

Patterns of Mean-Level Change in Personality Traits Across the Life Course: A Meta-Analysis of Longitudinal Studies

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The present study used meta-analytic techniques (number of samples = 92) to determine the patterns of mean-level change in personality traits across the life course. Results showed that people increase in measures of social dominance (a facet of extraversion), conscientiousness, and emotional stability, especially in young adulthood (age 20 to 40). In contrast, people increase on measures of social vitality (a 2nd facet of extraversion) and openness in adolescence but then decrease in both of these domains in old age. Agreeableness changed only in old age. Of the 6 trait categories, 4 demonstrated significant change in middle and old age. Gender and attrition had minimal effects on change, whereas longer studies and studies based on younger cohorts showed greater change.

Keywords: personality change, meta-analysis, mean-level change, personality development

How do people change in terms of personality traits across the life course? Despite the common perspective that personality traits—relatively enduring patterns of thoughts, feelings, and behavior—do not change, numerous longitudinal studies have now reported mean-level changes in traits at various ages across the life course (Haan, Millsap, & Hartka, 1986; Helson & Moane, 1987; Helson & Wink, 1992; Roberts, Caspi, & Moffitt, 2001; Robins, Fraley, Roberts, & Trzesniewski, 2001). It is assumed that mean-level change, sometimes referred to as absolute change or normative change (Caspi & Roberts, 1999), reflects generalizable patterns of personality development that apply to most people. However, it is difficult to draw definitive conclusions regarding the nature of mean-level change because longitudinal studies track changes in personality traits in particular samples by using distinct measures over specific times of the life course, which results in somewhat idiosyncratic findings that are sometimes contradictory. For example, Costa and McCrae (1997) argued on the basis of their longitudinal studies that there is little meaningful mean-level change in any personality traits past the age of 30 (Costa, Herbst, McCrae, & Siegler, 2000). In contrast, others have argued that personality traits continue to change in middle and old age (Helson, Jones, & Kwan, 2002; Helson & Kwan, 2000; Srivastava, John, Gosling, & Potter, 2003).

One solution to the debate over whether personality traits demonstrate systematic changes in any given period of the life course

is to synthesize the existing longitudinal studies by using meta-analytic techniques (e.g., Roberts & DelVecchio, 2000). A meta-analytic approach affords several advantages to any single longitudinal study. First, by examining change across studies, we can effectively control for the nature of the samples used in existing longitudinal efforts and weight findings from larger samples more heavily. Also, we can use the Big Five taxonomy of personality traits (John & Srivastava, 1999) to organize measures into domains that are not specific to individual personality inventories. The Big Five taxonomy organizes most trait terms and personality inventory scales into five broad categories: extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience. By using the Big Five taxonomy to organize findings, we can create a common conceptual framework that makes it possible to synthesize the results across questionnaires, including those that were not created with the Big Five in mind. Finally, we can put together data for most of the life course, a possibility seldom realized by individual longitudinal studies. Having data from the majority of the life course allows difficult questions to be addressed, such as whether people change more during specific time periods (e.g., adolescence, young adulthood, middle age) and whether people continue to show normative changes in middle age and beyond.

In the present study, we have assembled the largest meta-analytic database of longitudinal studies of mean-level personality change in existence in order to address the question of how personality traits change across the life course. We will first review how change is defined, then the patterns of personality change we expect given previous research and theory on personality development in adulthood, and finally the potential moderators of mean-level change.

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Can Personality Traits Be Both Consistent and Changeable?

Personality traits are indisputably consistent across time and age (Fraley & Roberts, 2005; Roberts & DelVecchio, 2000). It is

common to believe that if a construct demonstrates temporal consistency, it does not change. Unfortunately, this conclusion is often premature and sometimes simply incorrect. This misunderstanding stems from a semantic problem with the use of such terms as “stability,” “consistency,” and “change.” These terms are often used too broadly and interchangeably and, when used as such, fail to take into account the fact that continuity and change come in many forms and can also occur simultaneously—they are not the opposites of one another (Block, 1971).

In most longitudinal studies, consistency is operationalized as rank-order consistency, which refers to the relative placement of individuals within a group over time. Change is most often defined as mean-level change, which refers to whether a group of people increases or decreases on trait dimensions over time. The existence of consistency, at least defined in terms of rank-order consistency, does not preclude the existence of change, especially mean-level change over time. For example, the numbers $x = (1, 2, 3, 4)$ show perfect rank-order consistency ($r = 1$) with the numbers $y = (2, 4, 6, 8)$ but yet a clear change in mean level. On the other hand, pairing the same x with $y = (4, 6, 6, 4)$ yields zero rank-order consistency ($r = 0$) and still the same amount of mean-level change. Therefore, rank-order consistency and mean-level change are better thought of as independent or orthogonal constructs. Conceptually and empirically, both can exist simultaneously (Block, 1971; Caspi & Roberts, 1999; Funder & Colvin, 1991). Furthermore, there are now a number of clear empirical cases where it has been demonstrated that rank-order consistency and mean-level change coexist in the same longitudinal study (Haan et al., 1986; Mortimer, Finch, & Kumka, 1982; Roberts et al., 2001; Roberts, Helson, & Klohnen, 2002; Robins et al., 2001).

Mean-level change in personality traits is often equated with normative change in personality. Normative change occurs when most people change in the same way during a specific period within the life course. Normative changes are thought to result from maturational or historical processes shared by a population (e.g., Helson & Moane, 1987; McCrae et al., 2000). These shared processes could be biological in origin, such as the general period when adolescence is begun or when menopause occurs in women (e.g., Helson & Wink, 1992). The timing of these biological phenomena is partially driven by genetic factors and tends to happen within a specific period of the life course for most people in the particular population of interest. It also is possible that normative changes in personality traits arise because of engagement in normative life tasks and roles, such as leaving home, establishing a family, and starting a career, for example, which all happen in the period of young adulthood (Helson, Kwan, John, & Jones, 2002; Roberts, Wood, & Smith, 2005).

Needless to say, change is a multifaceted construct (Caspi & Roberts, 1999). In addition to being tracked with rank-order consistency and mean-level change, change also can be tracked in the structure of trait covariances (e.g., the longitudinal consistency in the factor structure; Small, Hertzog, Hultsch, & Dixon, 2003) and in individual differences in change (Mroczek & Spiro, 2003; Roberts, 1997). The existence of individual differences in change qualifies the inference that change does or does not occur and that changes are normative. For example, when there are no mean-level changes over time, there may still be robust individual differences in change. Subsets of individuals may be increasing and decreasing and thus offsetting each other's change, resulting in no mean-level

change overall. Moreover, the occurrence of normative trends does not imply that all people change in the same direction. For example, in one longitudinal study (Roberts et al., 2001), most individuals decreased in negative emotionality in young adulthood. Despite this general trend to decrease, a subset of individuals actually increased. Nonetheless, most people decreased in negative emotionality, and it is this trend that is captured in the overall mean-level change patterns that will be examined in this study.

The meta-analysis presented here will focus exclusively on mean-level change in personality traits over time. To the extent that these changes are consistent across studies, we can begin to draw conclusions concerning whether the changes are normative in that most people demonstrate a distinct pattern of change in personality traits.

Theories of Personality Trait Development

In his review of personality and aging, Kogan (1990) highlighted three theoretical approaches to personality trait development. The first model is the classical psychometric theory or trait model of personality development (see also Conley, 1984). The exemplar trait theory of personality development in adulthood is the five-factor theory of personality (McCrae & Costa, 1999). According to this perspective, traits remain so stable in adulthood that they are essentially “temperaments” and are impervious to the influence of the environment. In terms of personality traits, the five-factor theory clearly states that traits develop through childhood and reach maturity in adulthood and are thereafter stable in “cognitively intact individuals” (McCrae & Costa, 1999, p. 145) and that this pattern holds across cultures (McCrae & Costa, 1994; McCrae et al., 2000). Personality trait development is thus presumed to be governed by temperament or genetic factors rather than environmental influences or experiences. Therefore, the patterns of mean-level change demonstrated by various samples must be attributed to genetic factors that define propensities to grow in specific directions at specific ages during the life course.

The second theoretical approach highlighted by Kogan (1990) emphasizes the role of the environment. These contextual models focus on the effect of environmental contingencies often contained within social roles and how they affect personality (e.g., Brim, 1965). The prototypical contextual approach to understanding personality development is to focus on more microanalytic social-cognitive units of analysis (e.g., Bandura, 1999; Zelli & Dodge, 1999). Social-cognitive units of analysis are by definition context-bound constructs, such as social skills, competencies, and personal goals. Rather than presupposing consistency, as is done in trait models, personality consistency is thought to emerge through one's transactions with the social environment (Zelli & Dodge, 1999). This model does little to inform perspectives on mean-level changes in personality traits, as it limits its focus to phenomena that are presumably not traitlike. Moreover, from an extreme contextual perspective, mean-level change would result from environmental contingencies that are mostly unpredictable; therefore, patterns of mean-level change also would be relatively unpredictable (Lewis, 1999).

According to Kogan (1990), the third set of developmental models emphasizes the transactions between the traits and contexts across the life course and is therefore interactional. The most contextual of the interactional models is Levinson's (1978), which

focuses on the building of life structures in childhood, early adulthood, middle adulthood, and late adulthood. Life structures represent the basic pattern or design of a person's life and largely reflect the interplay between self-driven goals and societal and age-graded roles. As this perspective is most relevant to the pattern of social roles across the life course, it does not provide information pertinent to the development of personality traits. Similarly, Erikson's (1950) stage theory emphasizes the change and emergence of specific life tasks and associated crises at different ages. This perspective also essentially ignores personality trait development.

More recently, Baltes (1997; Baltes, Lindenberger, & Staudinger, 1998) has enumerated the life span development approach, which proposes a dialectic between consistency and change over the life course, with adaptation being the primary focus of development. The life span perspective specifies that people are open systems and that they exhibit both continuity and change in personality throughout the life course. Furthermore, according to the life span model, the effects of psychological, social, and cultural factors diminish as people grow older often as a result of selection, optimization, and compensation processes (Baltes et al., 1998).

Recently, Roberts and Caspi (2003) proposed an alternative theory of personality trait development consistent with Baltes's (1997) life span approach (see also Roberts & Wood, in press). This theory proposes that identity processes can help explain the patterns of continuity and change in personality traits across the life course. Specifically, the development of a strong identity and certain facets of identity structure, such as identity achievement and certainty, are positively related to many of the mechanisms that promote personality continuity. Furthermore, with age, a person's identity becomes clarified and strengthened, and this helps to explain the increasing continuity in personality traits across the life course. Finally, making normative commitments to the conventional social institutions necessary to create an identity (e.g., work, marriage, family, community) gives rise to the increases in traits associated with psychological maturity, such as agreeableness, conscientiousness, and emotional stability (see also Roberts, Caspi, & Moffitt, 2003; Roberts & Wood, in press). These investments in conventional social institutions are presumed to facilitate increases in these three core domains of the Big Five.

The theories of adult development range from static to dynamic. If adult development conforms to the more static form of trait models, then we should expect few if any systematic mean-level changes across the life course. A similar conclusion can be drawn from the contextualist approach, as the driving force behind development will be the immediate situation of any one person or group of persons. Moreover, because our samples are drawn from dramatically different cohorts ranging from the generations that experienced the Great Depression to the generations that grew up in the 1960s, 1970s, and 1980s, one would assume little consistency in the pattern of mean-level change across these studies. Therefore, from a contextualist perspective, we would not expect clear patterns of development across the life course because immediate situations and cohort differences are relatively unpredictable as are their consequences (Lewis, 1999). The interactional models all emphasize the continued dynamic nature of the life course beyond adolescence and therefore imply that development would occur in adulthood, even in terms of personality traits. One

consistent theme across these interactional models is the critical nature of young adulthood. This is a period in which identities are resolved and people make commitments to life paths (Arnett, 2000). Consequently, substantial changes in personality traits are expected to occur during this critical period. Finally, Baltes (1997) emphasized the plastic nature of psychological functioning across the life course, highlighting the possibility for changes to happen even in middle and old age. We will compare our findings with these broad generalizations about personality development in adulthood to see which perspective comes closest to capturing the empirical patterns of mean-level change across the life course.

Is There a Pattern to Mean-Level Changes in Personality Traits?

Despite the publication of numerous longitudinal studies in the last few decades, there was, until recently, a surprising paucity of statements or claims concerning normative trends in personality traits over the life course. In part, this lack of a coherent descriptive picture was a result of an emphasis on the more general question of whether personality changes occur at all during the life course. Until recently, the dominant perspective was that once adulthood is reached, which happens around age 30, there is no subsequent change in personality traits (McCrae & Costa, 1994). Specifically, on the basis of their interpretation of existing longitudinal studies, McCrae and Costa concluded that there is no relationship between mean levels of personality traits and age in cross-sectional studies of personality, nor are there age-related trends in longitudinal data (Costa & McCrae, 1994, 1997).

