Published in final edited form as:
*Psychol Aging*. 2010 March ; 25(1): 95–107. doi:10.1037/a0018199.

# Age Differences in Big Five Behavior Averages and Variabilities Across the Adult Lifespan: Moving Beyond Retrospective, Global Summary Accounts of Personality

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## Abstract

In three intensive cross-sectional studies, age differences in behavior averages and variabilities were examined. Three questions were posed: Does variability differ among age groups? Does the sizable variability in young adulthood persist throughout the lifespan? Do past conclusions about trait development, based on trait questionnaires, hold up when actual behavior is examined? Three groups participated: younger adults (18-23 years), middle-aged adults (35-55 years), and older adults (65-81 years). In two experience-sampling studies, participants reported their current behavior multiple times per day for one or two week spans. In a third study, participants interacted in standardized laboratory activities on eight separate occasions. First, results revealed a sizable amount of intraindividual variability in behavior for all adult groups, with standard deviations ranging from about half a point to well over one point on 6-point scales. Second, older adults were most variable in Openness whereas younger adults were most variable in Agreeableness and Emotional Stability. Third, most specific patterns of maturation-related age differences in actual behavior were both more greatly pronounced and differently patterned than those revealed by the trait questionnaire method. When participants interacted in standardized situations, personality differences between younger adults and middle-aged adults were larger, and older adults exhibited a more positive personality profile than they exhibited in their everyday lives.

### Keywords

personality traits; personality development; adult development; variability

The purpose of this article is to determine how individuals within different periods of the adult lifespan differ in Big Five trait-relevant behavior averages and variabilities. That is, the purpose is to determine age differences in personality, in terms of actual everyday behavior collected at the moment of the behavior, and including not only the typical way each person behaves but also his or her entire distribution of ways of behaving. We believe that examining age differences in behavior is important for at least three reasons. First, it contributes to the large and important literature on personality trait development (Donnellan & Robins, 2009; Roberts & Mroczek, 2008). Although the adult personality development literature has revealed a great deal about adult personality development, the majority of

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studies have relied almost exclusively on retrospective, single number trait questionnaire summaries rather than on behavior (Roberts, Walton, & Viechtbauer, 2006). This is the first study to examine age differences in personality traits directly in terms of everyday behavior.

Second, examining age differences in behavior is important because it allows an investigation of personality development not only in terms of central tendencies but also in terms of variability. Behavior variability has long been argued to represent an important individual difference (Fiske, 1961; Fleeson, 2001; Larsen, 1989; Murray, 1938), which may change across the lifespan in normative ways (Berry & Jobe, 2002; Charles & Pasupathi, 2003; Fleeson & Jolley, 2006; Hooker, 2002). In fact, such differences may be behind intuitions about what changes in personality in adulthood; for example, ideas about stormy adolescence or stable midlife may refer to within-person variability at the different ages, rather than to central tendencies. Although researchers have long studied *inter*individual variability in personality development (Roberts & DelVecchio, 2000), the study of *intra*individual variability is relatively rare (Hooker & McAdams, 2003; Mroczek & Almeida, 2004).

A third reason to examine age differences in behavior is to test a potential artifact explanation for the surprisingly large within-person variability in everyday trait-relevant behavior. Findings of large within-person variability may have been artifacts of using younger adult samples (Fleeson, 2001). Many theories suggest that high variability in behavior is a unique property of emerging adulthood, nearly eliminated by middle-age (Arnett, 2000; Brandtstädter & Greve, 1994; Erikson & Erikson, 1997). In contrast, high levels of within-person variability throughout the lifespan would argue for a combined trait and social-cognitive approach to personality development.

## Personality Development

Personality development is a thriving area of current research (Mroczek & Little, 2006). Recent years have yielded many advances, including evidence for genetic and environmental bases of traits (Krueger & Johnson, 2008), cross-cultural similarities in trait age differences between younger and older adults (McCrae, et al., 1999), and trait prediction of important life outcomes such as health (Ozer & Benet-Martínez, 2006), occupational and academic achievement (Barrick & Mount, 1991; Noftle & Robins, 2007), and mortality (Mroczek & Spiro, 2007).

One particularly important advancement has been a comprehensive analysis of Big Five trait changes across the lifespan. In a meta-analysis of 92 longitudinal studies, Roberts et al. (2006) found, first, that personality change continues well after emerging adulthood. Second, Openness and Social Dominance (a facet of Extraversion) increase to a peak in midlife. Third, Agreeableness, Conscientiousness, and Emotional Stability increase steadily into old age (cf. Srivastava, John, Gosling & Potter, 2003). The findings argue for a renewed focus on adult development during midlife and through to old age, the period during which most positive personality change occurs.

## Density Distributions Approach to Personality

Research on trait development has largely been influenced by traditional notions of traits, according to which, each person has a specific, single level of each trait, which may remain stable across life, or may change gradually with development. However, in recent years, inspired by Epstein (1982), Mischel (1968), and Nesselroade (1991), an alternative conception has arisen. The density distributions approach articulates traits as density distributions of trait-relevant behavior (Fleeson, 2001). This approach builds on theoretical and empirical work from the 1970s and 1980s, such as studies assessing intraindividual

variability and studies apportioning behavior variance to person, situation, and person*situation factors (B. P. Allen & Potkay, 1973; Bem & A. Allen, 1974; Endler & Magnusson, 1976; Epstein, 1982; Moskowitz, 1982; Nesselroade, 1988; Sarason, Smith, & Diener, 1975). Instead of summarizing traits with a single-number trait questionnaire score, trait-relevant behavior is assessed multiple times across a representative short-term span of daily life. The density distribution approach thus incorporates two main elements of a trait, the average (the central tendency of a person's behavior) and variability (the amount a person's behavior deviates from that average level).[1]

Initial research using the density distributions approach demonstrated two apparently contradictory findings (Fleeson, 2001). Using the aggregation technique pioneered by Epstein (1979), Fleeson (2001) showed that averages of Big-Five behaviors had stability correlations from one week to another week of around .80 to .90, demonstrating high stability of individual differences in behavior (Fleeson, 2001). Apparently contradictorily, the majority of variability in Big-Five behavior (e.g., between 62% and 93% in Fleeson, 2007b) was found to be within-person, due to the same person expressing different trait levels from hour to hour; in the average week the typical younger adult manifested most levels of most traits in his or her behavior. This amount of within-person variability is considered to be high for at least three reasons (Fleeson, 2001). First, it accounts for more of the variance than the between-person variance in personality, meaning that a typical person differs from herself on two occasions more than she differs from someone else. Second, the amount of within-person variability in personality is comparable in magnitude to the amount of variability in mood, a construct which is theoretically so variable that it is generally considered to represent more of a state than a trait (e.g., Ekman & Davidson, 1994). Third, the amount of within-person variance is close to the amount of total variance. Thus, the apparently contradictory findings of high stability and high variability are resolved with the conceptualization of a personality trait as a behavior distribution.

