</sup></b>	<b>.004</b>	<b>-.58<sup>i</sup></b>	<b>.02</b>									
Over 30			<b>1.68</b>	<b>0.13</b>			<b>.02</b>	<b>.003</b>	<b>-.44</b>	<b>.02</b>									

Note. Values in bold are significant at  $p < .05$ . Age was centered at the mean age for each group in 1981.  $M_1$  = mean intercept;  $D_1$  = deviation from the intercept;  $M_S$  = mean slope;  $D_S$  = deviation from the slope;  $r_{1S}$  = correlation between the slope and the intercept;  $D_U$  = unaccounted variation;  $Cov_1$  = beta from age to intercept;  $Cov_S$  = beta from age to slope.

<sup>a</sup> Test of group differences:  $\Delta\chi^2(1) = 13.4, p < .05$ . <sup>b</sup> Test of group differences:  $\Delta\chi^2(1) = 18.6, p < .05$ . <sup>c</sup> Test of group differences:  $\Delta\chi^2(1) = 18.8, p < .05$ . <sup>d</sup> Test of group differences:  $\Delta\chi^2(1) = 33.2, p < .05$ . <sup>e</sup> Test of group differences:  $\Delta\chi^2(1) = 6.8, p < .05$ . <sup>f</sup> Test of group differences:  $\Delta\chi^2(1) = 15.9, p < .05$ . <sup>g</sup> Test of group differences:  $\Delta\chi^2(1) = 8.0, p < .05$ . <sup>h</sup> Test of group differences:  $\Delta\chi^2(1) = 7.0, p < .05$ . <sup>i</sup> Test of group differences:  $\Delta\chi^2(1) = 8.0, p < .05$ .

questions by examining individual differences in change. Using latent growth modeling, we modeled changes in extraversion, neuroticism, work satisfaction, and relationship satisfaction over time and examined how these constructs change together over an 8-year period. Moreover, we examined whether individual differences in change were different for people under age 30 versus people age 30 and over. Several important findings emerged.

First, despite impressive rank-order stability of traits, there were significant within-person changes in extraversion and neuroticism as evidenced by the nonzero variability in the slopes of both neuroticism and extraversion over time (cf. Jones & Meredith, 1996; Mroczek & Spiro, 2003; Small et al., 2003). Furthermore, individuals over age 30 exhibited just as much change as those under 30, thus refuting the idea that personality becomes “set like plaster by age 30” or that development slows down after young adulthood (Costa & McCrae, 2006). In only one case did the two age groups differ in variance around slopes ( $D_S$ ), and this was in variability in change in relationship satisfaction. Although both groups had nonzero variances around the slope of relationship satisfaction, the older group exhibited greater variance in change

than the younger group. The direction of group differences directly contradicts the notion that development ceases or slows down with old age. Although it is probably tenuous to conclude that older adults change more than younger ones, development certainly does not cease by age 30. In all likelihood, development at least continues on the same trajectory.

Second, individual differences in changes in personality appeared systematic. Consistent with Roberts and Chapman (2000), increased work satisfaction accompanied decreases in neuroticism and increases in extraversion over time. Similarly, increased relationship satisfaction predicted decreases in neuroticism and increases in extraversion as well. Correlations among changes were similar for the under-30 and 30+ samples, indicating that transactional influences on development are not limited to young adulthood. Furthermore, the magnitude of the relation between change components was not trivial. In fact, on average, trajectories correlated about .40. In light of Mroczek and Spiro’s (2005) finding that increases in neuroticism are associated with mortality risk, we believe our results have serious implications. Our findings also lend further support to the idea that the social environment shapes personality and vice versa. At the same time, the current results pose a challenge to FFT (e.g., McCrae & Costa, 1990). Contrary to the notion that traits are insular dispositions, the present study suggests that extraversion and neuroticism can and do change over time and that these changes to some extent are related to important social institutions, such as work and romantic relationships, above and beyond the effects of age. Although trait changes found in this study could be interpreted as resulting from intrinsic maturation, we think this is an unlikely explanation. Intrinsic maturation would be more consistent with a general pattern of increasing positivity such that the correlated changes would be similar in magnitude regardless of domain or trait. However, we did not find such a pattern. Instead, work satisfaction had stronger

Table 7  
Correlated Change: Correlations Among Slopes in Bivariate Growth Models for All Available Data and Complete Case Data

Variable	Neuroticism		Extraversion	
	All data	Complete data	All data	Complete data
Work satisfaction	-.64**	-.43†	.58**	.56*
Relationship satisfaction	-.42*	-.51*	.26†	.41†

Note. Under-30 and over-30 groups did not differ in their correlations between slopes.  
†  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ .

relations to trait changes, particularly declines in neuroticism. Relationship satisfaction was associated with decreases in neuroticism but had only a marginal relation to increases in extraversion.

Third, in addition to individual differences in change, we also examined mean-level change and rank-order stability and found results comparable to previous research. Mean levels of extraversion and neuroticism declined with age, consistent with Srivastava et al. (2003), McCrae et al. (1999), Roberts et al. (2006), and others. At the same time, the rank-order stability of these traits was remarkably high and consistent with research by Costa and McCrae (1988). Thus, the present study underscores the conceptual and empirical independence of the three types of change (Caspi & Roberts, 1999).

Fourth, our findings are consistent with research showing that extraversion and pleasant affect are consistently related. Cunningham (1988a, 1988b) and Lucas (2001) have demonstrated that extraverted behaviors follow pleasant mood induction, whereas Fleenon, Malanos, and Achille (2002) have shown that acting extraverted can lead to increased positive emotion. These past studies, however, focused on the short-term relation between pleasant emotion and extraversion. To our knowledge, ours is the first study to estimate the long-term, dynamic relation between satisfaction (in roles) and extraversion.