A more differentiated perspective has emerged recently from both cross-sectional studies and two new narrative overviews of the evidence for personality trait change in adulthood. First, McCrae et al. (1999) reported cross-sectional mean-level differences across the Big Five in five different cultures. In contrast to earlier reports, McCrae et al. reported mean-level differences between individuals over the age of 30 and younger people in several cultures for neuroticism, extraversion, openness, agreeableness, and conscientiousness. Specifically, older individuals scored higher on agreeableness and conscientiousness and lower on extraversion, neuroticism, and openness (see also Srivastava et al., 2003).

Helson and Kwan (2000) reviewed data from three cross-sectional studies and three longitudinal studies that covered the majority of the life course from age 20 to age 80 and found evidence for significant mean-level change in select personality traits across the life course. For example, they reported increases of a little under half a standard deviation in norm orientation, which could be construed as a facet of conscientiousness. They argued that previous research on extraversion has overlooked the fact that there are two components to extraversion—namely, social dominance and social vitality—which demonstrate distinctly different maturational patterns. Specifically, social dominance reflects such traits as dominance, independence, and self-confidence, especially in social contexts. On the other hand, social vitality corresponds more closely to traits like sociability, positive affect, gregariousness, and energy level. According to Helson and Kwan's review, people increase in measures of social dominance and decrease in measures of social vitality with age. Finally, Helson and Kwan presented data indicating small increases in

openness, with some contradictory evidence across cross-sectional and longitudinal studies.

Finally, Roberts, Robins, Caspi, and Trzesniewski (2003) reviewed a more comprehensive list of cross-sectional and longitudinal studies than previously captured in narrative reviews. According to their interpretation of the data, there is evidence for increases in social dominance and decreases in social vitality, as Helson and Kwan (2000) proposed. They also argued that measures of agreeableness and conscientiousness increase across the life course from age 18 to over age 60 and that neuroticism tends to decrease with age, possibly reaching a plateau in old age. Finally, they found a complex pattern of change for measures of openness, with some evidence for increases in early young adulthood and contradictory evidence for later portions of the life course.

The primary goal of this meta-analysis was to test whether the evidence in the longitudinal database is consistent with theoretical and narrative descriptions of personality trait development in adulthood as described above. On the basis of a modified Big Five framework (with extraversion further divided into social vitality and social dominance), we expected to find that traits from the domain of social vitality decrease with age while traits from social dominance increase. We also expected to find traits from the domains of agreeableness, conscientiousness, and emotional stability to increase with age, and traits from the domain of openness to experience to show little or no change or to decrease slightly. We also attempted to identify when and whether personality traits stop changing during the life course, at least in terms of mean-level change. A final goal was to identify the critical periods during the life course when the largest changes occur.

Moderators of Mean-Level Change in Personality Traits

One distinct advantage of a meta-analytic approach is the opportunity to test potential moderators of changes in personality traits across the life course. We considered four potential moderators. First, we examined the effect of sex on the patterns of change in personality traits. Although claims for and against sex differences in personality development have been made in the past (Guttman, 1987; Helson, Pals, & Solomon, 1997; Roberts et al., 2001), comparisons have yet to be made across different longitudinal studies. The most concrete hypothesis about sex differences in adult personality trait development is the crossover hypothesis (Guttman, 1987). According to this perspective, men and women change differently in middle age because of shifting demands of gender-related sex roles. Presumably, men become more nurturing and emotional with age, especially during the transition from young adulthood to middle age, because of the shift from the self-focused drive of occupational success in young adulthood to the more generative role of family patriarch in midlife. In contrast, women are expected to become less nurturing and emotional and more confident and dominant, because of the shifting focus away from the family to a potential career as children grow older and leave home (Guttman, 1987; Roberts & Helson, 1997; Wink & Helson, 1993). Accordingly, we should observe larger increases on measures of agreeableness for men between the age of 40 and 60, whereas women should increase more so than men on measures of social dominance in the same age period. No previous research has

led us to believe that men and women should differ in their development on other traits at any age period.

A second moderator considered in this meta-analysis is the effect of time on the patterns and magnitude of change in personality traits. The length of time between assessments has a known negative effect on rank-order consistency, implying that larger changes occur as more time passes between assessments. Whether this effect holds for a different metric of change, such as mean-level change, has never been examined.

The third moderator we tested—namely, attrition—is one of the most problematic study features in longitudinal research. Attrition apparently has little effect on estimates of rank-order consistency (Roberts & DelVecchio, 2000). Nonetheless, given the typical findings that individuals who remain in longitudinal studies are more conscientious (e.g., Robins et al., 2001), we suspect that attrition may have an effect on the magnitude and types of changes demonstrated by longitudinal studies, especially in the domain of conscientiousness.

Finally, we tested the effect of cohort standing, meaning the year when the sample of any given longitudinal study was born. It has been shown in several cases that cohort standing is related to level of psychological functioning on such traits as neuroticism and extraversion. For example, Twenge (2000, 2001, 2002) has reported that younger cohorts are more neurotic and extraverted than older cohorts. Differences in mean levels across cohorts are thought to reflect the effect of shared values that differ from decade to decade. So, for example, individuals growing up just after World War II may have been less narcissistic than individuals growing up in the 1960s and 1970s because the value system within the United States in this later period became more self-focused (Roberts & Helson, 1997). One possibility is that people living through periods of cultural change will show analogous psychological change that reflects the changing value system in the culture. For example, a sample of women followed from their early 20s to their early 40s during the 1960s and 1970s showed a pattern of increased narcissism and decreased norm adherence, which was consistent with the changes in values in the social climate of the United States during that same period of history (Roberts & Helson, 1997). Therefore, we might expect to see patterns of change in the longitudinal data across different cohorts that are similar to the patterns of differences found across cross-sectional studies of different cohorts. In this case, we would expect longitudinal studies tracking change in younger cohorts to show decreases in emotional stability and increases in either social vitality or social dominance (i.e., extraversion).

Method

Literature Searches

We used six methods to locate studies. First, we reviewed the reference list from an earlier meta-analysis of rank-order consistency for longitudinal studies (Roberts & DelVecchio, 2000). Many of these studies reported information on rank-order consistency and mean-level change, although Roberts and DelVecchio did not examine the latter in this previous study. Second, we reviewed additional databases developed by Brent W. Roberts on personality development (Roberts, Robins, et al., 2003). Third, we searched the PsychLIT and Dissertation Abstracts databases by using the following keywords: *normative personality change*, *mean-level personality change*, and *longitudinal personality change*. Fourth, we reviewed current

issues of relevant journals (e.g., *Journal of Personality and Social Psychology*, *Journal of Personality*, *Developmental Psychology*). Fifth, after developing a preliminary list of studies, we reviewed the references cited in each article for additional studies. Sixth, after developing a relatively comprehensive list of studies, we asked knowledgeable colleagues to review the list and alert us to any studies that were overlooked.

Criteria for Study Inclusion

We included studies if they fulfilled five criteria. First, the study had to include dispositional or trait variables (i.e., enduring, cross-situationally consistent). Measures of attitudes, values, self-esteem, affect, mood, intelligence, cognitive functioning, sex role (e.g., femininity), temperament, and validity scales were not included. Second, to emphasize the longitudinal change of traits and to diminish potential carry-over effects that may affect estimates of change, we included only those studies with test-retest intervals greater than or equal to 1 year. Third, at a minimum, each study needed to contain information on mean-level change, sample size, and age of the sample. Fourth, the sample needed to be nonclinical. Fifth, we excluded studies that examined change over time for samples heterogeneous in terms of age (e.g., a 3-year longitudinal study of individuals ranging in age from 18 to 80), as these studies precluded the possibility of examining the effect of age on development.

Ninety-two studies satisfied the inclusion criteria. Because many of these studies reported data from several samples, the number of samples, 113, was greater than the total number of studies. The total number of participants for the 113 samples was 50,120. A total of 1,682 estimates of change were compiled.

Study Variables

Age. We recorded the age at the inception and conclusion of each wave of assessment in each longitudinal study. Results in a few studies were reported for a range of ages (e.g., 20 to 30, 30 to 40). For these studies, the midpoints of the reported age ranges were used as estimates of age.

To test the effect of age on mean-level personality trait change, we created age categories across the life course. We focused only on studies of individuals older than age 10, as this is the age at which children begin to describe themselves with trait terms and are administered standard personality measures (Roberts & DelVecchio, 2000). We created age categories that corresponded to adolescence (ages 10 to 17.9), the college years (ages 18 to 21.9), and the subsequent decades through age 101.¹ A study was categorized into an age period by taking the midpoint between the age at the first assessment and the age at follow-up. For example, if a study first assessed individuals at age 20 and then again at age 30, the corresponding "age" for the study was 25 and the data were categorized into the age 22 to 30 period.

Trait categories. A modified version of the Big Five taxonomy of personality traits used in Roberts and DelVecchio's (2000) previous meta-analysis was used to categorize the standardized mean differences of personality trait change. This system was similar to Roberts and DelVecchio's previous system, with the exception of a division of the domain of extraversion into two subcategories of social vitality and social dominance. Social vitality corresponds more closely to traits like sociability, positive affect, and gregariousness. Representative scales would be the Gregariousness and Activity Scales from the Revised NEO Personality Inventory (Costa & McCrae, 1994) and the Sociability Scale from the California Psychological Inventory (Gough & Bradley, 1996). Social dominance reflects such traits as dominance, independence, and self-confidence, especially in social contexts. Representative scales would be the Assertiveness Scale from the Revised NEO Personality Inventory, the Dominance and Capacity for Status Scales from the California Psychological Inventory, and the Dominance Scale from the 16 Personality Factor Questionnaire (Conn & Reike, 1994).

Two judges categorized the scales by using the modified Big Five taxonomy. Interjudge reliability was quite high across the whole database ($\kappa = .93$). Discrepancies were subsequently discussed until a consensus was reached on the categorization of all scales into the six personality domains.

Moderators

Sex of sample. Sex of the sample was coded as follows: 0 = men, 1 = both men and women, and 2 = women.

Time interval. Time interval was coded in number of years. If the time interval was reported in months, then the appropriate fraction of a year was included in the coding.

Attrition. Attrition was computed by subtracting the number of participants at the end of each stage of a longitudinal study from the number of participants at Time 1 and converting this figure to a percentage. Two judges computed attrition ratings. Interjudge reliability, indexed by the intraclass correlation, was quite high across the whole database ($r = .93$). Most discrepancies were small in magnitude, some resulting from rounding errors. These were subsequently discussed until a consensus was reached on the level of attrition for each study.

Cohort. Cohort was coded by subtracting the age at the time of the first assessment from the year that the first assessment was conducted in each longitudinal study. When the years of assessment were not available, we used estimates of the year of assessment on the basis of information in the article, such as year of publication.

Demographic variables. We also attempted to extract information about ethnicity, education, and socioeconomic status (SES) to see whether the studies were comparable on these statistics across the life course. The information provided by researchers on these three demographic variables was limited and often missing. For ethnicity, we coded studies as "diverse" if they included ethnic minorities in their sample and "not diverse" if the sample did not include ethnic minorities. For education, we coded studies as follows: 1 = most of the sample was high school educated and some of the sample had college education, 2 = most of the sample had some college education, and 3 = most of the sample had finished college or had advanced degrees. For SES, we coded studies as follows: 1 = representative (included full range of SES), 2 = predominantly middle class, and 3 = predominantly upper class. There were no studies focusing exclusively on poor or working-class citizens. The most salient feature of these three demographic domains was that the information was missing from 40% to 55% of the studies. Therefore, we chose not to examine these variables as moderators of personality change.

Computation and Analysis of Effect Sizes

The effect size measure used in this meta-analysis was a standardized mean difference and was calculated by subtracting the mean of the personality trait scores at Time 2 from the mean at Time 1 and dividing this raw mean difference by the standard deviation of the raw scores at the first time point. This is also known in short as the single-group, pretest-posttest raw score effect size (Morris & DeShon, 2002). When dealing with repeated measures data as in the present case, one must choose between two effect size metrics—namely, the change score and raw score metric. For the change score metric, one divides the observed mean difference by the standard deviation of the changes scores. The change score metric incorporates the test-retest correlation into the estimate of the standardized mean difference. Therefore, difference scores based on data with high test-retest correlations (i.e., above .50) are increased because of the strong

¹ In describing the analyses, we use the convention of describing the changes as change from "20 to 30," from "30 to 40," and so on. In each case, the actual age ranges were from 20 to 29.9, 30 to 39.9, and so on.

correlation over time. Difference scores based on data with low test–retest correlations (i.e., below .50) are decreased because of the weak correlation over time (see Morris & Deshon, 2002).

Because the test–retest correlation is a direct function of the rank-order consistency of the data, using the change score metric provides an effect size measure that does not differentiate between (or confounds) rank-order consistency and mean-level change. As we were interested only in the latter, we used the raw score metric, which is not affected by changes in rank-order consistency. Also, for the raw score metric, the mean difference is standardized in the units of the original scale and therefore provides an effect size measure that is directly comparable to standardized mean differences obtained from independent samples.