However, these findings, especially those of high variability, could easily be an artifact of relying on samples of younger adults. Indeed, there are several theoretical reasons to expect the large amount of behavior variability *not* to generalize to adults in general. Identity development is an exploratory process undertaken by individuals in late adolescence and early adulthood. Variability may result from individuals trying out a variety of activities in search of an identity (Pals, 1999). Marcia's (1966) identity status of identity moratorium is quite common in emerging adulthood (Waterman, 1982), and may be particularly facilitated by exposure to a liberal arts curriculum. Instead of being surrounded by a relatively homogenous set of peers from the same neighborhood or town, college students find themselves interacting with people from across the state, country, or world. Thus, it is plausible that middle-aged and older adults will not be as variable in their behavior.

## Age Differences in Behavior Averages

The current research charts personality development in terms of density distributions of behavior. The first main purpose is to investigate the adult development of traits, by assessing traits as behavior averages rather than as questionnaire scores. Trait questionnaires are probably generally accurate in capturing people's average behavior, but they may also reflect other influences, such as biases, memory deficits, and identities. The development of experience-sampling methodology and the state concept allow us to ascertain developmental trends directly in behavior.

[1]The Density Distributions approach also includes an analysis of other aspects of distributions of behavior, such as skew and kurtosis (Fleeson, 2001), but those elements are not included in this article.

There are at least three advantages to assessing behavior averages. First, assessing behavior averages drastically reduces *retrospection and summary*. Recall errors, memory biases, and availability heuristics are likely to influence trait ratings (Jobe, 2000; Schwarz, 1999). Although state ratings are still self-reports and thus are still subject to biases, because state ratings are of very recent immediate behavior, they reduce or nearly eliminate retrospection and summary biases (Fleeson, 2009; Furr, 2009). A second reason to assess behavior averages is that self-ratings of traits could be *biased by stereotypes* about personality trait development, because lay beliefs, past perceptions, and future expectations concerning adult trait development are similar to the trends identified by trait questionnaires (Fleeson & Heckhausen, 1997; Haslam, Bastian, Fox, & Whelan, 2007; Robins, Noftle, Trzesniewski, & Roberts, 2005; Wood & Roberts, 2006). Measuring behavior reduces the possibility that people will rely on age stereotypes, because they are rating how they are currently acting rather than rating themselves as a whole. The subsequently derived central tendency of a person's behavior is presumably closer to his or her actual average trait level in everyday life than is a retrospective summary. Third, limitations of the trait questionnaire method may be especially pertinent when considering age differences. When retrospecting, people likely include behavior from former periods of life. This *developmental imprecision* is a problem because it incorporates past behaviors into assessments of current trait levels, and thus may attenuate estimates of change (Fleeson & Baltes, 1998). Measuring behavior, on the other hand, necessarily refers only to the current age period.

Because this study is the first to use behavior to assess age differences in traits it makes only exploratory predictions about such age differences. One possible outcome is that developmental trends previously identified by trait questionnaire methods will hold up when actual behaviors are considered. The validity evidence for trait measures suggests that this is not an unlikely outcome. If they do hold up, Agreeableness, Conscientiousness, and Emotional Stability would be found to be higher in older age groups (Roberts et al., 2006, Terracciano, McCrae, Brant, & Costa, 2005). Previous findings for Extraversion have been somewhat mixed – some studies show decreases across the lifespan whereas others show no change or even increases (Trzesniewski, Robins, Roberts, & Caspi, 2004) – but some findings suggest that Extraversion may be highest in midlife, as most people are at the peak of social roles (career roles, parental and family roles, community roles; e.g., Lodi-Smith & Roberts, 2007). Personal growth conceptions of maturity and wisdom (Helson & Srivastava, 2001) would predict Openness to be higher in older ages. If trait questionnaire findings are indeed verified, this would be an important outcome, for it would provide needed evidence that trait questionnaires provide accurate representations of developmental trends.

## Age Differences in Behavior Variability

The second main purpose of this study is to consider intraindividual behavior variability as a developmental phenomenon in its own right (Charles & Pasupathi, 2003; Nesselroade, 1991). Variability in a person's behavior may be an important feature of personality that changes in systematic ways across adulthood (Berry & Jobe, 2002; Fleeson & Jolley, 2006; Hooker, 2002). Fleeson and Jolley (2006) posit two broad sets of mechanisms of adult personality development that influence development of variability: the STRIDE and GLIDE mechanisms.

### STRIDE and GLIDE mechanisms

Six proximal, “micro” mechanisms are proposed to influence immediate behavior. These “STRIDE” mechanisms are competing to produce different behaviors, and vary in the strength of their impact over time. The STRIDE mechanisms are Stabilizing forces, Temporal trends, Resource availability, Interpretations of situations, Drives and Desires, and *Error* (STRIDE), and are proposed to directly influence behavior variability. The second set

of mechanisms is derived directly from the existing developmental literature and includes the mechanisms typically studied by developmentalists. The five distal, "macro" mechanisms of adult personality development are Genetics, Learning, Identity, Developmental regulation, and *Environment* (forming the acronym GLIDE – which refers to their broad, long-ranging effects on gradual developmental changes). These latter GLIDE mechanisms represent distal forces operating over the long-term that have an influence at the "macro" level, which influence an individual's behavior in general but not directly. The key aspect of the theory is the proposal that distal, GLIDE mechanisms are linked to behaviors through their influence on the strength and variability of the proximal, STRIDE mechanisms. Figure 1 shows the paths from GLIDE mechanisms to STRIDE mechanisms to behavior.

