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Intra-individual Change in Personality Stability and Age

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Abstract

The stability of individual differences in personality traits is typically examined at the group level with test-retest correlations across two assessments. For 684 subjects (age range 17–76) we computed individual coefficients from three sequential assessments to evaluate intra-individual (i.e., within-person) change in stability over time. For both trait and profile (ipsative) stability, results indicate that intra-individual stability increases up to age 30 and then plateaus. Neither demographic variables (sex, ethnicity, education, and secular trends), nor the standing on the five major dimensions of personality, were predictors of change in trait stability. Contrary to results from studies of adolescents, personality "maturity" was unrelated to personality stability in adulthood. These findings support the notion that personality stability plateaus early in adulthood.

Keywords

personality; change; stability; longitudinal; intra-individual; GZTS; NEO-PI-R; profile; cohort; age

Introduction

Although the notion of stability[1] is central to the definition of personality traits, which are generally thought of as enduring tendencies or habitual patterns of behavior, thoughts, and emotions (McCrae & Costa, 2003), stability does not imply immutability. Under normal circumstances, adult traits are largely stable, as indicated by high correlation coefficients computed for a group assessed twice on the same trait. These coefficients represent the average stability for a sample, but individuals vary in terms of their intra-individual stability. Even at the group level, trait consistency may vary across age, with substantial increases from childhood to college age (Asendorpf, 1992;De Fruyt et al., 2006;Roberts & DelVecchio, 2000). The relation between stability and age during adulthood, an area of research with both theoretical and clinical implications (Ardelt, 2000;Roberts & DelVecchio, 2000;Terracciano, Costa, & McCrae, 2006;Viken, Rose, Kaprio, & Koskenvuo, 1994) is less clear.

For example, in one of the largest studies to date (15,000 twins, which included about 6,600 adults of age ≥ 30), Viken and colleagues (1994) reported that rank-order stability coefficients among the adult cohorts were unrelated to age for Extraversion but were slightly higher in older cohorts for Neuroticism. An influential meta-analysis by Roberts and DelVecchio (2000) included data for about 6,100 adults (age ≥ 30) compiled from 29 samples. The results of the meta-analysis indicated that the test-retest correlation coefficients in samples of younger adults tend to be lower than those found in samples of older adults, from $r = .64$ at age 30 to $r = .74$

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[1]By the term *stability*, we mean the consistency in the individual's rank-order standing on a trait over time.

between the age of 50 to 70. Another meta-analysis (Ardelt, 2000) concluded that the average magnitude of test-retest stability coefficients declines in old age.

Surprisingly, the evidence to date on the effects of age on trait stability derives from cross-sectional analyses, by comparing retest correlations obtained in groups of different ages. The present study takes a different analytic perspective by examining the influence of age on trait stability using a longitudinal intra-individual approach, in which stabilities across two successive intervals are traced within individuals.

Group vs. individual stability coefficients

The question of whether personality trait stability is related to age is typically addressed at the group level by comparing rank-order stability coefficients across samples that differ in age. Although differences across groups are attributed to age differences in these designs, many other variables may contribute to or reduce such differences. For example, scales differ in their degree of reliability, which strongly influences stability coefficients (Chmielewski & Watson, 2009). Comparing stability coefficients across studies that use different personality scales, as is usually done in meta-analyses (Ardelt, 2000; Roberts & DelVecchio, 2000), might introduce confounding factors. Even in studies that use the same scales, the groups being compared might differ on variables other than age, such as time interval across assessments, demographic factors (e.g., sex, education, ethnicity), psychological characteristics (e.g., memory, attitude toward testing, personality traits), or clinical status (e.g., addictions, depression, dementia). Secular trends are an additional potential source of influence on personality stability. In cross-sectional studies, age effects are essentially indistinguishable from birth cohort effects. Differences in stability between a group of 30- and 60-year-olds tested in 2000 could be due either to age or to cohort differences—for example, the 60-year-old cohort may have grown up in an era that promoted higher personality stability at all ages. Although some of these variables can be statistically controlled in group-level analyses, examining change over time with intra-individual analyses (using individuals as their own controls) provides a direct test of whether or when personality trait stability reaches a plateau.

Asendorpf (1992) advocated going "beyond the notion of stability at the sample level by asking from a developmental perspective (a) whether systematic inter-individual differences in intra-individual change exist, (b) how they can be assessed, and (c) whether these inter-individual differences can be explained by characteristics of the person or of the environment" (p. 103). To this end, Asendorpf and others have proposed coefficients to estimate stability at the individual level (Asendorpf, 1992; McCrae, 2008). There is a growing interest in these methods (De Fruyt et al., 2006; Donnellan, Conger, & Burzette, 2007; Löckenhoff et al., 2008; Lönnqvist, Mäkinen, Paunonen, Henriksson, & Verkasalo, 2008; McCrae, 1993; Terracciano, Costa et al., 2006), given that they can potentially shift the focus to individual differences in personality stability. Asendorpf's (1992) individual stability (IS) coefficient is defined for each individual as $IS_{XY} = 1 - [(z_X - z_Y)^2 / 2]$, where z_X and z_Y are scores for a trait standardized across the full sample at administrations X and Y, respectively. Because scores are standardized within administrations, IS is unrelated to mean-level changes that occur at the group level. Conceptually, Asendorpf's IS coefficient decomposes the group retest correlation into the contributions of each individual; the mean of the IS coefficients across all respondents is equal to the retest correlation of the group.