It is important to recognize that the raw score metric also uses the test–retest information, but only to adjust the standard errors of the effect size estimates instead of the actual standardized mean difference scores themselves. Specifically, all else being equal, standardized mean difference estimates with higher test–retest stabilities have smaller standard errors. Therefore, mean-level changes with high rank-order consistency (i.e., mean-level changes that are more consistent on an individual-level basis) provide more efficient effect size estimates. Finally, instead of using the pooled standard deviation of the raw scores at Time 1 and Time 2, one must use the standard deviation from Time 1 alone, because the repeated measures structure of the data makes it impossible to estimate the correct degrees of freedom for the pooled standard deviation (see Morris & Deshon, 2002).

We used various statistics from the studies to estimate the standardized mean difference scores. The computation was based on reported means and standard deviations for 93% of the studies and inferred from *F* and *t* values in 7% of the studies. Because the latter studies used repeated measures *F* and *t* test results, we transformed these scores into the raw score metric by using formulas provided by Morris and Deshon (2002).

The structure of the data necessitated several levels of aggregation to ensure that the effect size estimates were independent. To retain the developmental trend information across the life course, we aggregated effect sizes within the age categories rather than collapsing multiple waves of data across the life course into one effect size. For example, if a longitudinal study reported results from age 20 to 30 and from age 30 to 40, then these two estimates were aggregated into the age 22 to 30 and age 30 to 40 periods, respectively. If a longitudinal study reported multiple waves of data that fell within an age category (e.g., age 22 to 23, and 23 to 24), then these standardized mean differences and the relevant study moderator variables were averaged within that age category (e.g., age 22 to 30).

After the aggregation within age period, the next level of aggregation was within each Big Five category. If a study contributed multiple effect sizes that were coded as measures of agreeableness, then these effect sizes were aggregated into one estimate of change in agreeableness. If a study contributed multiple effect sizes that were coded as measures of agreeableness and openness, then these effect sizes were aggregated into one estimate of change for agreeableness and one estimate of change for openness. Finally, we further organized the data around the sex of the sample studied, aggregating data within the categories of male, female, and data from combined samples. This technique for aggregation meant that each longitudinal sample could contribute an averaged standardized mean difference score for each of the Big Five separately for men and women, to each of the separate age categories. Therefore, each age category within each of the Big Five essentially constitutes a separate meta-analysis.

When possible, we tested the likelihood of publication bias by using a trim and fill procedure (Duval & Tweedie, 2000). Publication bias reflects the possibility that the studies retrieved for the meta-analysis may not include all studies actually conducted, with the most likely omissions being studies that failed to find statistically significant results. The trim and fill procedure is a nonparametric statistical technique that examines the symmetry and distribution of effect sizes plotted against the inverse of the variance or standard error. This technique first estimates the number of

studies that may be missing as a result of publication bias, with publication bias meaning studies with effect sizes that are low or near zero relative to the average effect. Then, the trim and fill procedure calculates hypothetical effects for potentially omitted studies and then reestimates the average effect size and confidence intervals on the basis of the influence of studies that would have been included in the analyses if they had been published. For effect sizes that were predominantly in the negative direction, we first reversed the sign of the effects before running the trim and fill analyses because the procedure assumes that the effects are generally positive. In several instances, the data from our meta-analysis violated one of the basic assumptions of the trim and fill procedure. Specifically, if the distribution includes large positive and negative values, this tends to violate the distributional assumptions of the procedure and biases the estimates. We examined the distributions for each effect and did not run the trim and fill procedure on data that demonstrated this type of pattern. The trim and fill procedure was performed with the DVBID library (Biggerstaff, 2000) by using the S-Plus statistical computing program. The procedure as implemented in the DVBID library generates three estimators of missing studies, L_0 , R_0 , and Q_0 . We used the L_0 estimator as it is the most robust estimator in the case of problematic distributions described above (S. Duval, personal communication, November 19, 2003).

To determine whether each set of standardized mean difference scores shared a common effect size, we calculated the homogeneity statistic *Q* within each of the age categories and for each personality factor. When the effect sizes were found to be homogeneous, we applied the fixed-effects model. On the other hand, a random-effects model was used for heterogeneous effect sizes. In either case, we obtained an estimate of the overall effect size (denoted by *d*) for each age category and personality factor, which was also tested for statistical significance by computing a 95% confidence interval.

To examine the relationships between the moderator variables and the effect sizes, we first created data sets for each trait category that included as many nonoverlapping studies as possible. Testing the moderators within each age and trait category separately would greatly reduce the power to detect any moderating effects, because of the smaller number of studies in each age period. Moreover, the likelihood of making a Type I error increases quickly when conducting multiple hypothesis tests, such as when testing the moderators within each age and trait category separately. Finally, using as many studies as possible in each trait category allows for more efficient tests of the moderators as we could include all the moderator variables simultaneously in the model. Thus, we were able to test for the independent effect of each moderator, controlling for the remaining moderators.

We proceeded as follows to create data sets with independent effect sizes for each of the trait categories. When a sample provided results across multiple assessment waves, we retained the effect size with the largest sample size. When the sample size did not vary across effect sizes, we selected effect sizes with the longest time period, as these were rarer than those with short time periods. If neither sample size nor time period varied, we selected effect sizes from the oldest age period from the sample, as these were rarer than other types of change estimates. The resulting six databases contained between 31 and 102 independent effect sizes, depending on the personality trait.

To test the moderators, we used a random-effects model with moderators or, in other words, a mixed-effects model (Overton, 1998; Raudenbush, 1994). Mixed-effect models provide a more stringent test of moderators and help to diminish the possibility of Type I errors, which can become severely inflated in the typical fixed-effects with moderators approach to meta-analysis (Overton, 1998; Viechtbauer, 2004a, 2004b). Mixed-effects models allow for the possibility of residual heterogeneity, meaning heterogeneity in the effect sizes over and beyond that which we would expect on the basis of the moderators alone. Therefore, after estimating the amount of residual heterogeneity, we tested the relationships between the moderators and the mean-level change in personality measures by fitting a

weighted least squares regression model within each trait category that incorporated this estimate of residual heterogeneity. We report parameter estimates, indicating the change in the effect size for a one-unit increase in the corresponding moderator value. We also tested whether each moderator was significantly related to the effect sizes and whether residual heterogeneity was present with the Q_E statistic. The method we used for fitting the mixed-effects model and analyzing moderators is essentially identical to that discussed by Raudenbush (1994), except that the amount of heterogeneity was estimated via restricted maximum-likelihood estimation (Raudenbush & Bryk, 2002). Restricted maximum-likelihood estimates are approximately unbiased, as opposed to regular maximum-likelihood estimates, which tend to be too small on average. The analysis was conducted in S-Plus, by using a custom function written by Wolfgang Viechtbauer, which is available upon request.

Results

Study Characteristics

Table 1 shows the author, sample size, measures, types of traits, attrition, and ages for each study.² Table 2 shows the descriptive statistics for the relevant variables in the unaggregated database. The age at the initiation of study ranged from 10 to 101. The average time span between assessments was 9.5 years. This estimate is somewhat misleading as the median time span was 6 years and the modal study was 2 years in length. The oldest cohort was born in 1898 and the youngest was born in 1982, with the average cohort being born in 1944. The average attrition rate across samples was 44%. Analysis of the quartiles of the attrition distribution showed that 25% of the effect sizes came from studies with less than 27% attrition, whereas another 25% came from studies with more than 59% attrition. Twenty-six percent of the estimates came from samples that did not report results separately for men and women. Thirty-four percent of the estimates were derived from samples of men and 40% from samples of women. The majority of the effect sizes came from studies that were heterogeneous in terms of ethnicity. Also, SES of the samples was evenly distributed across those that included working-class, middle-class, and affluent samples. There was a distinct lack of studies of the poor, however. Most of the samples had some college education, with a substantial minority being highly educated. The most common trait category studied was emotional stability (29%), followed by openness (19%), conscientiousness (18%), and social vitality (18%). The least common trait domains studied were agreeableness (12%) and social dominance (5%).

To determine the comparability of the samples across the life course, we broke down the study characteristics and moderator variables by the age categories that were used to organize the data (see Table 3). The demographic characteristics revealed several interesting patterns. Studies of adolescents and college-age students appear to be the most representative, in that these samples included ethnic minorities and tended to have more of a mixed SES pattern. The data drawn from longitudinal studies that tracked adults in midlife tended to be more homogeneous in terms of ethnicity, SES, and college education. The median length of the longitudinal studies in each age period also showed a differentiated pattern. Compared with the remaining periods of the life course, studies in adolescence and college tended to be short-term studies. The longest studies were derived from samples that first started in young adulthood. This makes sense as some of the classic longi-

tudinal studies in the field have followed college samples for long periods of time (e.g., Helson & Wink, 1992). Cohort had a strong negative relationship with age. This reflects the fact that longitudinal research is a relatively recent phenomenon, at least in terms of cohort. For example, there has not yet been the opportunity to study people born in the 1970s and 1980s into middle or old age. In turn, studies of older cohorts when they were young were not carried out because longitudinal studies were relatively rare before the 1960s. Finally, the gender composition and attrition levels showed the least amount of variability and no clear pattern across the different age periods.

Mean-Level Changes in Personality Traits Across the Life Course

We analyzed aggregate change in traits within specific age categories across the life course. Specifically, each age category can be thought of as its own meta-analysis, as each study could contribute one and only one effect size per age category. We will first present data for each trait across the life course or the portion of the life course for which there were enough studies to make estimates.

Table 4 shows the standardized mean-level changes in the facet of extraversion described as social vitality. On the basis of narrative reviews and the cross-sectional data, we expected these scores to decrease with age. The standardized mean-level change data revealed a more complex pattern. Traits that fell within the social vitality domain showed small but statistically significant increases in the college period ($d = .06, p < .05$). In contrast, social vitality demonstrated statistically significant decreases in the age 22 to 30 period ($d = -.14, p < .05$) as well as the age 60 to 70 period ($d = -.16, p < .05$), with no systematic change in the intervening decades of the life course. Overall, the pattern is consistent with the perspective that there are small decreases in social vitality as people approach old age. None of the social vitality effects demonstrated potential publication bias.

Table 5 shows the population estimates of mean-level change in social dominance, the second facet of extraversion. The pattern of change was very consistent with the argument that social dominance increases with age (Helson & Kwan, 2000). We found statistically significant increases in social dominance in adolescence ($d = .20, p < .05$), the college years ($d = .41, p < .05$), and the two decades of young adulthood ($d = .28$ and $.18$, respectively, $ps < .05$). Beyond age 40, changes in social dominance did not demonstrate sizable increases or decreases. It is interesting to note that none of the statistically significant increases were heterogeneous. The trim and fill analyses identified one estimate that was potentially biased. The age 18 to 22 effect size had two potential missing studies. Nonetheless, the estimated effect of including these potentially missing studies was small, and the reestimated effects were still statistically significant. Thus, traits from the domain of social dominance showed a consistent pattern of increase from adolescence through age 40.

Next, we examined standardized mean-level change in measures of agreeableness (see Table 6). We hypothesized that traits from

² We also considered method (e.g., self-report, observer ratings, projective tests) as a moderator, but there were too few studies in the observer and projective test categories to test the effect.