### Applying GLIDE mechanisms to generate predictions for continuing high variability

Based on the GLIDE-STRIDE theory, behavior variability, rather than a phenomenon limited to emerging adulthood, is expected to instead represent an essential component of personality across the lifespan. Two GLIDE mechanisms in particular predict high behavior variability throughout adulthood. First, the lifelong need for developmental regulation – intentional efforts toward self-improvement – predicts that behavior is necessarily flexible and adaptable throughout life (Fleeson & Baltes, 1998; Heckhausen, 2002). If people are adaptable, then they must be able to change how they respond to different situations (i.e., modify their interpretations of situations), and thus will remain behaviorally variable. Developmental regulation may even increase in midlife -- when life satisfaction is lowest (Fleeson, 2004) -- which may increase the influence of drives and desires on behavior. Second, learning continues across the lifespan, as crystallized intelligence steadily increases until old age (Baltes, 1987). Learning may lead to an increased availability and strength of one type of resource, skills, which in turn may make behavior less haphazard, and more tailored to the situation. Thus, learning, unlike habits, may actually increase behavior variability. Both mechanisms suggest a very different kind of development from that in which habits are genetically determined or fully formed early in life, apply pervasively across situations, and endure relatively unchanged throughout adulthood.

Three studies will test two competing predictions – maintenance of high variability versus a decrease in variability with age – to determine whether the large amount of variability observed in younger adults (Fleeson, 2001; Fleeson, Malanos, & Achille, 2002; Fleeson, 2007b), is also typical of middle-aged and older adults. In Study 3, the GLIDE-STRIDE hypothesis that some age differences in personality may result from age differences in environments (i.e., the typical situations encountered), is tested by standardizing situations across the three age groups. For our purposes, younger adults are individuals in the period of emerging adulthood (defined as between 18 and 25 or 30 years of age; Arnett, 2000), middle aged adults are between age 35 and 55, and older adults are 65 and above.

## Study 1: Extraversion, Agreeableness, and Emotional Stability in Daily Life

### Method

**Participants—**Data from all three studies come from the Integrating Process and Structure in Personality project (IPSP). IPSP is a large-scale behavioral study, designed to assess a large number of behaviors of individuals in a variety of naturalistic situations and activities. Three age groups were investigated: younger adults, middle-aged adults, and older adults. Younger adults were recruited through signs posted on campus. Middle-aged and older adults were recruited through advertisements in local media. Participants were required to be fluent in English, willing to carry a palm pilot, have transportation, and to be a new participant to our studies. Additionally, individuals in the middle-aged and older adult

samples were required to have a college degree, to attempt to make the three groups similar in educational background. The final sample in Study 1 included 80 participants, including 28 younger adults (18-22 years old; M = 19.41, SD = 1.42), 27 middle-aged adults (35-54 years old; M = 44.00, SD = 5.47), and 25 older adults (66-81 years old; M = 70.88, SD = 3.78). 66% of the younger adults, 56% of the middle-aged adults, and 60% of the older adults were women. The sample was 4% Asian, 24% African-American, and 71% Caucasian (1% did not report their race). Younger adults were paid $40 each for participating, and middle-aged and older adults were paid $75 each.

**Procedure—**Five times per day for 14 days, participants described how they were acting during the previous twelve minutes. These reports were completed on a regular schedule, every 3 hours, and took about 1 to 2 minutes to complete. Each participant was allowed to select either a 9am to 9pm schedule or a 12pm to 12am schedule. Younger adults were more likely to choose a noon to midnight schedule (N = 17), versus middle-aged (N = 6) or older (N = 4) participants.

Reports were completed on Palm Pilots, hand-held computers about the size of a calculator. Each question appeared on a screen, and participants responded by tapping a number with a plastic stylus. The first report occurred during a 45-minute introductory session in which the procedure was explained. The unique nature of this study, that it investigated a representative sampling of 2 weeks of each individual's life, was stressed, as well as the importance of completing as many reports as honestly as possible. Participants also completed several questionnaires during the introductory session and at the end of the experience-sampling phase.

The response rate was within normal range for experience-sampling studies. For the 80 participants, the mean number of reports was 49.7 of 70 possible (71%), with a range of 15 to 70 reports. Participants were instructed to miss a report if it would be a major inconvenience to complete (e.g., driving, during an exam, while sleeping). Participants were also told they could complete a report up to 1 hour later than the scheduled time. To enhance data quality, a strict procedure was followed for including reports in the final dataset. Reports were excluded that had six or more missing values, were completed early or at least 1 hour later than the scheduled time, or were beyond the five allowed per day. Because time of completion was recorded surreptitiously, this procedure verified that all reports were completed close in time to the described behavior. In total, 516 of the 4,489 reports (11.5%) were excluded for one of the three reasons.

**Big Five personality states—**Big Five personality states were assessed with the same format as traditional, adjective-based, Big Five scales with the exception that, rather than describing themselves in general, participants described their behavior during the previous twelve minutes (e.g., “During the last twelve minutes, how hardworking have you been?). The Numbers 1 through 6 were listed across the bottom of the screen, and participants responded by tapping a number on the electronic number pad. In addition, an option was included for participants to tap a N/A button (for “not applicable”) if the item was irrelevant to what they were doing. For this study, adjectives were chosen that loaded on the correct Big Five factor in Goldberg (1992), were reliable in previous work, were distinct from each other, were easy to use to describe behavior, and had a minimal social desirability component. To reduce participant fatigue, only three Big Five traits were selected, as participants were answering the personality items up to seventy times. Thus, only the traits of Extraversion, Agreeableness, and Emotional Stability were assessed, with six items each (Extraversion: “talkative,” “energetic,” “assertive,” “quiet,” “unenergetic,” “unassertive,” ($\alpha$ = .81); Agreeableness: “cooperative,” “respectful,” “kind,” “uncooperative,” “disrespectful,”

"unkind," ($\alpha$ = .75); Emotional Stability: "relaxed," "even-tempered," "secure," "restless," "irritable," "insecure," ($\alpha$ = .81)).