To provide a sense of how individuals vary in rank-order trait stability over a single time interval, Figure 1 presents Asendorpf's (1992) mean IS coefficients for 684 individuals from the Baltimore Longitudinal Study of Aging (BLSA). ISs are computed for a single trait. In Figure 1 we report the mean IS across the ten scales of the Guilford-Zimmerman Temperament Survey (GZTS) over an average interval of nine years (see Method for detailed information).

Although from Figure 1 it is clear that most individuals remain remarkably stable (the test-retest correlation for the sample is $r = .75$), a few participants have low trait consistency over time. It is of theoretical, practical, and clinical importance to examine how these individuals differ from others, and what variables, if any, can explain such individual differences.

From cross-sectional to longitudinal analyses of personality stability

In previous studies based on the BLSA sample (Terracciano et al., 2006), we reported rank-order stability coefficients for men and women for three age groups (initially 30 to 50, 50 to 65, and older than 65 years old). The rank-order stability coefficients were generally similar across the age groups, but adults aged 30 to 50 showed significantly lower rank-order consistency than adults older than age 50 on GZTS Sociability, Emotional Stability, and Thoughtfulness in men and on General Activity, Ascendance, Emotional Stability, and Masculinity in women. In the same study, in addition to the usual analyses at the group level, we obtained a measure of intra-individual consistency by subtracting from 1 the standard deviation across all available assessments of a trait for each individual. With this measure, respondents whose scores were similar on all assessments had high consistency; those whose scores varied widely had low consistency. We then performed regression analyses, controlling for time interval differences, and found that age was a significant predictor of consistency for some GZTS scales: Consistency on Restraint, Ascendance, and Personal Relations increased, whereas consistency on General Activity declined with age. These effects were small, accounting for less than 1% of the variance, and for the other scales there was no linear association with age. Overall, group and individual level analyses provided weak and inconsistent evidence that stability increased across adulthood.

The use of the standard deviation across assessments provides a measure of individual difference in consistency across assessments, but it is not directional: It does not indicate whether consistency increased or declined over time. Other studies that used different IS coefficients (e.g., Asendorpf, 1992; McCrae, 1993; Löckenhoff et al. 2008) examined stability across one time interval, and thus could not examine whether stability changed as a person gets older. In short, current knowledge on rank-order personality stability is based on analyses limited to only one test/re-test stability coefficient for a group or individual. These stability coefficients have been compared cross-sectionally (i.e., the stability of the younger vs the older) but they have never been examined with a longitudinal approach (i.e., the stability of the same individual when younger compared to older).

In the present study, we aim to advance our understanding of personality stability by examining intra-individual change in rank-order stability longitudinally. We take advantage of the fact that BLSA participants have been tested multiple times over several decades, and focus on those individuals who completed the GZTS at least three times. For each individual, we compare IS between the first and second assessments with IS between the second and third assessments. For example, a person tested at age 20, 30, and 40 might have a coefficient $IS_{12} = .70$ between ages 20 to 30, and $IS_{23} = .80$ between ages 30 to 40. Clearly, this individual was more stable (changed less in rank-order standing) in his/her 30's than in his/her 20's, as reflected in a difference $\Delta IS = IS_{23} - IS_{12} = .80 - .70 = .10$. ΔIS is thus a measure of intra-individual change in stability, which allows us to identify those individuals who became more or less stable over time. The intra-individual change scores can also be used as an individual difference variable and can be related to factors such as age, sex, or personality traits that could account for that variability.

Figure 2 provides an illustration of how this IS measure of rank-order stability changes over time for 15 BLSA participants across the adult lifespan, and highlights variability in individual trajectories. The present study attempts to account systematically for variability in intra-

individual change in trait stability for 684 BLSA participants. The main hypothesis we test is that intra-individual stability increases with age. More specifically, we examine whether ISs increase from the first retest interval to the second interval, and whether any increase depends on initial age. With these intra-individual analyses across the adult age range we also ask whether there is a continuing increase in stability over time, or whether there is a period when ISs peak. If so, at what age?

Individual differences in personality stability: Demographic and Personality Moderators

We also examine the influence of time interval, sex, ethnicity, education, and secular trends on intra-individual personality trait stability. In the present study, retest intervals vary across participants, and it is known that stability declines with longer intervals (Roberts & DelVecchio, 2000; Terracciano et al., 2006), so adjusting for varying intervals is necessary. Because we use within-individual analyses, each subject is his or her own control, and statistical control for between-individual variables such as gender and education are not needed. However, between-individual differences may moderate within-individual changes. For example, we explore whether patterns of trait stability differ for men and women across the lifespan, and ask whether people with higher levels of education reach a stability plateau earlier in life, perhaps implying that they mature or fully develop self-knowledge of their personalities at an earlier age.

As discussed by some researchers (Roberts & DelVecchio, 2000), historical changes in the social condition and life expectancy over the last century might have produced differences among cohorts in the age at which the stability plateau is reached. Although secular trends are less likely to occur if personality development is mostly driven by biological processes, as some personality theories postulate (McCrae & Costa, 2003), change in diet and physical health may still influence the age at which different cohorts reach “maturity”. We therefore test whether later-born generations required more time for their personality to develop fully.