Table 1
Longitudinal Studies of Mean-Level Change in Personality

| Authors | N | Measure | Traits ^a | % attrition | Ages and time intervals ^b |
|-------------------------------------|-------------|---|---------------------|-------------|--|
| Asendorpf (unpublished data) | 93, 81 | German CAQ | E, A, C, N, O | 6 | 12–17 |
| Asendorpf & Wilpers (1998) | 132 | NEO-FFI | E, A, C, N, O | 44 | 20–22 |
| Baltes & Nesselroade (1972) | 1,249 | Cattell's High School Personality Questionnaire | E, A, C, N, O | 24 | 14–15 |
| Barefoot et al. (2001) | 151 | MMPI | N | 76, 78 | 50–60, 50–80, 60–80 |
| Berdie (1968) | 148 | Minnesota Counseling Inventory | C, N | 41 | 14–18 |
| Block (1971) | 159 | California Q-Sort | N | 83 | 14–18, 14–30, 17–30 |
| Branje et al. (2004) | 285 | Goldberg's 30 adjectives (Dutch version) | E, A, C, N, O | 1 | 12–13, 12–14, 15–16 15–17, 16–17, 42–43, 42–44, 43–44, 44–45, 44–46, 45–46 |
| Bronson (1966) | 85 | Interviewer ratings of personality traits | E, A, C, N, O | 31 | 11–14 |
| Cairns et al. (1990) | 2,429 | Locus of Control | N | 16 | 17–18 |
| Cantoni (1955) | 211 | Bell Adjustment Inventory | N | 10 | 14–18, 14–27, 18–27 |
| Caputo et al. (1966) | 52 | Edwards Personal Preference Schedule | E, A, C, N, O | 34 | 18–20 |
| Carmichael & McGue (1994) | 121 | Eysenck Personality Inventory | E, N | 63 | 16–35 |
| Cartwright & Wink (1994) | 40 | California Psychological Inventory | E, C | 31 | 24–31, 24–46, 31–46 |
| Cooper (2004) | 1,363 | NEO-PI-R | C | 44 | 17–22, 17–27, 21–27 |
| Costa et al. (2000) | 2,274 | NEO-PI-R | E, A, C, N, O | 26 | 41–50, 44–50 |
| Costa & McCrae (1988) | 398 | NEO-PI | E, C, N, O | 37 | 35–38, 35–41, 45–48, 45–51, 55–58, 55–61, 65–68, 65–71, 75–78, 75–81 |
| Costa & McCrae (1992) | 175 | Guilford–Zimmerman Temperament Survey | E, A, C, N, O | M | 53–60 |
| Costa et al. (1980) | 433 | Guilford–Zimmerman Temperament Survey | E, A, C, N, O | M | 36–42, 45–51, 54–60 64–70, 74–80 |
| Cramer (1998) | 88 | Narcissistic Personality Inventory | A | 25 | 18–22 |
| Cramer (2003) | 155 | California Q-Sort | E, A, C, N, O | 64 | 33–43, 33–57, 43–57 |
| Crook (1943) | 52 | Thurstone Personality Schedule | N | 50 | 18–25 |
| Davis & Franzoi (1991) | 205 | Interpersonal Reactivity Index | A, N, O | 74 | 16–18 |
| Dudek & Hall (1991) | 70 | California Psychological Inventory | E, C, N, O | 44 | 49–74 |
| Field & Millsap (1991) | 72 | Personality trait ratings | E, A, N, O | 83 | 66–80, 75–89 |
| Gold & Henderson (1990) | 74 | Revised Imaginal Processes Inventory | O | 76 | 12–13 |
| | | Academic Curiosity Scale | | | |
| | | Revised Children's Reactive Curiosity | | | |
| Grigoriadis & Fekken (1992) | 89 | MMPI | E, C, N | 7 | 30–33 |
| Gustavsson et al. (1997) | 130 | Karolinska Scales of Personality | E, A, C, N | 24 | 43–52 |
| Haan, Millsap, & Hartka (1986) | 118 | California Q-Sort | E, A, C, N, O | 74 | 14–17, 14–57, 17–33, 33–43, 43–57 |
| Hair & Graziano (2003) | 147 | Goldberg's bipolar self-rating markers | E, A, C, N, O | 23 | 13–17 |
| Hathaway & Monachesi (1963) | 3,976 | MMPI | E, C, N | 74 | 14–18 |
| Helson & Kwan (2000) | 40, 106, 45 | California Psychological Inventory | E, A, C, O | 31, 24, 79 | 24–46, 21–60, 33–75 |
| Helson & Moanc (1987) | 81 | California Psychological Inventory | E, A, C, O | 42 | 21–27, 21–43, 27–43 |
| Helson et al. (1995) | 104 | California Psychological Inventory | O | 26 | 21–43, 21–52, 43–52 |
| Helson & Wink (1992) | 101 | California Psychological Inventory | E, C, N | 28 | 43–52 |
| | | Adjective Check List | | 31 | |
| Holmlund (1991) | 349 | Cesarec–Marke Personality Schedule | E, A, C, N | 31 | 15–25 |
| Karney & Bradbury (1997) | 106 | Eysenck Personality Questionnaire | N | 12 | 24–28, 25–29 |
| Karney & Coombs (2000) ^c | 91 | California Psychological Inventory | E, A, N | 48 | 26–36, 26–46, 36–46 |
| Keltikangas-Järvinen (1989) | 1,737 | AFMS questionnaire | A | 17–46 | 12–15, 15–18, 18–21, 21–24 |
| Kitchener et al. (1984) | 61 | Sentence Completion Task | O | 15, 25, 30 | 16–18, 20–22, 28–30 |

Table 1 (*continued*)

| Authors | N | Measure | Traits ^a | % attrition | Ages and time intervals ^b |
|-----------------------------|--------------------|--|---------------------|-------------|--|
| Klopsch (1983) | 150 | MMPI | E, C, N | 39 | 25–30 |
| Labouvie-Vief & Jain (2002) | 300 | California Psychological Inventory | E, C, N | 17, 24, 38 | 23–25, 23–29, 25–29, 39–41, 39–45, 41–45, 53–55, 53–59, 55–59, 72–74, 72–78, 74–78 |
| Leadbeater et al. (1999) | 460 | Depressive Experiences Questionnaire for Adolescents | N | 8 | 12–13 |
| Leon et al. (1979) | 71 | Youth Self-Report | A, C, N | | |
| Loehlin et al. (1990) | 83 | MMPI | E, N | 75 | 49–79 |
| Loevinger et al. (1985) | 298 | Parent ratings of personality | E, C, N | 50 | 10–20 |
| J. Martin & Redmore (1978) | 32 | Sentence Completion Task | O | 42–53, M | 18–19, 18–20, 18–21, 19–21 |
| P. Martin (2002) | 179 | Sentence Completion Task | O | 70 | 12–18 |
| McGue et al. (1993) | 254 | 16-PF | E, A, C, N, O | 45 | 65–70, 83–88, 101–103 |
| Mclamed et al. (1974) | 62 | Multidimensional Personality Questionnaire | E, A, C, N, O | M | 20–30 |
| Morizot & LeBlanc (2003) | 145, 277 | 16-PF | E, A, C, N, O | 35 | 36–39 |
| | | Jesness Personality Inventory | E, A, C, N | 74, 41 | 15–17, 15–30, 15–40 |
| | | Eysenck Personality Inventory | | | 17–30, 17–40, 30–40 |
| Mortimer et al. (1982) | 368 | Semantic Differential Scale | E, N, C | 43 | 18–22, 18–32, 22–32 |
| Mroczek et al. (2002) | 205 | Goldberg 100 | E, A, C, N, O | 29 | 13–14 |
| Mroczek & Spiro (2003) | 521, 742, 409 | Eysenck Personality Inventory | E, N | 27 | 42–58, 59–68, 69–96 |
| Mussen et al. (1980) | 53 | Observer trait ratings | E, A, N, O | 58 | 30–70 |
| Nesselroade & Baltes (1974) | 816 | Cattell's High School Personality Questionnaire | E, A, C, N, O | 38 | 14–16 |
| | | Personality Research Form | | | |
| Neyer & Asendorpf (2001) | 489 | NEO-FFI | E, A, C, N | 23 | 24–28 |
| Nichols (1967) | 636 | 16-PF | E, A, C, N, O | 46 | 18–22 |
| Ogawa et al. (1997) | 48 | Youth Self-Report of Behavior Checklist | N | 37 | 17–20 |
| Ormel & Rijdsdijk (2000) | 383 | Amsterdamse Biografische Vragenlijst | N | 23, 33, 42 | 35–40, 35–41, 35–49, 35–51, 40–41, 40–49, 40–51, 41–49, 41–51, 49–51 |
| Ormel & Schaufeli (1991) | 226, 389 | Rotter's Locus of Control | N | 41, 39 | 39–46, 23–24 |
| Pederson (1991) | 553 | General Health Questionnaire | N | 7 | 17–19 |
| | | Zuckerman Sensation Seeking Scale (Form V) | E, C, O | | |
| Peterson & Lane (2001) | 69 | Altemeyer's Right-Wing Authoritarianism | O | 65 | 18–22 |
| Piccione et al. (1989) | 50 | Stanford Hypnosis Susceptibility Scale | O | 92 | 20–30, 20–45, 30–45 |
| Plant (1965) | 1,177, 974 | Modified California Ethnocentric Scale | O | 50, 59 | 18–20, 18–22 |
| | | Gough Revision of the F Scale | | | |
| | | Rokeach Dogmatism Scale | | | |
| Plant & Telford (1966) | 1,713 ^d | California Psychological Inventory | E, C, O | 62 | 18–20 |
| Pogue-Geile & Rose (1985) | 266 | MMPI | A, C, N | 34 | 20–25 |
| Popham & Holden (1991) | 55 | MMPI | E, A, N, O | 31 | 20–21 |
| Roberts (1997) | 81 | California Psychological Inventory | E | 42 | 21–27, 21–43, 27–43 |
| Roberts et al. (2001) | 980 | Multidimensional Personality Questionnaire | E, A, C, N | 5 | 18–26 |
| Roberts & Chapman (2000) | 77 | California Psychological Inventory | N | 45 | 21–27, 21–43, 21–52, 27–43, 27–52, 43–52 |
| Roberts et al. (2002) | 78 | California Psychological Inventory | E, A, C, O | 44 | 21–27, 21–43, 21–52, 27–43, 27–52, 43–52 |
| Robins et al. (2001) | 270 | NEO-FFI | E, A, C, N, O | 45 | 18–22 |
| Sanderman & Ranchor (1994) | 225 | Eysenck Personality Questionnaire | E, A, N | 74 | 42–48 |
| Sanford (1962) | 108, 118 | Vassar Scale | E, C, O | M | 18–19, 18–20 |
| | | California Psychological Inventory | | | |
| | | MMPI | | | |
| | | Personality trait ratings | | | |

Table 1 (*continued*)

| Authors | <i>N</i> | Measure | Traits ^a | % attrition | Ages and time intervals ^b |
|-----------------------------|---------------------|--|---------------------|-------------|--|
| Schofield (1953) | 83 | MMPI | C, N | 0 | 22–24 |
| Scollon (2004) | 400 | Eysenck Personality Inventory | E, N | 57 | 24–32 |
| Small et al. (2003) | 223 | NEO-PI | E, A, C, N, O | 54 | 68–74 |
| Stein et al. (1986) | 654 | Bentler Psychological Inventory | E, A, C, N, O | 60 | 13–21 |
| Stevens & Truss (1985) | 92, 85 | Edwards Personal Preference Schedule | E, A, C, N, O | 91, 93 | 18–30, 20–42, 18–42 |
| Tenerowicz (1992) | 62 | Personality Research Form | E, A, C, N, O | 22 | 27–29 |
| Townsend et al. (1989) | 112 | Zung Self-Rated Depression Scale | N | 38 | 47–48 |
| Vaidya et al. (2002) | 392 | Big Five Inventory | E, A, C, N, O | 48 | 18–21 |
| | | PANAS | E, N | | |
| van der Velde et al. (1995) | 314 | Depression Adjective Checklist | E, C, N | 29 | 18–22, 20–24 |
| | | Eysenck Personality Inventory | | | |
| | | Zuckerman's Sensation Seeking Scale | | | |
| | | Feij's Impulsiveness Scale | | | |
| | | Heesink's Locus of Control | | | |
| Viken et al. (1994) | 14,932 ^d | Eysenck Personality Inventory | E, N | 5–14 | 20–26, 26–32, 32–38 38–44, 44–50, 50–56 |
| Watson & Slack (1993) | 82 | Multidimensional Personality Questionnaire | E, N | 46 | 45–47 |
| Watson & Walker (1996) | 237 | PANAS | E, N | 78 | 18–25 |
| Weinryb et al. (1992) | 37 | Karolinska Scales of Personality | E, A, C, N | 43 | 39–41 |
| Westenberg & Gjerde (1999) | 97 | Sentence Completion Task | O | 7 | 14–23 |
| Wilhelm & Parker (1990) | 163 | Costello–Comrey Trait Depression Scale | N | 4 | 23–33 |
| Wink & Helson (1993) | 42, 21 | Adjective Checklist | E, A, C, N, O | 68 | 27–52, 31–56 |
| Woodall & Matthews (1993) | 108 | Type A Structured Interview | A | 29 | 14–18 |
| | | MMPI | | | |
| Woodruff & Birren (1972) | 54 | California Test of Personality | N | 89 | 20–45 |

Note. Multiple numbers in the *N* column indicate the sample sizes for multiple sample sizes reported within the same study. Multiple numbers in the attrition column correspond to the different samples reported in each study. Ranges indicate that more than three samples were reported on in the study. CAQ = California Adult Q-Sort; E = Extraversion, including measures of Social Dominance and Social Vitality; A = Agreeableness; C = Conscientiousness; N = Neuroticism or Emotional Stability; O = Openness to Experience; NEO-FFI = NEO Five-Factor Inventory; MMPI = Minnesota Multiphasic Personality Inventory; NEO-PI-R = Revised NEO Personality Inventory; NEO-PI = NEO Personality Inventory; M = missing data; 16-PF = 16 Personality Factor Questionnaire; PANAS = Positive and Negative Affect Scale for Children.

^a The Big Five categories included in the meta-analysis do not always correspond perfectly to the Big Five categories included in the measure, such as the NEO-PI-R. The discrepancy resulted from a variety of factors, such as the authors not reporting the statistics for all of the scales contained in the personality inventory or because of problems with the way scales were measured over time (e.g., the items were changed as scales were developed).

^b To determine which age categories each study contributed to, identify the age at the midpoint between the ages listed under the Ages and time intervals column. This age was used to categorize studies into the various age categories (22–30, 40–50, etc.).

^c Data were unreported means on personality measures from the samples described in the respective studies that we acquired from the authors of the original studies.

^d These studies reported on five or more samples, so the aggregate *N* is provided. Also, we used the overall attrition as attrition for each subsample was not reported.