**Trait ratings of the Big Five—**At the end of the introductory meeting, participants completed a Big Five measure with the same content as the Big Five state measure, except with standard trait instructions and the Big Five presented as bipolar items on a 7-point scale (e.g., participants rated themselves on the bipolar item "talkative-quiet"). All three scales had adequate reliabilities: Extraversion ($\alpha$ = .65), Agreeableness ($\alpha$ = .54), and Emotional Stability ($\alpha$ = .73).

## Results of Study 1

### Density distributions of personality states

Unconditional models from multilevel modeling (MLM, also known as hierarchical linear modeling) estimated the degree of variability due to persons and due to the moment. State level was predicted from a grand mean, a deviation for the participant's mean, and a deviation specific to that occasion. MLM allows for the partitioning of the total variance in behavior into two components, that which is explainable by individual differences (between-person variance) and that which is explainable by factors present in the moment, such as situations or internal rhythms (within-person variance). The first three rows of Table 1 show the results for each personality state for the full sample, depicting the average state for the average individual, the amount of variance between individuals in states, and the amount of variance within individuals in states. As can be seen, 53% to 81% of the variance in states occurred within individuals, representing the same person expressing different trait levels at different moments. Only 19% to 47% of the variance in states occurred between individuals, representing different people expressing different trait levels across moments.

Differences between individuals are also evident in the parameters of each individual's distribution of states. Each participant's data were split into the first week's behavior ratings and the second week's behavior ratings. Then, the mean and standard deviation were calculated for each trait for each half. The next to last row of Table 1 shows stability correlations indicating the degree to which individual differences in behavior averages were maintained across two independent sets of data. People's behavior averages from week to week were very similar (stabilities of .84 to .92).

### Age differences in behavior averages

Age group was included as a fixed effect in MLM analyses to determine what proportion of the variance it would predict. Age group was a significant predictor in the case of Agreeableness and Emotional Stability, accounting for 24% and 18% of the between-individual variance of the two personality states, respectively (age predicted 8% of the between-individual variance of Extraversion personality states, but it was not significant). As shown in Table 2, there were significant effects of age on Agreeableness and Emotional Stability, and a marginal effect of age on Extraversion ($F$ = 3.09; $p$ = .051). Younger and middle-aged adults acted more extraverted than the older adults did, although this trend was not significant. Older adults and middle aged adults acted significantly more agreeable and emotionally stable than the younger adults did. The older group acted more emotionally stable than the middle-aged group, but this trend was only marginally significant ($p$ = .05).

### Trait questionnaire scores versus behavior averages

When the three age groups' traits were examined, similar trends were found as were identified in with behavior averages, although none of the age differences in trait questionnaire scores were significant. First, because the two methods used different scales

(the behavior averages were rated on a 6-point scale whereas the trait questionnaire scores were on a 7-point scale), both sets of scores were converted into the POMP (Percentage of Maximum Possible) metric (P. Cohen, J. Cohen, Aiken, & West, 1999). A POMP score is a linear transformation of any raw metric into a 0 to 100 scale, where 0 represents the minimum possible score and 100 represents the maximum possible score. Figure 2 plots the behavior averages next to the trait questionnaire scores for each trait. To examine differences between the trait questionnaire and behavior averages methods, a 3 (agegroup) × 3 (trait) × 2 (method) repeated measures ANOVA was conducted. Significant main effects were found for method and trait. Slightly higher ratings were delivered by the behavior average method than the trait questionnaire method ($F = 7.05$), and Agreeableness was the highest rated out of the three traits ($F = 154.05$). The trait*method interaction was also significant ($F = 137.57$); Extraversion had the lowest behavior ratings whereas Emotional Stability had the lowest trait questionnaire means (Agreeableness was highest using either method). The trait*agegroup interaction was significant ($F = 5.57$), meaning that the three traits displayed different age differences. The method*agegroup interaction was not significant, meaning that age-related differences did not depend on the method. Finally, the trait*method*agegroup interaction was not significant.

### Age differences in behavior variability

Table 2 shows analyses of age differences in behavior variability. MLM analyses were conducted, but instead of analyzing participants' raw ratings of each personality state, MLM analyzed squared deviations of each personality state. Just as the behavior-average analyses compared the behavior averages across the three age groups, these analyses compared the variances across the three age groups. Age differences were found for all three behavior variabilities. As shown in Table 2, behavior variability generally was lower at later ages, but remained high even for older adults. Extraversion variability was lower in older adults, whereas Agreeableness variability and Emotional Stability variability was lower in both middle-aged and older adults. Furthermore, the fact that individual differences in variability were highly predictable from one week of behavior to the second week of behavior (displayed in the last row of Table 1) demonstrates that individual differences in variability are quite stable.

## Study 2: Extraversion, Conscientiousness, and Openness in Daily Life

### Method

Study 2 examined age differences in density distributions for the two Big Five traits that were not examined in Study 1, Conscientiousness and Openness. The method was similar to Study 1, except in respects noted below.

**Participants—**Two hundred and thirty-three participants each completed a week-long experience-sampling study. The final sample included 110 younger adults (18-22 years old; M = 19.58, SD = 1.27), 58 middle-aged adults (36-55 years old; M = 46.98, SD = 5.52), and 65 older adults (65-80 years old; M = 71.68, SD = 4.20). 68% of the younger adults, 72% of the middle-aged adults, and 54% of the older adults were women. The college degree restriction for middle aged and older adults was "some college education" but not necessarily a degree, because the younger adults were still in college, meaning that they had at least some college, but did not yet have a degree. The sample was 3% Asian, 14% African-American, 80% Caucasian, and 1% Pacific Islander, with the remaining 2% of individuals reporting more than one race or not reporting their race. In addition, 3% reported Hispanic/Latino ethnicity (of any race). Participants were paid $25 for completing the study.