We also examine whether standing on the five major personality factors is related to changes in stability over time. Based on previous research, several hypotheses can be advanced. First, open individuals seek out new life experiences and process them more deeply, from which McCrae (1993) hypothesized that “those who are characteristically open to experience may be more susceptible to influences for change than those who are closed to experience” (p. 577). Second, Neuroticism, also known as emotional stability, may also be related to personality stability. Individuals higher on Neuroticism are at higher risk of depression (Kendler, Gatz, Gardner, & Pedersen, 2006), which has been found to be associated with change in personality (Costa, Bagby, Herbst, & McCrae, 2005). We therefore test the hypothesis that individuals scoring higher on Neuroticism have lower stability. A third hypothesis is that individuals lower in Conscientiousness will tend to increase in stability later in life, suggesting belated maturity. In recent studies of adolescents, using either self-reports or observer ratings, higher scores on measures of Neuroticism and lower scores on measures of Conscientiousness were predictors of lower personality profile stability (Donnellan et al., 2007; Lönnqvist et al., 2008; Roberts, Caspi, & Moffitt, 2001). These findings are consistent with the notion that lower personality maturity (i.e., lower Conscientiousness and higher Neuroticism) during adolescence is associated with lower stability and greater personality change. To our knowledge, there is no evidence to support the maturity-stability hypothesis in large samples of middle-age and older adults. Finally, to examine whether findings for trait stability differ for alternative methods and conceptualizations of personality stability, we address the same set of questions for personality profile (ipsative) stability.

Method

Participants and procedure

The BLSA is an ongoing multidisciplinary study of aging. Participants have agreed to return for repeated assessments of biomedical and psychosocial variables. GZTS data were collected during regularly scheduled visits, starting for men in October, 1958, and for women in January, 1978, and continuing until May, 2002. The GZTS was administered to all participants at their first or second visit, and subsequently approximately every 6 and then 12 years. Retest stability, in the form of between-subjects coefficients, has previously been reported for GZTS scales in the BLSA sample (Costa & McCrae, 1992, 1998; Costa, McCrae, & Arenberg, 1980; Terracciano, Costa et al., 2006). The present study examined data for individuals with at least three administrations. When four, five, or six administrations were available, the assessments chosen were those that maximized the interval length between observations (generally the first, middle and last assessment), excluding administrations with excessive missing data. We examined whether the data from the 246 individuals with more than 3 assessments differed from those of 438 individuals with just 3 assessments. All the analyses reported below indicate no differences in ΔIS between these groups. The final sample was composed of 684 subjects with complete data on at least two GZTS scales at each administration, ranging in age from 17 to 76 years ($M = 46.3$; $SD = 13.2$) at baseline. The sample was composed mostly of white (95%) males (78%) with a college or higher degree (80%). Baseline data were collected from 1959 to 1993 ($M = 1970$).

Attrition analyses showed that subjects who were tested with the GZTS only once or twice entered the study later in time (average year of first GZTS assessment: $M = 1983$ vs. $M = 1970$), and most of them were not retested for a third time simply because not enough time had passed. However, some participants died and some dropped out of the study. Subjects rarely refused to complete the questionnaire. There were small differences on baseline personality between participants that were included or excluded from the current analyses, with the former scoring lower on Thoughtfulness, and higher on Emotional Stability and Objectivity (effects accounting for no more than 0.2 *SD*).

Measures

The GZTS (Guilford, Zimmerman, & Guilford, 1976) is a factor-based personality questionnaire composed of 300 items, 30 for each of the 10 GZTS scales. For each item, participants choose between *yes, no,* and ?. Any scale with more than three ? responses was considered missing, a procedure suggested by Guilford and colleagues. Therefore, there are small variations in the number of participants for different scales. Most of the GZTS scales assess the Neuroticism and Extraversion domains (Terracciano, Löckenhoff, Zonderman, Ferrucci, & Costa, 2008; Terracciano, McCrae, & Costa, 2006). In the BLSA, the factorial invariance or structural stability of the GZTS has been shown across age, cohort, and time-of-measurement (McCrae, Costa, & Arenberg, 1980).

To assess the possible effect of baseline personality traits on patterns of personality development on the GZTS, we used data from the Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992b) gathered on 481 participants. Unlike the GZTS, the NEO-PI-R has measures of all five dimensions of the Five-Factor Model. Using an independent assessment to test for personality influences on GZTS scale intra-individual stabilities reduces potential confounds such as regression to the mean effects.

Analyses

For each individual, we computed Asendorpf's (1992) IS_{12} for the first retest interval and IS_{23} for the second; we then subtracted IS_{12} from IS_{23} to obtain an intra-individual measure of change in rank-order stability over time, ΔIS.

Because ISs tend to be skewed, Asendorpf (1992) proposed a transformation to normalize the data. Analyses conducted with and without such transformation produced the same pattern of results. For simplicity, in the Tables we report the results obtained with the non-transformed coefficients.