Table 2
Descriptive Statistics for Characteristics Associated With Trait Consistency

| Study Characteristics | <i>M</i> | <i>SD</i> | Range |
|--|----------|-----------|---------------|
| Time interval in years | 9.0 | (8.7) | 1 to 43 years |
| Age range of samples | | | 10 to 101 |
| Cohort | 1942 | (18.2) | 1898 to 1982 |
| Attrition | 42% | (22) | 0% to 93% |
| Male samples | 34% | | |
| Female samples | 40% | | |
| Both | 26% | | |
| Ethnicity | | | |
| Homogeneous | 30% | | |
| Heterogeneous | 70% | | |
| Socioeconomic status | | | |
| Includes working class | 36% | | |
| Predominantly middle class | 32% | | |
| Predominantly affluent | 32% | | |
| Education | | | |
| Mostly high school educated with some with college education | 33% | | |
| Most have some college education | 54% | | |
| Most have completed college or have advanced degrees | 12% | | |
| Trait category | | | |
| Social vitality | 18% | | |
| Social dominance | 5% | | |
| Agreeableness | 12% | | |
| Conscientiousness | 18% | | |
| Emotional stability | 29% | | |
| Openness to experience | 19% | | |

Note. Descriptive statistics are based on overall database before aggregation.

the domain of agreeableness would increase with age. This hypothesis was not strongly supported. Up through the age 50 to 60 period the changes were positive, but all the estimates included zero in their confidence intervals, indicating that we cannot rule out the null hypothesis. We should also note that all the effect sizes through the age 50 to 60 period were heterogeneous and thus were evaluated with the random effects model. We did find a statistically significant increase in agreeableness in the age 50 to 60 period ($d = .30, p < .05$). None of the estimates were biased according to the trim and fill procedure.

Table 3
Characteristics of the Samples Across the Life Course

| Age | Not monoethnic | Mixed SES | Most have some college | Time | Cohort | Gender | | Attrition |
|-------|----------------|-----------|------------------------|------|--------|--------|-------|-----------|
| | | | | | | Men | Women | |
| 10–18 | 96% | 79% | | 3 | 1960 | 31% | 27% | 35.6 |
| 18–22 | 100% | 73% | | 2 | 1955 | 23% | 42% | 40.9 |
| 22–30 | 100% | 37% | 54% | 10 | 1951 | 42% | 35% | 48.6 |
| 30–40 | 54% | 38% | 71% | 10 | 1939 | 41% | 47% | 49.2 |
| 40–50 | 51% | 39% | 72% | 7.6 | 1941 | 37% | 39% | 35.6 |
| 50–60 | 42% | 42% | 57% | 7.3 | 1926 | 39% | 44% | 47.1 |
| 60–70 | 28% | 6% | 94% | 7.3 | 1916 | 58% | 22% | 46.3 |
| 70+ | 50% | 27% | 61% | 6 | 1914 | 26% | 21% | 48.2 |

Note. Descriptive statistics are based on aggregated database. Time estimates are medians rather than means because of skewed distributions. Gender percentages do not add up to 100% because the remaining samples were combined samples. SES = socioeconomic status.

Table 4
Population Estimates of Mean-Level Change in Social Vitality Facet of Extraversion Across the Life Course

| Age | <i>K</i> | <i>N</i> | <i>d</i> | CI | <i>Q_h</i> |
|--------------------|----------|----------|----------|------------|----------------------|
| 10–18 | 12 | 6,132 | .11 | –.06, .27 | 32.3* |
| 18–22 | 15 | 3,929 | .06* | .01, .10 | 20.0 |
| 22–30 | 21 | 7,306 | –.16* | –.27, –.05 | 56.6* |
| 30–40 | 14 | 2,310 | .04 | –.07, .15 | 58.8* |
| 40–50 | 20 | 4,948 | –.02 | –.06, .02 | 38.7* |
| 50–60 ^a | 9 | 1,266 | .01 | –.04, .04 | 7.5 |
| 60–70 | 11 | 1,406 | –.16* | –.27, –.05 | 26.3* |
| 70+ | 10 | 1,045 | –.01 | –.05, .04 | 8.3 |

Note. *K* = number of samples; *d* = standardized mean difference; CI = 95% fixed effects confidence intervals; *Q_h* = heterogeneity statistic.

^a Trim and fill procedure was not carried out on these data because the distribution of effects violated assumptions of the procedure.

* $p < .05$.

Table 7 shows the pattern of standardized mean-level changes in measures of conscientiousness. We hypothesized that traits from the domain of conscientiousness would also increase with age and found strong support for this hypothesis. We found little or no change in measures of conscientiousness in adolescence and the college period. In contrast, conscientiousness increased from age 20 to 30 ($d = .22, p < .05$), from age 30 to 40 ($d = .26, p < .05$), and from age 40 to 50 ($d = .10, p < .05$). In addition, conscientiousness increased during the age 60 to 70 period ($d = .22, p < .05$). Three of the effects, from adolescence, the college period, and middle age (40 to 50), were heterogeneous. None of the statistically significant effects demonstrated evidence of publication bias.

The patterns of standardized mean-level change for measures of emotional stability were similar to those of conscientiousness but centered earlier in the life course (see Table 8). People showed small, positive increases in emotional stability in their teens ($d = .16, p < .05$), the college period ($d = .12, p < .05$), as well as in their 20s ($d = .23, p < .05$) and their 30s ($d = .26, p < .05$). We also found a very small but statistically significant increase in the age 50 to 60 period ($d = .06, p < .05$), although the latter effect demonstrated publication bias and should be interpreted cautiously.

Table 5

Population Estimates of Mean-Level Change in Social Dominance Facet of Extraversion Across the Life Course

| Age | K | N | d | CI | Q_h | d_a | CI _a | Q_{ha} |
|-------|----|-------|------|-----------|-------|-----------------------|-----------------|----------|
| 10–18 | 5 | 1,700 | .20* | .01, .39 | 3.9 | | | |
| 18–22 | 9 | 1,655 | .41* | .13, .69 | 3.7 | .32* (2) ^a | .07, .58 | 6.0 |
| 22–30 | 14 | 2,445 | .28* | .12, .44 | 9.2 | | | |
| 30–40 | 8 | 807 | .18* | .004, .35 | 2.4 | | | |
| 40–50 | 7 | 2,009 | .02 | –.02, .07 | 8.6 | | | |
| 50+ | 7 | 418 | .01 | –.16, .15 | 22.9* | | | |

Note. K = number of samples; d = standardized mean difference; CI = 95% fixed effects confidence intervals; Q_h = heterogeneity statistic; d_a = fixed effects standardized mean difference adjusted for potential publication bias; CI_a = 95% fixed effects confidence interval for the standardized mean difference adjusted for potential publication bias; Q_{ha} = heterogeneity statistic for the mean difference adjusted for potential publication bias.

^a Represents the number of studies presumed to be missing from the distribution of scores according to the trim and fill procedure.

* $p < .05$.

Traits from the domain of openness to experience showed a similar pattern to social vitality (see Table 9). People showed increases in openness in adolescence (though not statistically significant) and statistically significant increases in the college years ($d = .37, p < .05$). In the ensuing decades, openness either did not change or declined. Like social vitality, the standardized mean-level change in openness dropped in old age ($d = -.19, p < .05$). Also, changes in openness to experience showed significant heterogeneity mostly in adolescence and young adulthood. None of the statistically significant effects for the domain of openness to experience demonstrated evidence of publication bias.

Three aspects of the results stand out. First, it is clear that personality trait change occurs well past ages previously used to demarcate when traits purportedly stop changing, such as age 30 (McCrae & Costa, 1994). All six trait domains demonstrated statistically significant changes past the age of 30, and four of the six trait domains demonstrated statistically significant changes in middle or old age. Second, as is shown in Figure 1, when the aggregate amount of change across the six trait categories is plotted against age, we see that personality traits change most during the period of young adulthood (age 20 to 40), rather than in adolescence. This finding indicates that the window for personality development is open well into adulthood. Finally, as can be seen in the panels of Figure 2, most of the change was in the positive

direction. Each of these panels shows the cumulative d values across the life course for the six trait domains. The assumption underlying these figures is that the change in personality traits is cumulative across the life course, which is somewhat risky as none of the known longitudinal studies have tracked individuals from birth to death. Thus, we would propose that the change shown here is most likely an upper bound estimate of personality trait change. The patterns and magnitude of change are easily discernable in these figures. The changes in social vitality were small and in the downward direction. The increases in social dominance were robust in young adulthood and cumulate to over one standard deviation. Similar patterns are shown for conscientiousness and emotional stability. Despite demonstrating few significant increases in any given age period, agreeableness shows a clear trend toward increasing across the life course. Finally, openness to experience shows a clear curvilinear pattern of change.

Moderators of Mean-Level Change in Personality

We investigated four potential moderators of mean-level change in personality traits: sex, time between assessments, attrition, and cohort standing (see Table 10). To control for the effect of age on the effect sizes, we also entered this variable in the model. Ac-

Table 6

Population Estimates of Mean-Level Change in Agreeableness Across the Life Course

| Age | K | N | d | CI | Q_h |
|-------|----|-------|------|-----------|-------|
| 10–18 | 20 | 4,378 | .01 | –.09, .11 | 61.3* |
| 18–22 | 11 | 2,239 | .05 | –.08, .18 | 39.4* |
| 22–30 | 17 | 2,962 | .17 | –.02, .34 | 47.6* |
| 30–40 | 11 | 1,046 | .06 | –.10, .22 | 24.6* |
| 40–50 | 14 | 3,079 | .03 | –.05, .11 | 55.7* |
| 50–60 | 5 | 281 | .30* | .003, .61 | 4.5 |
| 60+ | 7 | 551 | .04 | –.04, .13 | 12.0 |

Note. K = number of samples; d = standardized mean difference; CI = 95% fixed effects confidence intervals; Q_h = heterogeneity statistic.

* $p < .05$.

Table 7

Population Estimates of Mean-Level Change in Conscientiousness Across the Life Course

| Age | K | N | d | CI | Q_h |
|-------|----|-------|------|-----------|--------|
| 10–18 | 17 | 7,506 | .03 | –.09, .14 | 170.2* |
| 18–22 | 18 | 5,226 | .04 | –.18, .11 | 89.6* |
| 22–30 | 22 | 4,827 | .22* | .11, .32 | 28.6 |
| 30–40 | 12 | 1,079 | .26* | .09, .43 | 18.7 |
| 40–50 | 13 | 2,838 | .10* | .01, .19 | 66.8* |
| 50–60 | 5 | 240 | .06 | –.06, .19 | 6.5 |
| 60–70 | 7 | 434 | .22* | .01, .43 | 9.8 |
| 70+ | 7 | 444 | .03 | –.04, .11 | 7.2 |

Note. K = number of samples; d = standardized mean difference; CI = 95% fixed effects confidence intervals; Q_h = heterogeneity statistic.

* $p < .05$.

Table 8

Population Estimates of Mean-Level Change in Emotional Stability Across the Life Course

| Age | K | N | d | CI | Q_h | d_a | CI_a | Q_{ha} |
|--------------------|----|--------|------|-----------|--------|----------------------|-----------|----------|
| 10–18 | 23 | 10,557 | .16* | .09, .23 | 32.6 | | | |
| 18–22 ^a | 15 | 3,621 | .12* | .004, .24 | 38.5* | | | |
| 22–30 | 31 | 10,480 | .23* | .14, .32 | 26.9 | | | |
| 30–40 | 20 | 4,025 | .26* | .05, .47 | 84.9* | | | |
| 40–50 | 27 | 7,153 | .06 | –.03, .15 | 158.9* | | | |
| 50–60 | 12 | 2,002 | .06* | .004, .12 | 9.0 | .03 (2) ^b | –.02, .08 | 15.4 |
| 60–70 | 13 | 1,560 | .01 | –.15, .17 | 68.3* | | | |
| 70+ | 10 | 1,227 | –.05 | –.22, .12 | 66.2* | | | |

Note. K = number of samples; d = standardized mean difference; CI = 95% fixed effects confidence intervals; Q_h = heterogeneity statistic; d_a = fixed effects standardized mean difference adjusted for potential publication bias; CI_a = 95% fixed effects confidence interval for the standardized mean difference adjusted for potential publication bias; Q_{ha} = heterogeneity statistic for the mean difference adjusted for potential publication bias.

^a Trim and fill procedure was not carried out on these data because the distribution of effects violated assumptions of the procedure.

^b Represents the number of studies presumed to be missing from the distribution of scores according to the trim and fill procedure.

* $p < .05$.

according to the crossover hypothesis, we expected to find evidence for gender differences in changes in social dominance and agreeableness. However, given the complete lack of statistically significant relationships between gender and standardized mean-level change, we found no support for this hypothesis.