**Procedure—**Four times per day for 7 days, participants described how they were acting during the previous 12 minutes. All participants completed reports at noon, 3pm, 6pm, and 9pm. For the included 233 participants, the mean number of reports was 22.8 of 28 scheduled reports (81.5%), with a range of 10 to 32 reports (if the 25 participants with 29-32 reports were excluded, the mean number of reports was 21.9; 78.3%). Reports were excluded that were completed outside of 20 minutes before or two hours later than the scheduled time. In total, 982 of the 6299 reports (15.6%) were excluded for a data quality reason.

**Big Five personality states—**Participants described their behavior during the previous twelve minutes on 1-6 scales ("not applicable" was omitted), Each state comprised three items: Extraversion: "talkative," "energetic," "assertive" ($\alpha$ = .75); Conscientiousness: "efficient," "thorough," "systematic" ($\alpha$ = .88); Openness: "imaginative," "creative," "perceptive," ($\alpha$ = .79).

**Trait ratings of the Big Five—**At the end of the introductory meeting, participants completed trait Big Five questionnaires on 6-point scales with identical items as the state measures, but with standard trait instructions. The only discrepancy was that the item "organized" was used in place of "systematic" in the Conscientiousness trait questionnaire scale. All three scales had adequate reliabilities: Extraversion ($\alpha$ = .47), Conscientiousness ($\alpha$ = .68), and Openness ($\alpha$ = .64).

## Results of Study 2

### Density distributions of personality states

As depicted in Table 3, 65% to 82% of the variance in states occurred within individuals, the majority of the variance, as in Study 1. Only 18% to 35% of the variance in states occurred between individuals. The fourth row of Table 3, displaying the stability of individual differences in behavior averages across halves of behavior, demonstrates the same high correlations as were observed in Study 1.

### Age differences in behavior averages

Age group was a significant predictor in the case of Extraversion and Conscientiousness, accounting for 5% and 3% of the between-individual variance of the two personality states, respectively. Age group was not a significant predictor of Openness. As shown in Table 4, middle-aged adults acted significantly more conscientious than did younger adults; older adults were in between the other two groups and did not differ from them. Middle-aged adults acted significantly more extraverted than the other groups; younger and older adults did not differ from one another. In Study 1, however, both the younger and the middle-aged adults had shown elevated Extraversion. To reconcile this difference, the data from Study 1 were reanalyzed using only the positively worded items; this produced the same pattern as in Study 2, in which the middle-aged adults had higher levels of Extraversion than the other two age groups. When we reanalyzed just the positive terms for the other two traits from Study 1 -- Agreeableness and Emotional Stability -- the results were similar to those reported in Study 1 on the full set of terms for the two dimensions: younger adults were the lowest, middle-aged adults were in between, and older adults were highest. However, although younger and older adults' means were significantly different from one another (for both traits), middle-aged adults' means were not significantly different from either age group.

### Trait questionnaire scores versus behavior averages

None of the age differences in trait questionnaire scores were significant. Figure 3 shows a comparison of the questionnaire scores with the behavior averages for the three traits once converted into in the POMP metric (see Study 1). In a 3 (agegroup) × 3 (trait) × 2 (method) repeated measures ANOVA, the trait main effect, the method main effect, and the trait*method interaction were all significant. The agegroup*trait interaction was not significant, because when both methods were combined, all three traits tended to follow the same developmental pattern of lowest in emerging adulthood, highest in midlife, and in between in older adulthood. Other interactions were not significant.

### Age differences in variability

Table 4 shows analyses of age differences in behavior variability, analyzed in the same manner as Study 1. Age differences in behavior variability for Extraversion were not significant, but followed a similar pattern to those reported in Study 1: older adults were lower than middle-aged adults, and younger adults were in between. Age differences in behavior variability for Conscientiousness were also not significant ($p = .09$), but middle-aged and older adults were higher than younger adults. However, age differences in behavior variability for Openness were significant. Younger adults were least variable in Openness, and middle-aged adults the most variable; older adults did not differ significantly in variability from those in midlife. Individual differences in variability were highly predictable from one week of behavior to the second week of behavior (displayed in the last row of Table 3).

## Study 3: Extraversion, Conscientiousness, and Openness in Structured Lab Situations

Studies 1 and 2 examined self-reported behavior averages and variabilities in daily life, thereby benefitting from high levels of ecological validity. These two studies demonstrated that high variability persists across the adult lifespan and that people of different ages act fairly differently on average from one another in their everyday lives. However, because the studies examined behavior in everyday life, it is impossible to determine whether the observed age group differences reflected differences in the individuals themselves or age differences in the individuals' situations. Thus, Study 3 was designed to examine development of density distributions for the same Big Five traits examined in Study 2, Extraversion, Conscientiousness and Openness, but in a set of semi-structured laboratory interactions standardized across age groups.

### Method

**Participants—**Study 3 included a portion of the same participants as Study 2, but entirely different experience-sampling data. Roughly half of those participants served as participants in a series of laboratory interactions: the sample included 134 participants: 48 younger adults (18-23 years old; M = 19.73, SD = 1.38), 42 middle-aged adults (36-55 years old; M = 47.19, SD = 5.57), and 44 older adults (65-80 years old; M = 71.70, SD = 4.38). 64% of the younger adults, 74% of the middle-aged adults, and 52% of the older adults were women. The sample was 2% Asian, 16% African-American, 79% Caucasian, and 1% Pacific Islander, with the remaining 1% of individuals reporting more than one race or not reporting their race. In addition, 1% reported Hispanic/Latino ethnicity (of any race). Participants were paid up to the following for completing the study: younger adults ($120), middle-aged adults ($200), and older adults ($150).

**Procedure—**Participants were involved in 8 sessions over the course of five weeks (the data from Study 2 were collected at the same time or directly after the sessions for this study). For each session, four to six participants were scheduled to meet together for approximately 50 minutes (the number of participants was occasionally less because of absences). Participants read the instructions and then participated in the instructed activity. For each activity, participants made three ratings: after the first 12 minutes, the second 12 minutes and the third 12 minutes. Each session consisted of a unique activity, including debating current political issues, taking turns telling an embarrassing story, and interpreting a painting. The set of activities were chosen for three reasons: (i) engage individuals in the activity; (ii) be unstructured and unconstrained enough to allow a wide range of behaviors from the individuals in the situation (so as not to inflate or deflate estimates of variability or accuracy) and (iii) provide a variety of tasks to allow possible expression of each level of the three Big 5 traits.