Because individual change scores are less reliable, and because analyses at the level of individual GZTS scales showed generally similar patterns, we also created an overall variable, GZTS-IS, for each individual as the mean IS across all non-missing GZTS scales for each pair of administrations. The global ΔGZTS-IS was the main focus of analyses examining possible moderation effects of demographic and personality variables. Conceptually, GZTS-IS summarizes global changes in personality that might reflect a general loss of plasticity with age, or state effects at different administrations. Because it is affected by the stability of each component scale, it can be considered a measure of profile or ipsative stability. Indeed, ΔGZTS-IS correlates $r = .75$ with change in another measure of profile stability, the intraclass correlation (ICC, see below) of the GZTS scales across administrations.

Profile (ipsative) stability, refers to the stability of the configuration of personality traits in each individual. We assessed profile stability using the double-entry intra-class correlation (ICC) across the ten standardized GZTS scales (McCrae, 2008; Terracciano & McCrae, 2006), and compared ICC_{12} and ICC_{23}.

For some analyses, participants were grouped into age decades, with those age 17 to 19 included with the 20-year-olds, and those above 70 included with the 60-year-olds. Education was coded as years of education. Ethnicity was coded 1 for White and 0 for others. To examine the effect of secular trends, we tested models using either year of birth or year of the first assessment. All analyses were performed in SPSS.

Results

The major aim of this study was to assess how intra-individual rank-order stability changes with age during adulthood. The ΔIS for each of the ten scales is reported in Table 1. The largest increase in stability with age was found for Sociability, with an average increase from $IS_{12} = .78$ to $IS_{23} = .82$. The largest mean decline in stability was found for General Activity, from $IS_{12} = .80$ to $IS_{23} = .76$. Averaging across the ten GZTS scales, we found that the mean ΔGZTS-IS is essentially zero ($M = -.001$).

We next tested the hypothesis that increases in trait consistency occur mainly in early adulthood. Using regression analyses, no significant association was found between age and ΔGZTS-IS or ΔIS for any individual scale. However, when baseline age was grouped by decade, planned comparisons showed that there was an increase in stability among individuals who were initially younger than age 30 compared to those over age 30 (see Table 2). On average, younger individuals tend to increase in stability by about .07 points, which in terms of ISs would correspond roughly to an increase from .68 during their 20's to .75 during their 30's. Changes in mean IS were close to zero for each of the age groups older than 30.[2]

The data reported in Table 1 and Table 2, along with the results from the regression analyses, suggest that the effects observed are quite small and the differences among scales minimal. Unlike Viken and colleagues (1994), we did not observe systematic differences between scales

related to Neuroticism compared to those related to Extraversion. Therefore, the following analyses focus on the average of the ten GZTS scales to examine broad trends and reduce the small idiosyncratic effects of each scale.

Controlling for Retest Interval

As retest interval increases, stability tends to decline, following an exponential decay toward a non-zero asymptote (with a steep decline in the first few years, and reaching a plateau within approximately two decades; Terracciano et al., 2006). There was substantial variability in the interval length between the GZTS assessments; the average interval was shorter between times one and two (M = 8.6; SD = 4.0; range 1 to 25 years) than times two and three (M = 10; SD = 4.8; range 2 to 28 years). Regression analyses across all GZTS-ISs confirmed that time interval was a significant predictor. To account for these interval differences, we obtained residuals from regression analyses and computed interval-adjusted GZTS-ISs. In the overall sample, the mean interval-adjusted ΔGZTS-IS was essentially zero. Regression analysis confirmed that after accounting for time interval, age was not a significant predictor of trait stability over time. Table 2 presents mean interval-adjusted ΔGZTS-ISs by decade, and the analyses confirmed that individuals younger than age 30 tended to increase in stability (M = .08), but there was little change in stability for adults older than age 30 (M = .00; t = 2.78; $p < 0.01$).

Demographic and Personality Moderators

Next we examined the role of sex, education, ethnicity, and secular trends on interval-adjusted ΔGZTS-IS using regression analyses. None of these variables was a significant predictor of interval-adjusted ΔGZTS-IS. Figure 3 presents the estimated marginal means, correcting for retest interval and demographic variables, of the interval-adjusted ΔGZTS-IS by decade.

We examined interaction terms between age and the other demographic variables, to explore whether increases in stability occur at different ages depending on sex or other demographic variables. We found no significant effects for any of these interaction terms, suggesting that people from different birth cohorts, ethnicity, sex, and educational levels have similar stability trajectories.

Finally, we explored whether personality trait levels influence change in intra-individual trait stability (ΔIS). In regression analyses using the five NEO-PI-R factor scores and their interaction with age as predictors we found no significant effects on ΔIS. It appears that whether an adult is high or low on any of the five factors does not influence the rate of change in overall trait stability.

Profile stability

Next, we extend the analyses from single traits to the intra-individual stability of configurations of traits, often referred to as ipsative or profile stability. These analyses focus on the relative standing of the constellation of traits that characterize the individuals. The profile stability was assessed using the double-entry method intraclass correlation across the ten GZTS scales for time one-two (ICC_{12}: M = 0.63) and two-three (ICC_{23}: M = 0.63). In the full sample, there was no average intra-individual change over time ($ICC_{23} - ICC_{12} = -.004$). As for analyses of