The second moderator, time span of the longitudinal study, has a well-known positive relationship to a lack of rank-order consistency, which led us to believe that longer longitudinal studies may report larger mean-level change. Consistent with this hypothesis, length of time between assessments was positively related to mean-level change in agreeableness and conscientiousness. Figure 3 shows the bivariate plot of standardized mean-level change in conscientiousness by time span of the longitudinal study. A very clear linear relationship can be seen in which all of the effect sizes become positive and increase in magnitude as longitudinal investigations exceeded 10 years in length. In contrast, time had a negative relationship with mean-level change in social vitality. On further examination of this effect, it became apparent that the predominantly negative changes in social vitality complicated the interpretation of these effects. Rather than interpreting this as showing less change for longer studies, these effects should be interpreted as showing that time and attrition were associated with

larger decreases in social vitality, which was the most common pattern of change on this trait.

On the basis of cross-sectional cohort differences, we expected to find increases in social vitality or social dominance and decreases in emotional stability in younger cohorts (Twenge, 2000, 2001, 2002). We found no statistically significant relationship between cohort standing and either social vitality or emotional stability. In contrast, and consistent with Twenge's findings, we did find a positive relationship between cohort standing and changes in social dominance. This indicates that younger cohorts were showing larger increases in social dominance than older cohorts. Figure 4, which shows the relationship between standardized mean-level changes in social dominance and cohort, demonstrates a clear linear relationship in which cohorts born in 1940 and after demonstrated increases in social dominance. Unexpectedly, we found cohort differences for agreeableness and conscientiousness. In both cases, bivariate plots revealed a more curvilinear relationship between change and cohort, such that cohorts born before 1930 and after 1960 showed increases on both dimensions. We confirmed this finding by testing the quadratic relationship between cohort and the effect sizes and found it to be statistically significant for both personality traits.

In examining the effect of cohort, it became clear that the effect was indistinguishable from age. That is, in the case of social dominance, most of the change occurred in young adulthood, and these were also the cohorts from the last half of the 20th century. Similarly, for conscientiousness, there were increases in young adulthood and old age, which also happened to correspond quite strongly with the cohorts from after 1960 and before 1930. In fact, the average linear correlation between age and cohort was .69 across all six trait domains. Even though we controlled for age in the estimate of the effect of cohort, the almost perfect overlap renders the interpretation difficult if not impossible to make. Therefore, we tested the effect of cohort within the age periods that demonstrated the largest change (college age, 20 to 30, and 30 to 40) and provided the largest number of change estimates. This also provides a more direct replication of Twenge's (2001) cross-sectional research, as it focused almost exclusively on adolescents and young adults. In the case of social dominance, cohort remained

Table 9

Population Estimates of Mean-Level Change in Openness to Experience Across the Life Course

| Age | K | N | d | CI | Q_h |
|-------|----|-------|-------|------------|-------|
| 10–18 | 13 | 2,911 | .23 | .00, .48 | 37.2* |
| 18–22 | 37 | 3,998 | .37* | .18, .56 | 76.6* |
| 22–30 | 12 | 702 | –.01 | –.14, .12 | 27.8* |
| 30–40 | 11 | 541 | .07 | –.06, .21 | 6.8 |
| 40–50 | 12 | 2,660 | –.01 | –.07, .04 | 10.6 |
| 50–60 | 6 | 317 | .11 | –.16, .39 | 21.1* |
| 60–70 | 8 | 507 | –.19* | –.37, –.02 | 11.3 |
| 70+ | 8 | 458 | –.08 | –.16, .01 | 5.1 |

Note. K = number of samples; d = standardized mean difference; CI = 95% fixed effects confidence intervals; Q_h = heterogeneity statistic.

* $p < .05$.

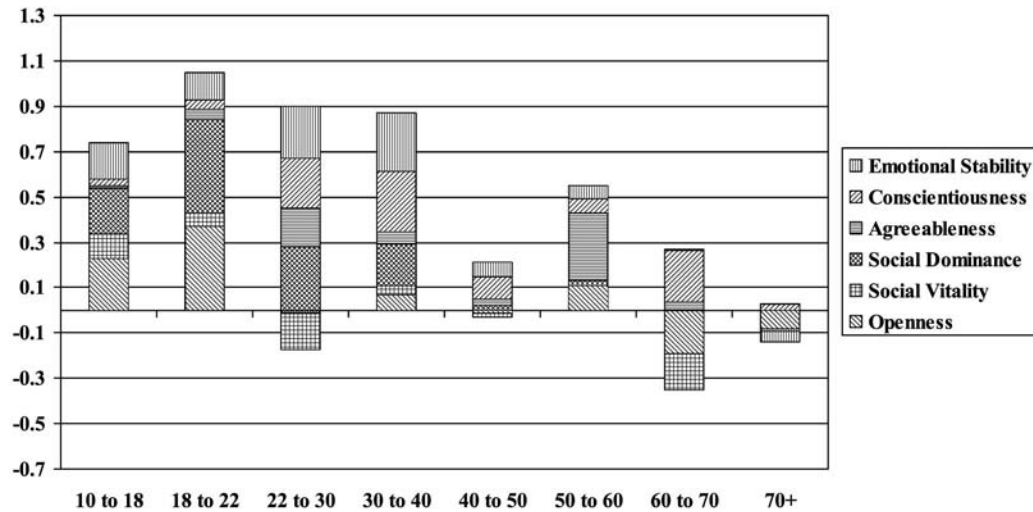


Figure 1. Aggregate mean-level changes in personality traits across the life course.

significantly related to standardized mean-level change when the analyses were limited to the college age, 20 to 30, and 30 to 40 age periods (number of samples [K] = 18, β = .12, p < .05). The effect of cohort on change in conscientiousness was still statistically significant when the analyses were restricted to the period of late adolescence and young adulthood (K = 30, β = .09, p < .05), as was the effect for agreeableness (K = 27, β = .11, p < .01). Thus, we can say with confidence that younger cohorts increased more in terms of social dominance, agreeableness, and conscientiousness than did older cohorts. Moreover, we did not find the expected relationships with changes in social vitality or emotional stability.

Finally, attrition had no relationship with standardized mean-level changes in any domain of personality. The moderators failed to account for all of the residual heterogeneity in the effect sizes, with the exception of social dominance.

Discussion

This study demonstrates that personality traits show a clear pattern of normative change across the life course. People become more socially dominant, conscientious, and emotionally stable mostly in young adulthood, but in several cases also in middle and old age. We found that individuals demonstrated gains in social vitality and openness to experience early in life and then decreases in these two trait domains in old age. These findings are directly relevant to the theoretical models that guide research on personality trait development. Many trait models emphasize stability and go so far as to hypothesize that specific ages, such as age 30, constitute significant developmental markers that provide adequate information to infer that personality traits stop changing. This meta-analysis clearly contradicts the notion that there is a specific age at which personality traits stop changing, as we found evidence for change in middle and old age for four of the six trait categories studied. In general, the findings were most consistent with interactional models of personality development (Baltes, 1997; Roberts & Caspi, 2003).

An argument could be made that the changes were all small in magnitude, and this would be a reasonable conclusion. But this argument merits further consideration. First, what is a small effect size in terms of changing personality traits? Traits are presumed to be some of the least changeable factors studied in personality psychology, if not psychology in general (Conley, 1984). Given their known effect on such significant life outcomes as occupational success, longevity, and health (Bogg & Roberts, 2004; Friedman, 2000; Judge, Higgins, Thoreson, & Barrick, 1999; Roberts & Bogg, 2004), any change in these attributes may reap unknown benefits and pitfalls for those individuals who do change. It is quite possible that even small changes in personality traits may have profound effects on successful development across the life course. A second reason to reconsider the magnitude of the effects is that they were constrained to specific periods of the life course and did not reflect the potential accumulation of change over the life course. If we assume that the changes are independent across different age periods, we can sum the absolute values of change in order to gain an upper bound estimate of change across the life course (see Figure 2). When we do this, the lower bound amount of change over the life course is over one half of a standard deviation (social vitality), and the upper bound is over one full standard deviation (social dominance), with most domains showing changes close to one standard deviation across the life course. Whole populations changing one full standard deviation constitutes what is typically considered a large effect in psychology (Cohen, 1992). To change this much in terms of personality traits over the entire life course is clearly more than a trivial amount of change.

One of the most noteworthy findings was that personality traits changed more often in young adulthood than any other period of the life course, including adolescence. Stereotypically, personality development is thought to be a phenomenon of childhood and adolescence. Moreover, personality is thought to stop developing once adulthood is reached, with chronological age markers for adulthood ranging from 18 to 30 (Caspi & Roberts, 1999; Roberts

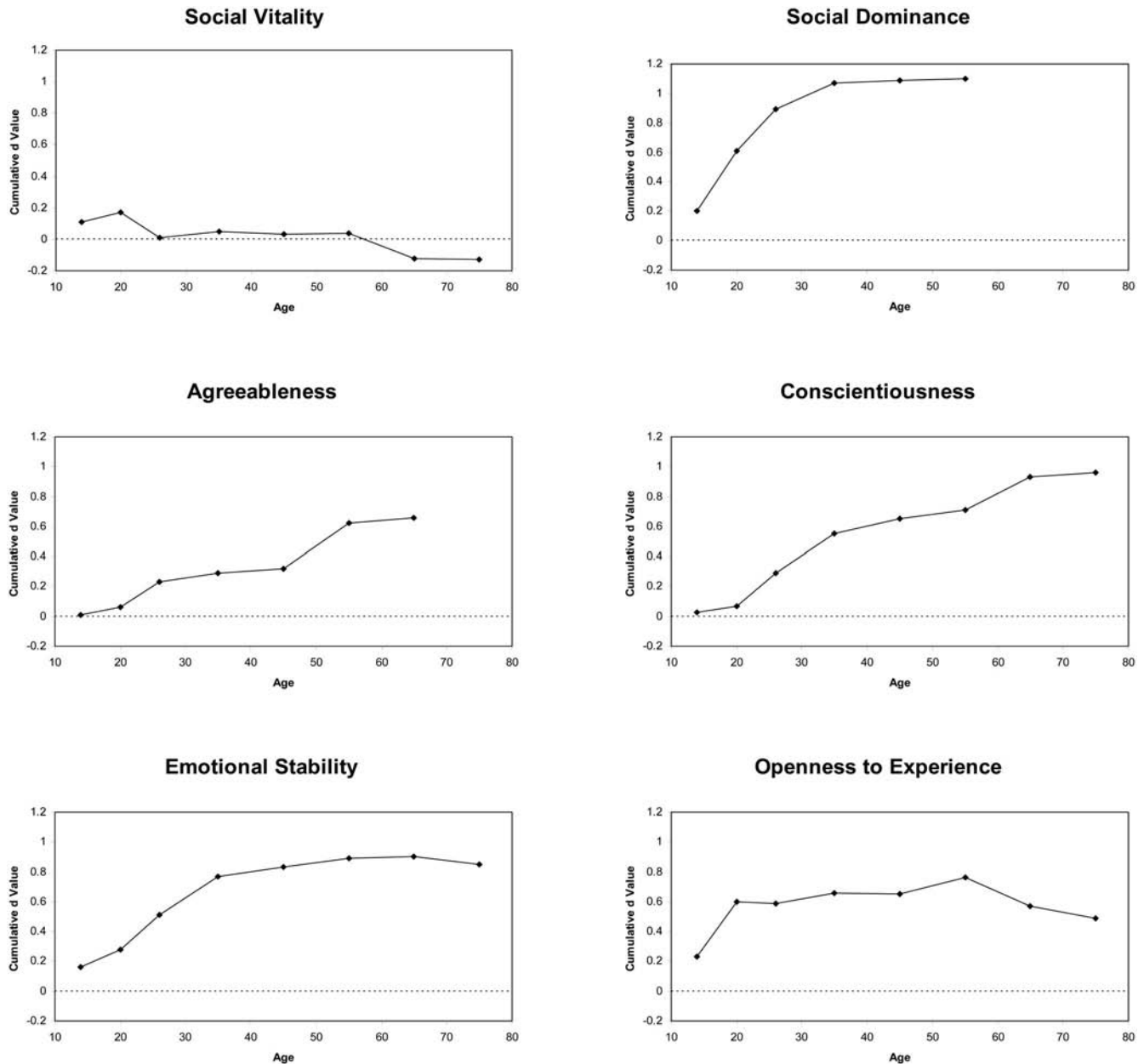


Figure 2. Cumulative d scores for each trait domain across the life course.

& DelVecchio, 2000). The picture derived from theory and practice in developmental psychology is that the crucible of personality development is centered early in life with subtle refinements made as people approach adulthood. Our data directly contradict this implicit developmental worldview. Moreover, adolescence apparently is not the crucial period during which personality is matured. Rather, young adulthood, the period of life in which people transition from their family of origin to their family of destination, from compulsory education to a career and to being active members of their community, is the time during which we see the most personality trait change and a uniformly positive pattern of change at that.