**Big Five Personality states—**The states were examined with the same set of items used in Study 2: Extraversion ($\alpha$ = .81); Conscientiousness ($\alpha$ = .83); Openness ($\alpha$ = .79), but using paper forms instead of palm pilots.

## Results of Study 3

### Density distributions of personality states

Table 5 shows the results for each state for the full sample, depicting the average state for the average individual, the amount of variance between individuals in states, and the amount of variance within individuals in states. It was calculated that 68% to 72% of the variance in states occurred within individuals. Only 28% to 32% of the variance in states occurred between individuals. Again, people were quite variable.

### Age differences in behavior averages

Even in standardized situations, age group was a significant predictor of behavior for all traits, accounting for between 12% and 26% of the between-individual variance of the personality states. As shown in Table 6, the middle-aged and older adults acted more extraverted, more conscientious, and more open than did the younger adults. Although the pattern of behavior in standardized situations was generally similar to the pattern of behavior in everyday life, there were two notable differences. First, the difference between the younger adults and the other two groups was more pronounced in standardized situations. Second, older adults showed a more positive behavioral profile in the standardized situations.

### Trait questionnaire scores versus behavior averages

The trait questionnaire scores showed somewhat different trends than did the behavior averages from the structured laboratory situations. Figure 3 shows a comparison of the questionnaire scores with the behavior averages for the three traits after conversion into the POMP metric. A 3 (agegroup) × 3 (trait) × 2 (method) repeated measures ANOVA revealed a significant method main effect and method*trait interaction. The trait main effect, agegroup*trait interaction, and agegroup*trait*method interaction were not significant. Importantly, there was a significant method*agegroup interaction ($F$ = 4.37, $p$ < .05). These results mean that behavior in standardized situations revealed significantly different age differences than questionnaires revealed; specifically, they revealed greater differences between younger and middle aged adults.

### Age differences in behavior variability

None of the age differences in behavior variabilities were significant (see Table 6). Thus, in standardized situations, individuals of different ages showed the same degree of within-person variability.

## Discussion

The present examination of cross-sectional age differences in Big-Five behavior demonstrated that behavior averages, just like trait scores, differ among adult age groups. The greatest age differences were identified in Agreeableness, Emotional Stability, Extraversion, and Conscientiousness behavior averages, and the smallest age differences were identified in Openness behavior averages. Importantly, these findings emerge from the traits people actually express in their daily behavior, and thus provide the essential behavioral confirmation of the trends revealed by trait questionnaires. Furthermore, the results suggest that trait questionnaire methodology might actually underestimate the amount of age differences that exist, because differences between age groups were generally more pronounced than typical age differences in retrospective trait questionnaire studies (e.g., Donnellan & Lucas, 2008).

Behavior averages in daily life suggest a slightly different pattern of trait levels in adulthood from the pattern suggested by trait scores on retrospective questionnaires (Donnellan & Lucas, 2008; Roberts et al., 2006; Srivastava et al., 2003). For Extraversion, retrospective questionnaire studies had found a steady decline from younger adulthood to middle age to older adulthood. However, behavior averages revealed that middle-aged adults act just as extraverted or even more extraverted than younger adults. For both Agreeableness and Conscientiousness, questionnaire studies had found a steady increase from younger adulthood to middle age to older adulthood. However, agreeableness and conscientiousness behavior averages did not differ between middle aged and older adults. For Emotional Stability, questionnaire studies had found an increase from younger adulthood to middle age, and then constant levels into older adulthood. However, behavior averages revealed that older adults may behave marginally more emotionally stable than middle-aged adults. Finally, for Openness, the patterns of age differences shown in questionnaire studies were similar to those revealed using behavior averages: middle-aged adults acted slightly, but non-significantly, more open than the other two groups.

The current findings are nonetheless mainly consistent with those of previous longitudinal studies, which have revealed maturational changes in traits that occur across the adult lifespan. Such studies have charted a trajectory of continuing, generally positive, personality development across adulthood and have demonstrated that personality is not “set like plaster” by early adulthood (Helson, 1993; Roberts & DelVecchio, 2000). Specifically, Extraversion and Openness tend to decrease after younger adulthood or middle age, whereas Agreeableness, Conscientiousness, and Emotional Stability tend to increase over the lifespan (Roberts et al., 2006). These two trait groupings reflect the differentiation that Digman (1997) made between higher-order factors of the Big Five, which he conceptualized as personal growth and socialization, respectively. Digman argued that socialization processes (e.g., learning to inhibit inappropriate emotions, developing self-control) is at the heart of personality development (also see Hogan & Roberts, 2004), which is consistent with findings showing that people of older ages have somewhat higher levels of these “socialization” traits. Our studies supported these longitudinal findings with behavioral data, revealing similar trends in age differences of the two trait groupings. We found the “personal growth” traits to be highest in middle-aged adults or to not show age differences whereas we found the “socialization” traits to be high in older adults.

It is important to note that because the current findings are cross-sectional and not longitudinal, the results may be influenced by cohort effects (Costa & McCrae, 1982). For example, the cohorts born across the middle third of the twentieth century may just be, and have been, more agreeable and emotionally stable than the younger millennial cohort is, and will be in the future.

Two of the current findings for behavior in standardized situations suggest the important role of the situation in age differences (e.g., Roberts & Pomerantz, 2004). First, in daily life, older adults acted more similarly to younger adults – low on Extraversion, Conscientiousness, and Openness. But when they were in the same situations as younger adults (in the laboratory), older adults acted like the middle-aged group – higher on the three traits. In everyday life, older adults may not experience environments that evoke extraverted, conscientious or open behaviors, but when they're placed into stimulating environments that do, they may rise to the challenge. Second, younger adults and middle-aged adults differed less on trait questionnaires than they did on behaviors in standardized situations. When the three groups were placed in the same situations, so that situations were not able to contribute to or obscure age differences, age differences actually became much more pronounced. In total, this suggests that the trait questionnaire method may underestimate the amount of personality development in adulthood.