[2]We further tested the hypothesis that increases in trait consistency occur mainly before age 30 using piecewise regression: We tested whether the intercept and slope before age 30 differ from the intercept and slope after age 30. Following an SPSS statistical support syntax guide, we computed a dummy variable knot = 0 if age < 30 and knot = 1 if age ≥ 30, which allows for discontinuity in the intercept at knot point. We also computed an age30 = age − 30 (if age ≥ 30, otherwise set to 0) parameter to estimate the shift in slope after age 30. Next, using hierarchical linear regression to predict ΔIS, we entered age at first assessment in block 1, and knot and age30 at step 2. Results indicate that the first block was not significant, but the second block was ($p < .05$; $\Delta R^2 = 0.02$). The coefficients for age (β = .055; $p < .05$) and age30 (β = −.055; $p < .05$) were of the same size but opposite directions, confirming a significant increase up to age 30 followed by a flat line for the average of the 10 GZTS scales.

single traits, those older than 30 years showed no average intra-individual change on stability coefficients, whereas the individuals younger than 30 increased in profile stability (Table 2). Controlling for time interval, sex, education, ethnicity, and secular trends confirmed that there is an increase in stability for those going from their 20's to their 30's ($M = 0.15$), but then stability coefficients remain mostly unchanged for those older than 30 ($M = -.02$). Demographic variables and personality traits failed to predict intra-individual changes in profile stability, with the only exception a weak effect for the Openness factor ($\beta = .10$; $p < .05$), with open people showing greater increases in trait stability. The null findings for Neuroticism and Conscientiousness suggest that the maturity-stability hypothesis derived from adolescent studies (Donnellan et al., 2007;Lönnqvist et al., 2008) does not apply to adult samples.[3]

Discussion

Although there is a broad consensus that personality traits are predominantly stable in adulthood, there is still controversy on whether personality trait stability reaches a plateau early in adulthood, or continues to increase (Ardelt, 2000; McCrae & Costa, 2003; Roberts & DelVecchio, 2000; Terracciano, Costa et al., 2006). A major contribution of this study is to shift focus from a group- to an individual-level perspective, and from a cross-sectional to a longitudinal examination of the effects of age on personality stability. We examined how trait and profile consistency changed over three sequential assessments. Instead of comparing stability coefficients from groups or individuals of different ages, we followed individuals longitudinally to identify those that increased or declined in rank-order stability as they aged. Using this intra-individual analytical approach, we provided further evidence in support of the view that most individuals reach a plateau in trait and profile stability when they are in their 30's. Indeed, we found that although individuals in their 20's became somewhat more stable as they reach their 30's, those initially older than age 30 did not increase in stability over time (see Figure 3).

Using an approach conceptually similar to multilevel modeling analyses (HLM, mixed models, growth curve analyses; Bleidorn, Kandler, Riemann, & Angleitner, 2009; Jones & Meredith, 1996; Mroczek & Spiro, 2003; Terracciano, McCrae et al., 2006), we moved beyond the average group-level stability coefficient to examine each individual trajectory over time, and relate the ΔISs to other individual difference variables. Of the demographic variables we tested (sex, ethnicity, and education), none significantly explained differences in ΔGZTS-IS, and neither these demographic variables nor the five major personality factors moderated the relation of age to changes in individual stability. These findings are consistent with earlier research that also failed to find moderators of differential stability in adults at the group level in self-reported or observer rated personality traits (McCrae, 1993). The finding that differences in personality traits are unrelated to personality stability in our adult sample indicates that the maturity-stability hypothesis is most likely confined to adolescence (Donnellan et al., 2007; Lönnqvist et al., 2008; Roberts et al., 2001). By the time individuals reach adulthood, their standing in the distribution of trait scores is unlikely to show large departure and their level of personality stability is unrelated to whether or not they exhibit "mature" traits. Although it is debatable whether or not there are effective and long-lasting interventions to promote personality change in adulthood, the present study provides observational evidence that for

[3]The lack of association of Neuroticism and Conscientiousness with trait stability in our sample might be due to the older age but also to the method used. To exclude the possibility that the lack of effects is due to the use of ΔIS, we performed analyses similar to those employed in the adolescent studies by correlating the five personality domains with the simple stability coefficient between time 1 and 2 (IS_{12}). Again, we found no association. Finally, we split our sample into those younger and older than age 30, but even among our younger participants (age $M = 26$), we found no significant associations.

most adults change is rare, and reinforces the notion that adolescence may represent a valuable window of opportunity for change.

These results can be explained in part by the high level of stability in our sample. As illustrated in Figure 1, roughly 75% of the sample had coefficients IS_{12} greater than .70, and less than 10% had an IS_{12} less than .50. Furthermore, about 80% of those with a low stability over the first interval ($IS_{12} < .50$) showed higher stability over the second interval ($IS_{23} > .50$), suggesting that the lower stability is unlikely to be due to stable individual characteristics, but more likely due to maturation (being under 30), diseases (e.g., major depression), temporary events, or measurement errors.

Among the major strengths of this study is the large sample of individuals tested three times over an average of about 20 years. Given the wide age range of the participants and the longitudinal span of the study, the results are informative on personality development across most of the adult lifespan. Although it is difficult to clearly separate age, time-of-measurement, and cohort effects, this study was well suited to detect secular trends over the last decades (Terracciano, 2009; Trzesniewski & Donnellan, 2008; Twenge, 2000), and the absence of any significant effects suggests that cohort effects are unlikely to significantly influence stability coefficients. Trait and profile consistency showed similar patterns, suggesting that the results are robust and independent of the method used.