Moderators of Mean-Level Change in Personality Traits

We considered the potential effect of several moderators of personality change in adulthood. We found less than definitive support for the crossover hypothesis that women should increase in terms of social dominance and men in agreeableness during middle age. Gender had no relationship to changes in social dominance and agreeableness. We also found no gender differences in estimates of standardized mean change in the domains of conscientiousness, emotional stability, and openness to experience. So in general, we conclude that there is very little support for the idea that men and women change in distinct ways or that they change

Table 10
Moderators of Personality Trait Development Across the Life Course

| Trait | <i>K</i> | Gender | Time | Cohort | Attrition | <i>Q_E</i> |
|------------------------|----------|--------|----------|---------|-----------|----------------------|
| Social vitality | 76 | .0308 | -.0135** | -.0066 | .0000 | 198.7** |
| Social dominance | 31 | .0470 | -.0027 | .1183** | .0043 | 22.1 |
| Agreeableness | 62 | -.0736 | .0204** | .0676** | .0002 | 127.3** |
| Conscientiousness | 65 | -.0147 | .0183** | .0420** | .0028 | 169.5** |
| Emotional stability | 102 | -.0025 | .0037 | .0164 | .0010 | 174.4** |
| Openness to experience | 66 | .0506 | .0070 | .0527 | -.0021 | 371.7** |

Note. Coefficients are unstandardized beta weights in the metric of the standardized mean-level difference scores. *K* = number of samples; *Q_E* = test for residual heterogeneity after accounting the effect for moderators.

** $p < .01$.

in ways that are related to their sex roles across the life course (Guttman, 1987).

Several factors may have contributed to the patterns contradicting Guttman's (1987) crossover hypothesis and the fact that there were little or no systematic differences between men and women in terms of mean-level personality change. For example, the aggregation of the personality measures into the broad categories of the Big Five may have effectively washed out possible gender differences, as the measures specific to Guttman's ideas may have been merged with too many other dispositions. Nonetheless, given Guttman's position, we expected women to increase faster on measures of social dominance in middle age and men to increase faster on measures of agreeableness in middle age, and we did not find these patterns. Overall, the inconsistent patterns of sex differences in personality trait development would seem to indicate that the effect of sex on personality development is neither large nor widespread across the life course.

Previous research has never addressed whether time has a noticeable effect on patterns of mean-level change. We know from studies of rank-order consistency that the longer the time between assessments, the lower the levels of rank-order consistency. What we did not know was whether longer time periods would also result in larger mean-level changes. On the basis of the findings of this study, there appears to be a consistent effect for longitudinal

studies that track change over longer time periods to show larger mean-level changes. We found that time was associated with larger increases for agreeableness and conscientiousness and with larger decreases for social vitality. This may have resulted from the largely linear change in these trait domains, especially in young adulthood and midlife. With a longer longitudinal study, it was more likely that changes would cumulate in one direction and thus be captured more readily in longer longitudinal studies. These findings imply that longer longitudinal studies will provide larger estimates of change, a result that needs to be taken into consideration when planning new studies and evaluating the results of existing longitudinal research.

We also tested for cohort effects on personality change. Previous research has shown that older cohorts tended to score lower on measures of extraversion and neuroticism than did younger cohorts. The developmental inference is complicated, but it is presumed that the differences reflected the effects of changing values and social context within a given culture (Roberts & Helson, 1997; Twenge, 2001). These changing values affect child-rearing practices and cohort experiences resulting in shifts in mean levels of certain traits across cohorts.

The interesting developmental question is whether these changes in culture are robust enough to change individuals living through those shifts in cultural values. For example, Roberts and

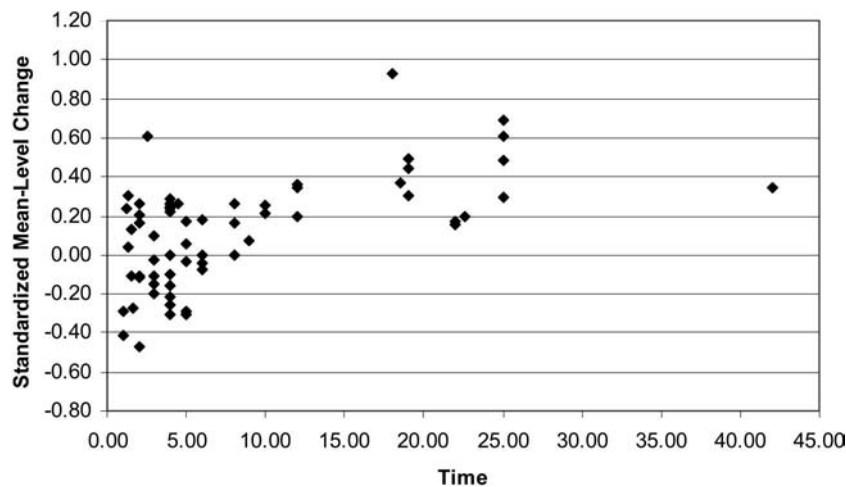


Figure 3. Bivariate plot of standardized mean-level change in conscientiousness and time.

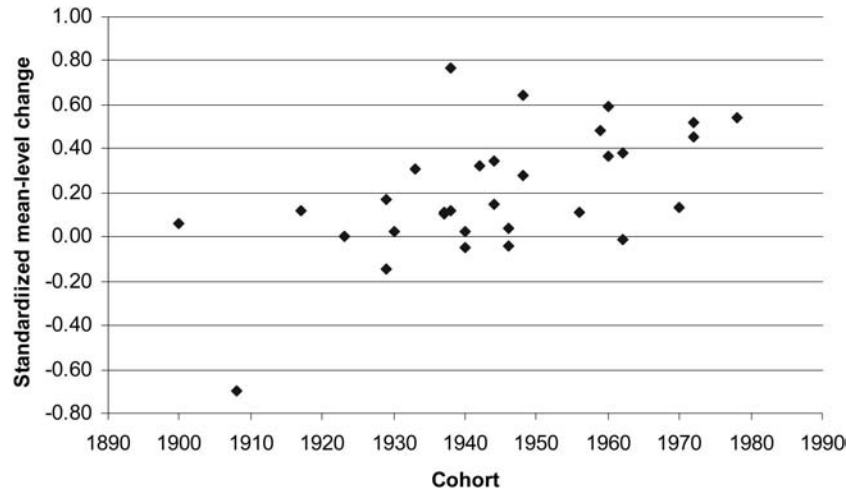


Figure 4. Bivariate plot of standardized mean-level change in social dominance and cohort.

Helson (1997) showed that women living through the 1960s and 1970s became more individualistic, just as separate cohorts of students did during that same period of history. In the present study, we found that younger cohorts had larger standardized mean-level changes in terms of social dominance. The changes in social dominance were consistent with the cross-sectional patterns identified in previous research that indicate that younger cohorts are more assertive (e.g., Twenge, 2000). In addition, these effects held even when we examined a narrower range of ages more consistent with the cross-sectional studies reported by Twenge. Therefore, we have a partial replication of the cross-sectional studies, indicating that the increase in self-assertion culturally over the last 50 years may have impacted the individuals living through those changes. We did not find a relationship between cohort and either social vitality or emotional stability, which was expected from the cross-sectional differences in cohorts. The lack of replication for the latter may have resulted because the cross-sectional findings have higher fidelity as they focused on narrower facets of emotional stability, such as anxiety (Twenge, 2000). Nonetheless, it is clear that cross-sectional cohort differences do not automatically translate into longitudinal changes in personality.

We found unexpected cohort effects for agreeableness and conscientiousness. It appears that younger and older cohorts increased on both of these trait domains, with a tendency for less of an increase in cohorts born in the middle of the 20th century. This pattern could be attributed to the general trend toward questioning norms and traditions in cohorts that came of age in the 1960s and 1970s, which might have been manifest in less of an increase on conscientiousness (Helson, Jones, & Kwan, 2002). Also, this same period has been described as the age of narcissism (Lasch, 1979), which may have attenuated increases in agreeableness. For both traits, it appears that the general trend across time is for increases and that this period in Western culture depressed this tendency. Overall, it appears that cohort does influence some estimates of longitudinal change and that some of these influences translate from cross-sectional to longitudinal studies.

Finally, we tested the effect of attrition across each trait category. Most longitudinal methodologists recommend that attrition

should be avoided at all costs. Consistent with our previous meta-analysis (Roberts & DelVecchio, 2000), we found that attrition had no discernable effect on estimates of mean-level change over time. We would caution that these findings should not be taken to indicate that attrition is not a problem for longitudinal studies. Many studies have reported that individuals who remain in longitudinal studies tend to be female, more conscientious, and higher on measures of cognitive ability (e.g., Robins et al., 2001). From a sampling perspective, then, it is still ideal to retain as many participants as possible. Nonetheless, it appears that attrition was not a biasing factor in estimates of mean-level personality change over time.

Can Personality Change? A Meta-Analytic Resolution of a Controversy

Historically, there has been an ongoing controversy over the existence of personality change in adulthood. One position, harkening back to Mischel (1968), was that personality traits did not exist and therefore could not develop (Lewis, 2001). With the accumulation of knowledge of both the long-term continuity of personality (Fraley & Roberts, 2005) and the increasing levels of consistency with age (Roberts & DelVecchio, 2000), coupled with the burgeoning evidence for the predictive validity of personality traits in important life domains, such as work (Judge et al., 1999), marriage (Robins, Caspi, & Moffitt, 2002), and health (Bogg & Roberts, 2004), we assume that this radical position can be considered refuted.

On the other hand, there has been an ongoing debate on the other side of the spectrum, with some arguing for the immutability of personality, especially in adulthood (McCrae & Costa, 1999), and others arguing that personality traits continue to develop, sometimes even in midlife and old age (Field & Millsap, 1991; Helson, Jones, & Kwan, 2002; Helson & Stewart, 1994; Roberts, 1997). We see the meta-analytic approach as a viable way of resolving this debate. It is interesting to note that our meta-analysis includes the data presented by all of these authors and, of course, dozens of others who were not invested in this debate. The impartial aggreg-

gation of studies provides the fairest way of determining the nature of personality development and whether there are normative trends in personality. In this sense, the data speak for themselves. Personality traits show clear patterns of normative change, continue to change after age 30, and in several cases change in old age.

The second advantage that a meta-analysis affords is the opportunity to examine the history of the field and how the persons on either side of this debate came to their positions. The position that there are no normative trends in personality traits derived almost exclusively from the arguments of Costa and McCrae (1988) and their ongoing Baltimore Longitudinal Study of Aging (BLSA). The position that personality can develop derives most strongly from the work of Helson (Helson, Jones, & Kwan, 2002; Helson & Moane, 1987; Helson & Wink, 1992) and her ongoing study of Mills graduates and from the team of researchers involved with the Institute of Human Development studies (Field & Millsap, 1991; Haan et al., 1986). The positions of each of these teams were eminently reasonable given the nature of their studies and the data that they have collected. The BLSA is made primarily of men and women over the age of 40. Furthermore, the early BLSA data focused most on the trait domains of social vitality, neuroticism, and openness. As we have seen in this meta-analysis, these three trait domains demonstrate the least amount of change after the age of 40. Moreover, many of the studies reporting on BLSA data have not broken change out for specific decades of the life course (e.g., Costa & McCrae, 1988). Therefore, small yet meaningful changes during specific age periods were not examined. Finally, their analyses tended to be over shorter time spans of 3 and 6 years, which also attenuates the amount of change that can be found. The Mills and Institute of Human Development studies, in contrast, concentrated more on change in young adulthood than in midlife, at least initially (cf. Field & Millsap, 1991). Each also incorporated a much greater focus on traits from the social dominance and conscientiousness domains, which we see from the meta-analysis are more prone to change, especially in young adulthood. Moreover, each of these studies has been focused on a single cohort moving through specific periods of the life course over quite long periods of time. All of these factors combined enhanced their ability to find statistically significant changes in personality traits over time.

So it is clear how this debate could have developed, given that each author tends to weigh his or her own data and ongoing study more heavily when drawing conclusions about the existence of normative changes in personality. The meta-analytic approach, in contrast, provides a more comprehensive, inclusive, and less arbitrary test of these ideas and therefore has the potential to resolve these debates.

Why Does Personality Change in Adulthood?

The clear question that emerges from this consistent pattern of mean-level changes across the life course is why people change in this way. According to five-factor theory (McCrae, 2004; McCrae & Costa, 1999; McCrae et al., 2000;), mean-level changes arise because of genetic predispositions to change in particular ways. According to the five-factor theory, traits are "endogenous dispositions that follow intrinsic paths of development essentially independent of environmental influences" (McCrae et al., 2000, p. 173). This position paints a very elegant if extreme portrait of

personality development. Life experiences, random life events, shifts in cultural values, and simple lessons learned from living life have no effect on the development of personality traits. If personality traits do change, it is because human beings have a species-wide genetic predisposition to develop in certain directions. Human beings are, within this perspective, hard-wired to become more socially dominant, conscientious, and emotionally stable and less open to experience with age.

As has been noted elsewhere, there are very few data to support this position (Roberts et al., 2005). The few longitudinal studies of twins have shown that childhood personality change appears to be largely genetic, whereas in adulthood genetics has only a small influence over personality change (Plomin & Nesselroade, 1990). In adulthood, the largest estimate of the heritability of personality trait change is around 30%, with the average being much lower (McGue, Bacon, & Lykken, 1993). This indicates that environmental factors play a larger role in personality trait change in adulthood than do genetic factors. Moreover, the findings from the present study showing that patterns of change were associated with cohort would also contradict the notion that personality trait development is independent of environmental influences. Thus, there is little evidence to support the idea that development of personality over time is independent of environmental influences.