## Implications of Age Differences in Behavior Variability

The current research also was the first test of the degree of behavior variability across the adult lifespan. Two important findings emerged: (1) behavior variability is very high in adulthood, contrary to expectations that older adults might be set in their ways or overly predictable; (2) there were significant age differences in amount of behavior variability for three of the traits, suggesting that variability is indeed a phenomenon relevant to developmental research.

### High variability and personality development

The high variability observed across the lifespan suggests that adulthood is not typically a time of rigidity and stagnation, as is sometimes assumed by lay people (Heckhausen, Dixon, & Baltes, 1989), but is instead a dynamic period. Along with the GLIDE mechanisms of learning and development, discussed in the introduction, the environment may also contribute to this high variability. It is commonly assumed that only younger adults have highly variable environments (Glenn, 1980). However, the current data showed that middle-aged and older adults were as variable or more variable on some traits than were younger adults. Thus, although college environments may shift rapidly (e.g., from one's dorm to class to the library), middle-aged individuals' environments may shift more profoundly. Perhaps the difference between work and home environments is much larger than the difference between dorm and library environments.

### Age differences in within-person variability of trait expression

The intuitions that people have about personality variability -- stormy adolescence versus stable midlife -- seem to be at least somewhat correct. Agreeableness and Emotional Stability, a constellation of traits that Costa and McCrae (2002) linked to anger control, tended to be less variable in older adults. Indeed, research has demonstrated that older adults have greater emotional control in general (Charles & Carstensen, 2007). However, variability in Extraversion and Conscientiousness did not differ much between age groups. Perhaps acting rudely (low Agreeableness) is best to be avoided completely if possible whereas acting quiet and unenergetic (low Extraversion) is sometimes appropriate to the situation or within the goals normative to a developmental stage. Future research should

investigate the outcomes associated with relative levels of behavior variability in context of developmental periods (Baird, Le, & Lucas, 2006).

However, what explains the lack of age differences in variability in the lab sessions? A main reason for conducting Study 3 was to test whether age differences in behavior were due to age differences in ecologies. As proposed by the GLIDE-STRIDE model, shifts in environment across the lifespan may influence the level and variability of one or more of the STRIDE components. One reason for no significant age differences in behavior variabilities may have been the lack of typical age–linked variability in the standardized situations themselves.

### A social-cognitive approach to personality development

Social-cognitive theories argue that people behave variably because of changing situations and changing interpretations of those situations (Mischel & Shoda, 1995). Several of the current findings highlight the value of a social-cognitive approach to explaining personality development. First, a comparison of the everyday life and standardized situation findings suggests that situations affect trait manifestation. Hence, different conclusions about personality development of averages and variabilities are reached when standardizing situations across age groups. Second, within-person variability was high for all adults; in all three age groups, personality expression varied more within people than it did between people. This means that people are flexible in how they act, and that a full explanation of personality will require an account of this adaptability.

## Limitations and Future Directions

The most significant limitation of the current studies was their cross-sectional nature. We tried to constrain the groups to be as similar as possible except for differences in age. However, it is possible that cohort or selection differences could explain some of the differences between age groups. Furthermore, this limitation may partially account for the discrepancies between our findings and those resulting from questionnaire-based longitudinal studies. Because of the intensive nature of ESM studies, and the newness of the technology, there have been few longitudinal studies using the methodology. Although the current findings are limited by the cross-sectional method employed, it is our hope that the current excitement about the experience-sampling method in personality (Conner, Barrett, Tugade, & Tennen, 2007; Fleeson, 2007a; Mroczek, 2007) will pay off in future studies which are able to test these findings longitudinally.

A second limitation is the use of self-reports of behavior; experience-sampling methodology deals with some of the shortcomings of self-reports (such as summarizing a great deal of information and retrospecting far into the past), but is still a self-report method. Other behavioral methodologies might be profitably used to study age differences in variability, such as the electronically-activated recorder (EAR), which records multiple audio samples of a person's immediate environment each day (e.g., Mehl & Pennebaker, 2003; Vazire & Mehl, 2008).

A third limitation was that the adult samples, because of an attempt to constrain them to be similar to the younger adult samples, were probably not representative of the population at large. In particular, they probably tended to be higher in SES and educational attainment than average. This limitation may have influenced the proportion of within-person variance to between-person variance, because the current samples of adults may have fewer between-person differences than does the population. Fourth, some of the samples were relatively small for analyses of group differences, although fairly large in size for experience-sampling research.

Fifth, the current research did not investigate subcomponents of Big Five personality traits. Roberts et al.'s (2006) meta-analysis found that the Extraversion subcomponents of Social Dominance (surgency, assertiveness) and Social Vitality (sociability, fun-seeking) differed in their trajectories: social vitality slowly decreased over the lifespan and social dominance increased substantially between youth and middle age (cf. Helson & Kwan, 2000). Unfortunately, our measures of Extraversion were not divisible into these components, possibly explaining why we observed a different pattern of age differences for Extraversion. Future work on behavior averages and variability should investigate the distinct subcomponents.

## Conclusions

These studies provided the first tests of lifespan differences in trait-relevant behavior averages and variabilities, and supported the usefulness of combining trait and social-cognitive approaches to personality development (Fleeson & Noftle, 2008). When tested in terms of actual behavioral expression of traits, the overall pattern of positive personality development revealed by the retrospective trait questionnaire method was verified. However, the way people act in everyday life did not follow the specific trajectories identified in retrospective questionnaires for four of the five traits. Furthermore, age differences in behavior in standardized situations were significantly larger in magnitude, suggesting that trait questionnaires may underestimate actual personality development. Everyday behavior reveals a more negative picture of personality during retirement, although the lab studies suggest that older people may have the capability to act as extraverted, conscientious, and open as people in midlife if they place themselves in stimulating situations. High levels of behavior variability across the lifespan, coupled with significant age differences in amount of behavior variability, calls for future personality development research from a within-person variability perspective, one that accounts for people's changing reactions to changing situations.