However, an important limitation is that the present sample was not selected to be representative of the general population. In particular, there was little variability in terms of education and ethnicity, which may have limited our analyses of the impact of these variables on intra-individual stability coefficients. It remains to be seen whether this developmental course of trait stability can be replicated in samples with lower education and lower commitment to participating in a longitudinal study. Another major limitation that might have biased the results is attrition and the pattern of missing data. It is possible that those individuals who stayed in the study were different from those who dropped out or died. Finally, the GZTS is a valid and reliable instrument, but unfortunately does not adequately assess all five dimensions of personality.

Looking backwards, the intra-individual approach used in this study broadly confirms and refines the trends observed in the BLSA sample using the classical group level analyses (Costa & McCrae, 1992, 1998; Costa et al., 1980; Terracciano, Costa et al., 2006). Looking forward, the intra-individual approach used in this study may prove useful in detecting a small number of individuals with low levels of stability, and the factors that characterize them, especially at younger ages. This approach can be applied to other traits and behaviors, and advance our understanding of individual differences in trait stability across the life-span.

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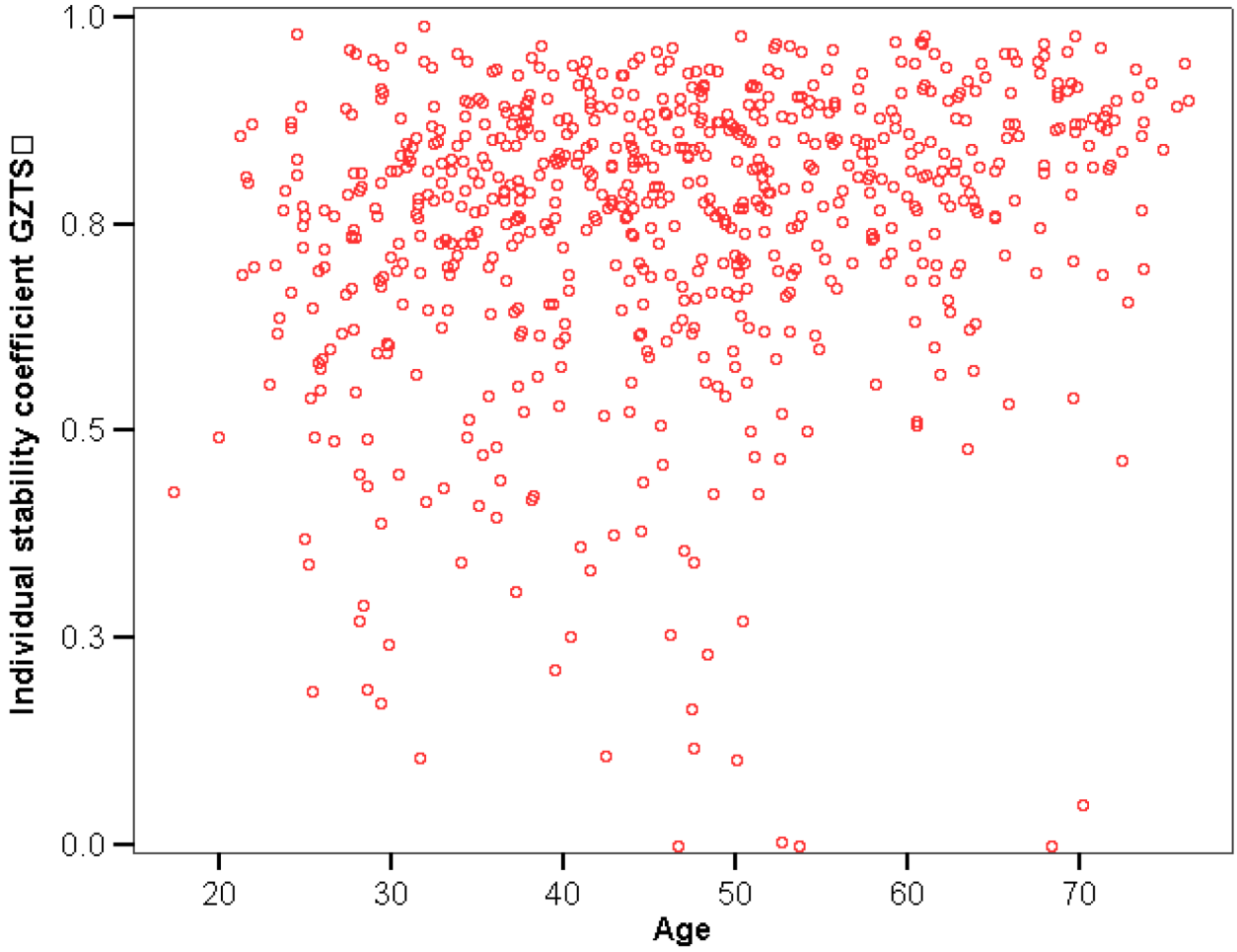

Figure 1.

Individual stability coefficients by age. $N = 684$. Circles represent individuals' average stability coefficient across the ten Guilford-Zimmerman Temperament Survey (GZTS) scales from the first to the second assessments (average interval = 8.6 years). Age at first assessment is used for the *x*-axis. For three individuals, negative stability coefficients were recoded to zero. Individual stability coefficients were higher than .50 for 92% of the sample, and higher than .70 for 74% of the sample.