On the basis of our analysis of the evidence to date, we believe that life experiences and life lessons centered in young adulthood are the most likely reason for the patterns of development we see in this meta-analysis, especially the increases in social dominance, conscientiousness, and emotional stability (Roberts et al., 2005). Specifically, the universal tasks of social living in young adulthood, such as finding a marital partner, starting a family, and establishing one's career, appear to be candidate experiences through which people also experience increases in such traits as conscientiousness and emotional stability. As all dominant cultures support if not promote these activities, they may be the catalysts for the widespread pattern of personality trait development found in adulthood and across cultures (Helson, Kwan, et al., 2002; Roberts et al., 2005).

If this position holds, then most personality change occurs through the press of contingencies found in age-graded social roles. Specifically, these contingencies come in the form of expectations for how one should behave if he or she occupies a specific role (Sarbin, 1964). For example, a person's first job may bring expectations to show up on time, work hard while at work, spend extra hours of the day at work, and interact in an agreeable manner with coworkers. These role expectations can affect change through either punishing inappropriate behavior or rewarding appropriate behavior. Violation of these expectations can lead to withdrawal of social approval and even tangible negative outcomes, such as losing one's job. In turn, meeting expectations should lead to greater levels of acceptance and social reinforcement. Therefore, role expectations can facilitate personality change by serving as guides for how one should act and possibly how one should change.

To some extent then, if we know the life course patterning of roles and the expectations that derive from these roles, then we should get a clearer picture of how personality should develop. The life course has been characterized as a series of interdependent trajectories of work life, marriage, and parenthood (Elder, 1985). We would expand this limited list to childhood roles, which

include being a child, teenager, friend, and student, and the roles of late life, which include being a friend, retired person, and grandparent. Clearly, the initial stages of life are dominated by the child, friend, and student roles. Young adulthood and middle age are marked by a clear emphasis on work, marriage, and family roles (Modell, 1989). Old age is a period dominated by disengagement with the roles of middle adulthood and the transition out of the labor force to become a retired person, grandparent, and possibly a widower.

Several longitudinal studies have examined the relationship between role experiences and personality trait change in young adulthood and have found clear relationships to changes in traits associated with social dominance, conscientiousness, and emotional stability. These studies lend further support to the idea that age-graded role experiences organized around universal tasks of human living are in part responsible for the changes reported in the present study. For example, compared with men who achieved the same or less than their fathers, upwardly mobile men became more dependable and responsible, independent, and motivated for success (Elder, 1969). Women who had higher labor force participation showed increases in self-confidence (Clausen & Gilens, 1990) and social dominance (Roberts, 1997). Furthermore, work satisfaction was associated with decreases in measures of neuroticism in women (Roberts & Chapman, 2000). Many of these effects were replicated in a longitudinal study of men and women, in which, for example, it was found that occupational success was related to increases in dominance, whereas satisfaction was associated with decreases in negative emotionality (Roberts, Caspi, & Moffitt, 2003).

Marital and family experiences also are associated with changes in personality traits. Helson and Picano (1990) tracked personality change from age 20 to age 43 in women who occupied either traditional or neo- or nontraditional role configurations. For example, women who occupied a traditional role configuration (e.g., homemaker) in young adulthood demonstrated fewer positive developmental gains in personality traits when compared with women who occupied neo-traditional (e.g., some involvement in the paid labor force) or nontraditional (e.g., working full time for whole career) role configurations (Helson & Picano, 1990). Moreover, changes in motherhood status and the experience of divorce were associated with changes in femininity and dominance, respectively (Roberts, Helson, & Klohnen, 2002). Finally, experiencing more satisfying relationships is associated with increases in emotional stability (Roberts & Chapman, 2000; Robins et al., 2002).

These findings are much in line with life span developmental theory that personality development occurs largely as a consequence of the expectations and experiences that come with age-graded roles (Roberts & Caspi, 2003; Roberts & Wood, in press). Clearly, there may be additional mechanisms and experiences that facilitate change, but when considering normative changes, especially those that appear to generalize across cultures (e.g., McCrae et al., 1999), then the dominant, universal tasks of social living in young adulthood appear to be the most likely factors contributing to this pattern of change.

One of the primary implications of the fact that change in personality traits comes about, in part, through social role experiences is that chronological age is a less than ideal marker of development. If people do change in response to life experiences

that can vary quite significantly, then normative patterns of personality trait development that result from these life experiences can vary also. For example, the age at which individuals embark on their careers has changed markedly over the last two centuries (Modell, 1989). With the decrease in agriculture and manufacturing and increase in technological and service jobs, people in Western countries have extended their educational experiences and delayed their careers from teens now well into their 20s and 30s. This means that if changes within a culture also change the age of onset of these major life transitions, then we might expect the normative age at which personality traits change to shift also. Many developmental psychologists have called for alternatives to chronological age, often referring to "psychological age" as a more appropriate depiction of development. One of the primary challenges of defining psychological age is knowing what factors would need to be accounted for in the conceptualization of the construct. One possibility, highlighted here, would be an index that accounts for when adult social roles are engaged and committed to.

Integrating Patterns of Rank-Order Consistency and Mean-Level Changes Across the Life Course

The pattern of mean-level change across the life course appears to be more complex than that found for rank-order consistency. The latter showed a progressive increase with age (Roberts & Delvecchio, 2000), whereas the patterns of mean-level change, though centered primarily in young adulthood, were found to exist in almost all age periods in the life course. The distinct patterns of rank-order consistency and mean-level change demonstrated across these two meta-analyses provide definitive support for Block's (1971) original argument that different indexes of continuity-change are relatively independent of one another. Thus, populations can demonstrate high rank-order consistency while simultaneously demonstrating significant mean-level change. The distinctiveness of these different indexes of change is often overlooked in characterizations of personality continuity and change, especially when broad descriptions of the changeability of personality are attempted.

In combination, the results of these two meta-analyses provide a unique and compelling picture of adult personality trait development. With age, people become increasingly consistent at least in relationship to one another (rank-order consistency). The increase in consistency is largely linear, with increasing increments occurring through at least age 50 when there is an apparent plateau in consistency. In contrast, mean-level changes appear to be centered primarily in young adulthood, with some continuing patterns of change occurring throughout the remainder of the life course. The combined pattern has relatively strong implications for our understanding of personality development in the transition from adolescence into young adulthood. Adolescence is marked by less distinct patterns of mean-level change and a lower level of rank-order consistency. Thus, rather than being a critical period in which dispositions are formalized and crystallized, it may be that adolescence is akin to a period of personality trait moratorium. Definitive gains and losses may not be centered on this period of the life course, as traits change in similar or greater magnitudes later in the life course. In combination with the lower levels of rank-order consistency, this implies that adolescence is a time not only of exploration in terms of identity but also of flux and

exploration in terms of dispositional qualities. It is during young adulthood when people begin to confront the realities of becoming an adult and when we find significant gains in personality traits. This fact alone argues for opening the developmental window to ages quite a bit older than typically considered in most depictions of personality trait development.

One distinct possibility is that the two patterns are linked. Specifically, the gains in terms of personality traits may, in turn, facilitate increased continuity. For the most part, people increased on desirable traits during this period, such as conscientiousness and emotional stability. It is interesting to note that a number of studies have demonstrated a positive association between these same trait domains and higher levels of continuity over time. For example, Asendorpf and van Aken (1991) found that ego resiliency, which is, in part, related to emotional stability (Klohn, 1996), predicted personality consistency over time in a longitudinal sample of children. More specifically, children who were more resilient tended to be more consistent over time. Similarly, Schuerger, Zarrella, and Hotz (1989) found that clinical samples, which we can assume are less emotionally stable, were less consistent than nonclinical samples. In an 8-year longitudinal study, men and women who were more controlled, less neurotic, and more pro-socially oriented demonstrated less change in personality traits and greater profile consistency across personality traits (Roberts et al., 2001). If we can extrapolate from these longitudinal studies, the peak of consistency found in middle age is in part the result of increases in conscientiousness and emotional stability that occur in young adulthood.

It should be noted that neither this meta-analysis nor the previous one on rank-order consistency provided any information on the existence of individual differences in change in personality traits (Nesselroade, 1991). There is now accumulating evidence for the existence of individual differences in personality trait change in young adulthood (Robins et al., 2001), middle age (Roberts et al., 2002), and old age (Mroczek & Spiro, 2003; Small et al., 2003). Individual differences in change speak to the unique patterns of development particular to individual lives. For the most part, individual differences in change are linked more strongly to mean-level changes than to rank-order consistency. For example, if there are strong normative trends to increase on a trait, such as conscientiousness, then more people in that sample show patterns of increase than of decrease (Roberts et al., 2001; Robins et al., 2001). Nonetheless, there remains a sizable minority that does not follow the normative trend and demonstrates, for example, a decrease in conscientiousness. Moreover, these nonnormative patterns of change can be predicted from life experiences, such as having an unstable marriage or participating in unconventional activities, such as smoking marijuana (Roberts & Bogg, 2004; Roberts et al., 2002).

One inference is that the existence of individual differences in change calls into question the existence of normative trends in personality trait development. Given the fact that these two indexes of change are positively associated, we think that this conclusion would be too extreme. However, it would be appropriate to qualify normative trends by saying that a normative trend to increase in a personality trait means that there is a higher probability for individuals to increase on this trait during a given period of the life course, but there is not a guarantee that this change will occur for all people. Moreover, the inclusion of individual differ-

ences in change is strongly relevant to any inference that personality traits can and do change. Thus, in the absence of mean-level changes, there may still be quite significant levels of individual differences in change. Before broad or sweeping descriptions of the changeability of personality traits can be made, a systematic investigation of the existence of individual differences in change across the life course needs to be made. Unfortunately, there are very few data to date on this topic as it has only recently become a focus of longitudinal researchers (Mroczek & Spiro, 2003; Roberts, 1997; Small et al., 2003).

Limitations, Future Directions, and Conclusions

Despite the comprehensive nature of this review, there are several glaring omissions in the longitudinal database and numerous questions that remain unanswered. It is clear from our review that many more studies performed on a wider variety of samples are needed before definitive statements can be made concerning the patterns of change for specific traits, such as social dominance and agreeableness. Also, a disproportionate number of longitudinal studies of personality have been based on highly educated, middle-class or affluent samples. Studies of ethnic minorities, the poor, and the working class are still a rarity in the field of personality development. Moreover, more studies of middle-aged and older individuals would help clarify some of the patterns of personality development. We hope that the results of the present study will motivate researchers to include personality measures in the longitudinal studies of older people, in part because personality traits apparently continue to change in old age. Moreover, it is clear from the distribution of cohorts across the life course that the enterprise of studying individuals longitudinally is a relatively recent phenomenon. Only with the ongoing collection of data in the coming decades will we be able to tease apart the effects of cohort and age on personality development.

A second limitation to the present study was the necessity of categorizing various personality measures into the Big Five domains. Although this approach has greatly enhanced our ability to synthesize research findings in numerous domains, including job performance (Hogan & Holland, 2003) and creativity (Feist, 1998) in addition to personality development, the act of categorizing personality measures into broad domains inherently leads to some loss of information. For example, much information is lost about particular measures that represent subcomponents of each domain. The breakdown of the domain of extraversion into the facets of social vitality and social dominance serves as an excellent example. Without differentiating the domain of extraversion, the patterns of development would have been unclear. Of course, before a more fine-grained analysis of each Big Five domain can be performed, we need replicable lower order models of each of the Big Five domains. Unfortunately, this more fine-grained understanding of the Big Five has yet to emerge.

A final limitation is the generalizability of the findings, as there are to date no longitudinal studies tracking continuity and change in personality traits from many parts of the world, such as Africa or Asia. Therefore, the results are particularly germane to Western cultures, and their generalizability to non-Western countries is still unknown and has yet to be established. This omission in the longitudinal database is more conspicuous when one considers the wealth of studies arguing that culture, especially in the particular

forms found in Asian countries, has a profound effect on psychological functioning (e.g., Markus & Kityama, 1991). In the absence of longitudinal studies of Asian populations, it is impossible to know whether people in these cultures demonstrate different developmental patterns in terms of personality traits than in Western cultures. For example, as a result of different socialization practices in many Asian cultures, children experience more shame and social comparison at an earlier age than in the West (Fung, 1999; Miller, Wiley, Fung, & Liang, 1997). One would assume that Asian parenting practices that center more on shame would result in higher levels of conscientiousness at an earlier age, but there are no longitudinal studies to test this hypothesis at this point.

In conclusion, the results from our meta-analysis demonstrate that the patterns of personality trait change are intrinsically positive. People tend to become more socially dominant, conscientious, and emotionally stable through midlife. Moreover, the period of young adulthood rather than adolescence is the primary period of mean-level personality trait development. We also provided definitive evidence for the continued plasticity of personality traits beyond age 30 and well into old age in the case of specific traits, such as social vitality, agreeableness, conscientiousness, and openness to experience. It appears that personality trait development is not just a phenomenon of childhood but also of all adulthood.

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