Fifth, the cross-lagged analyses revealed moderate support for trait effects operating on satisfactions with roles, especially with regard to neuroticism. These findings converge with previous studies (Asendorpf & Wilpers, 1998; Neyer & Asendorpf, 2001) that found mostly trait effects. However, there was also modest support for work satisfaction leading to increased extraversion, a finding that supports the social investment model (Roberts et al., 2005). It may be that work plays a special role in growth in extraversion, but we need more research to fully understand the processes going on here.

We caution, however, against drawing strong conclusions about causality from these cross-lagged models or from any observational data for that matter (Freedman, 1987). First, our model is an oversimplification of the development process, essentially treating multiwave data as a series of two-wave "snapshots" (Rogosa, 1980, p. 255). The length of time covered by the lags needs to correspond to the time course of the underlying causal process.<sup>6</sup> Lags that are too short or too long may lead to spurious results. Second, there is always the possibility of a third variable affecting change in both of the variables. Only a true experiment can eliminate the possibility of a third variable, although experiments are also not a perfect solution. Experiments raise serious ethical concerns in the study of development, and like cross-lagged models, experiments may also fail to capture the appropriate time course of an underlying process.

In all likelihood, developmental processes are too complex to be represented in simple "A causes B" terms. We believe transactional models, which highlight the codevelopment of traits and social relationships, most accurately reflect real-world development, although the cost of such models is that they cannot declare a causal "winner." Clearly, there are limitations to cross-lagged designs, and we believe our findings make the most sense when considered in conjunction with the growth modeling results.

## Limitations and Future Directions

The present study stands among only a small handful of large-scale longitudinal psychological studies. The large representative sampling allowed for the use of sophisticated models of change and greater generalizability. Nevertheless, several caveats are worth mentioning. First, there is the limitation that the data were collected in the 1980s in Australia. Although Australia does not differ much from the rest of the Western world, especially in terms of well-being (e.g., Diener, Diener, & Diener, 1995), it is possible that results would vary with non-Western samples. In addition, historical context limits the interpretation of these findings. An earlier or a later time period might yield different estimates of means (Twenge, 2000). Indeed, we were unable to rule out the possibility of cohort effects or secular trends in our data as well. Although the interrelationships among change components might differ by historical time periods, the diminished importance of work and close relationships seems unlikely.

Second, the heterogeneity in age in our sample allowed us to make intriguing comparisons of young and older adults. The downside of this heterogeneity, however, was a confounding of age and potential cohort effects. It is reassuring, however, that results from our study converged with other studies (Helson et al., 2002; Roberts, 1997). Unlike Roberts (1997), who compared development before age 27 with development after age 27 within individuals, the present study compared individual differences in development before and after age 30 between two groups. Thus, age differences in development in Roberts's (1997) study invite the possibility of historical differences (e.g., 1960s vs. 1980s), whereas age differences in developmental trajectories in the present study are qualified by potential cohort differences. Coupled with Helson et al.'s (2002) finding that different cohorts tend to change in similar ways, we believe significant individual differences in trait change occur above and beyond cohort effects. Our study adds to the growing literature that finds development is similar before and after age 30.

Third, although we found that changes in personality correlated with changes in social roles, the finding is nonetheless a correlation and subject to the limitations of any correlation. Chief among these, of course, is that we cannot infer causality from correlations. However, we believe that correlated changes tell an important story with implications for well-being research and interventions that should not be overlooked because of the lack of firm causal conclusions. For example, the relation between extraversion and pleasant affect is now a well-replicated finding in the subjective well-being literature (see Lucas & Fujita, 2000), and this relation appears to be a bidirectional one. Lucas (2001) demonstrated that people feel more sociable when pleasant affect is high. On the other hand, Fleenon et al. (2002) showed that behaving in an extraverted way, however artificial, leads to an increase in positive affect. Social roles and personality development may share a similar process to extraversion and pleasant affect. Future research should focus on this complex relation.

The present study also focused on a limited definition and level of personality. Although most psychologists would probably agree

<sup>6</sup> We thank an anonymous reviewer for pointing out this limitation of cross-lagged models and experiments.



that extraversion and neuroticism are important personality traits, they are not the only ones. In fact, traits alone capture only a facet of the complexities of personality (McAdams, 1996). Thus, evidence that self-reports of extraversion and neuroticism change over time cannot be generalized to other important aspects of personality. Moreover, items on the Eysenck Personality Inventory are behavioral indicators of personality, which can be far removed from molecular or other levels of individual differences; changes occurring at this level do not necessarily reflect changes on other levels.

Another limitation of the present study was the use of subjective indicators of role quality (e.g., satisfaction). Future research should examine more specific aspects of work and relationships, including observer ratings. Observer ratings would eliminate the shared variance from self-reports and possibly illuminate specific aspects of roles that mediate the relation between changes in role quality and traits. We would not necessarily expect objective role measures to result in a different pattern of findings, however, because Heller, Watson, and Ilies (2004) found that perceptions of domain satisfaction are often related to objective aspects of the domain.

### General Conclusions

Four main findings emerged from this study that advance current knowledge of adult development. First, there was evidence of individual differences in change in personality. Second, personality development was systematic and associated with changes in social roles. Third, age 30 did not mark a special time when development ceased or even declined. Instead, people continued to change throughout the life course. Fourth, there was moderate support for trait effects on roles and only mild support for work influencing the trait of extraversion.

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Received April 12, 2005

Revision received April 21, 2006

Accepted May 11, 2006 ■