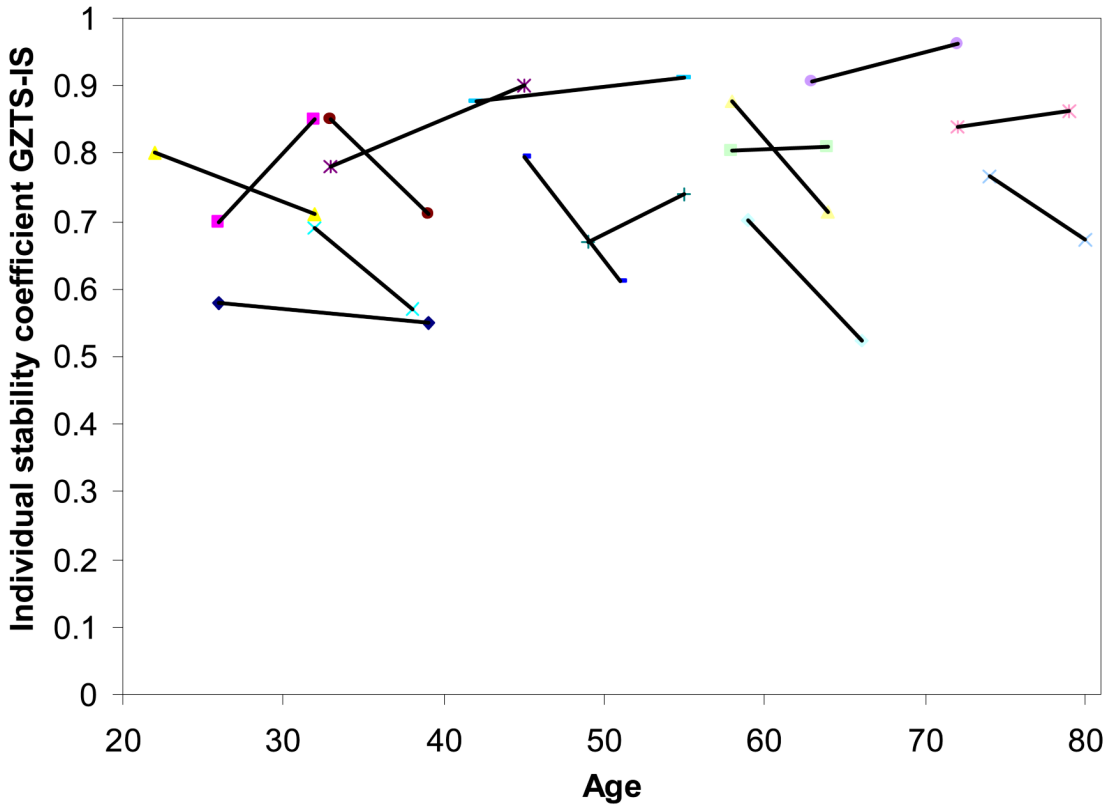

Figure 2.
Intra-individual change in stability coefficients for fifteen participants. Each line represents an individual's change in stability on the ten Guilford-Zimmerman Temperament Survey (GZTS) scales. For each decade, three individuals were chosen based on the 25th, 50th, and 75th percentiles of the distribution of individual stability coefficients between times one and two. Lines extend from the age of first to age of second assessment. GZTS-IS = Guilford-Zimmerman Temperament Survey – Individual stability

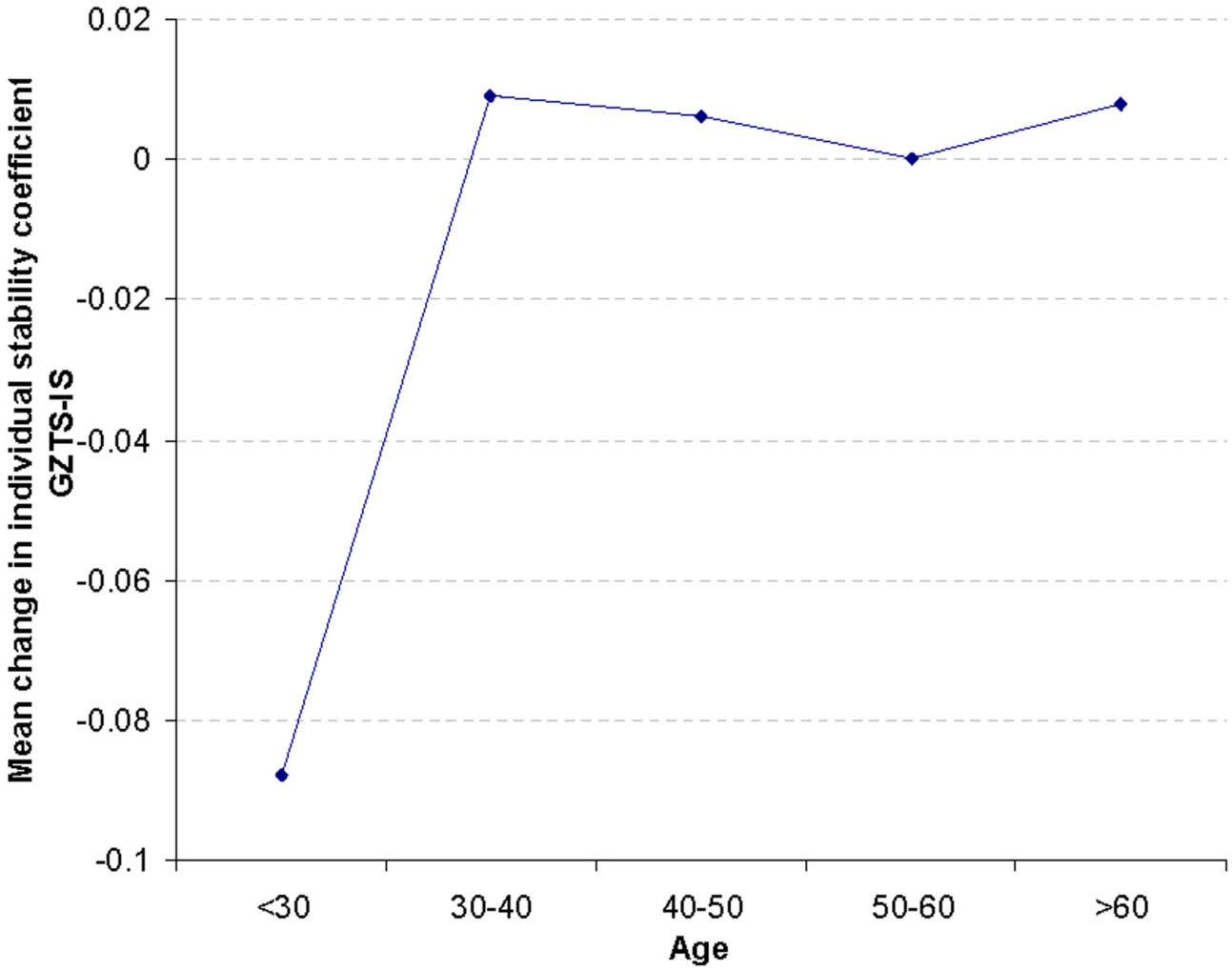

Figure 3.
Mean intra-individual change in stability coefficients by decade. *N* = 684. See Table 2 for sample sizes by decade. These are estimated marginal means of intra-individual change in stability coefficients adjusted for time interval, and controlling for differences on education, sex, ethnicity, and secular trends. Signs of the coefficients are inverted. GZTS-IS = Guilford-Zimmerman Temperament Survey–Individual stability

Table 1

Asendorpf's (1992) individual stability coefficients in sequential assessments.

GZTS Scale	N	IS_{12} (SD)	IS_{23} (SD)	ΔIS (SD)
General Activity	604	.80 (.31)	.76 (.39)	−.036 (.469)
Restraint	600	.68 (.52)	.70 (.47)	.018 (.633)
Ascendance	598	.82 (.28)	.82 (.28)	.009 (.344)
Sociability	583	.78 (.40)	.82 (.33)	.032 (.483)
Emotional Stability	624	.71 (.55)	.71 (.53)	.001 (.671)
Objectivity	594	.70 (.53)	.70 (.54)	−.000 (.695)
Friendliness	604	.73 (.45)	.73 (.48)	−.006 (.622)
Thoughtfulness	621	.71 (.48)	.69 (.49)	−.014 (.650)
Personal Relations	548	.70 (.49)	.72 (.43)	.022 (.591)
Masculinity	630	.84 (.24)	.85 (.22)	.013 (.302)
Overall	684	.75 (.19)	.75 (.21)	−.001 (.260)

Note: GZTS = Guilford-Zimmerman Temperament Survey; IS_{12} = individual stability coefficient between time one and two assessments; IS_{23} = individual stability coefficient between time two and three assessments; $\Delta IS = IS_{23} - IS_{12}$.

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Table 2

Changes in Asendorpf's (1992) individual stability coefficients (ΔISs) in sequential assessments by age groups.

	Age group				
GZTS Scale	**<30**	**30–40**	**40–50**	**50–60**	**>60**
General Activity	.07	−.05	−.05	−.11	.02
Restraint	−.08	.08	.07	−.05	.00
Ascendance	.09	.02	.00	−.04	.00
Sociability	.10	.03	.01	.00	.06
Emotional Stability	.03	.04	−.03	.06	−.10
Objectivity	.00	−.05	−.01	.03	.05
Friendliness	.07	−.08	.01	.01	−.01
Thoughtfulness	.15	−.07	−.01	.00	−.08
Personal Relations	.11	.06	−.02	.02	−.03
Masculinity	.07	−.02	.00	.02	.02
Overall ΔIS	.07	−.02	−.02	.00	−.01
Overall[a] ΔIS	.08	−.01	−.01	.01	.00
Overall[b] ΔIS	.09	−.01	−.01	.00	−.01
ICC	.11	−.06	−.02	.00	.00
ICC[a]	.13	−.05	−.01	.01	.00
ICC[b]	.15	−.03	.00	−.01	−.02
N	85	160	172	136	131

Note: GZTS = Guilford-Zimmerman Temperament Survey; ΔIS = $IS_{23} - IS_{12s}$ (see also Table 1 or text); ICC = Intraclass correlation.

[a]Based on residual scores adjusted for time interval.

[b]Based on residual scores adjusted for time interval, and controlling for the effects of sex, education, ethnicity, and secular trends.