## Acknowledgments

Preparation of this article was supported by National Institute of Mental Health Grant R01 MH70571, and by a Kirby Faculty Fellowship. Erik E. Noftle is now in the Department of Psychology at Linfield College, McMinnville, Oregon, 97128.

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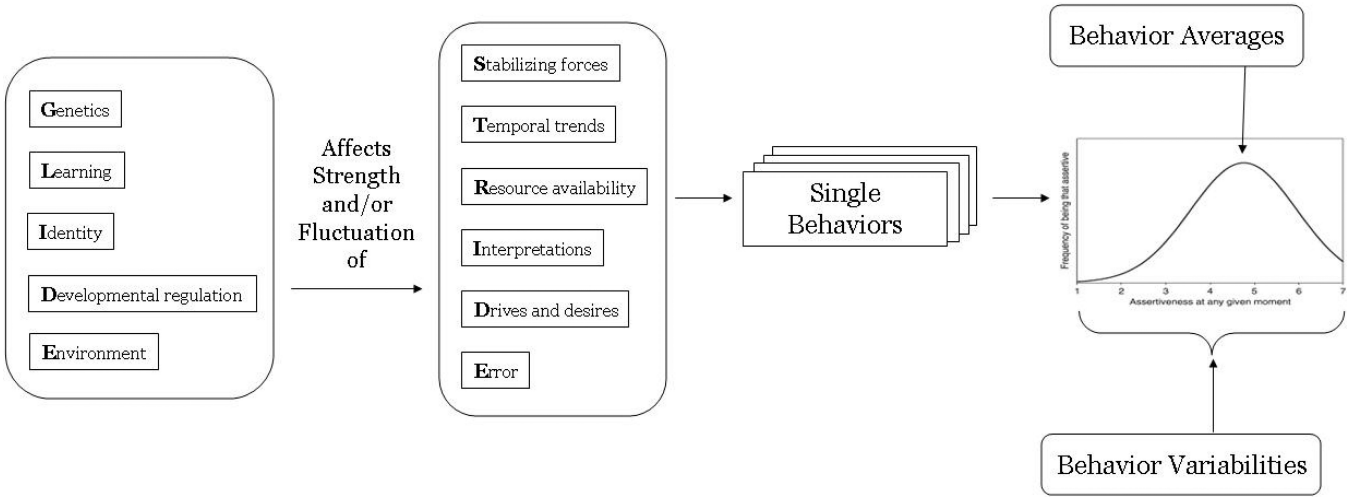
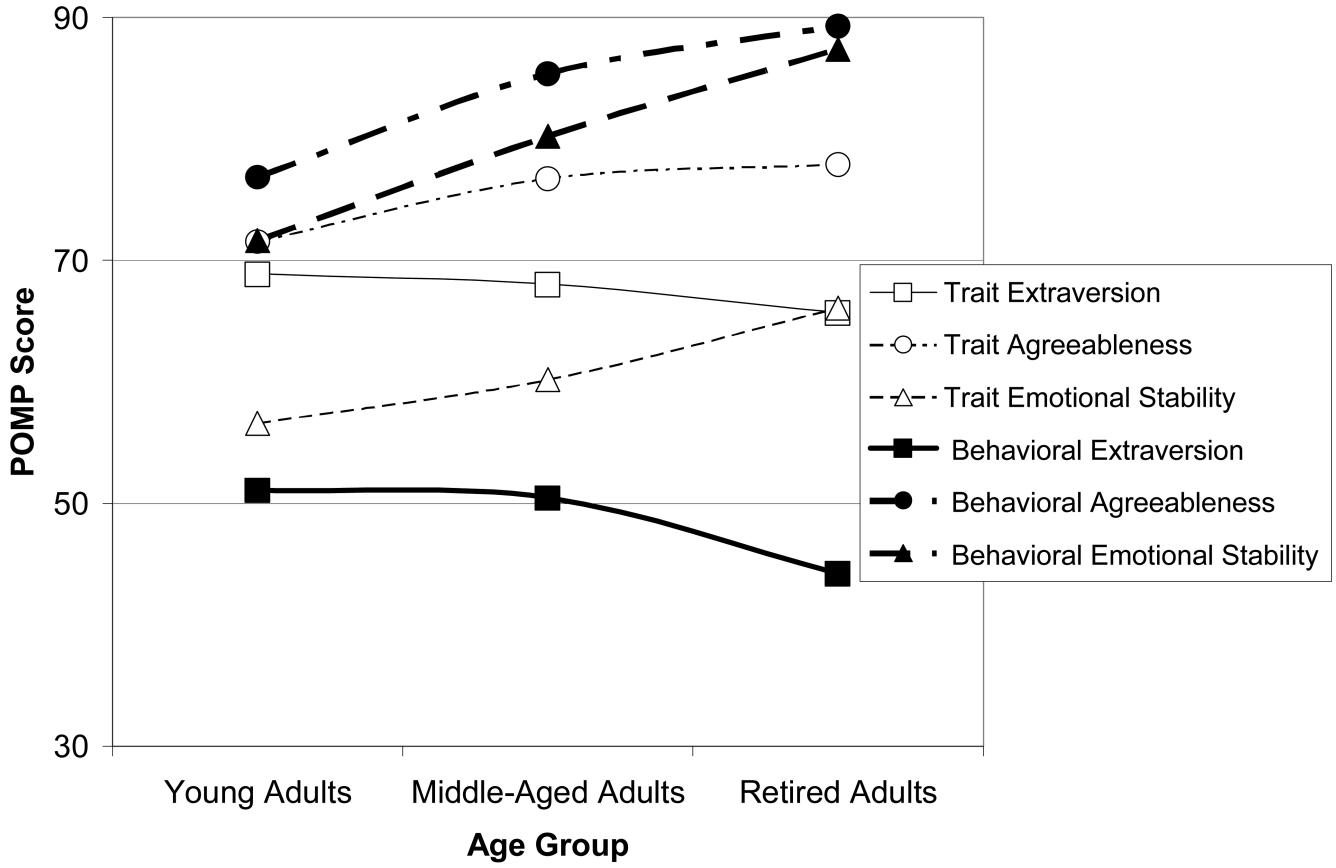
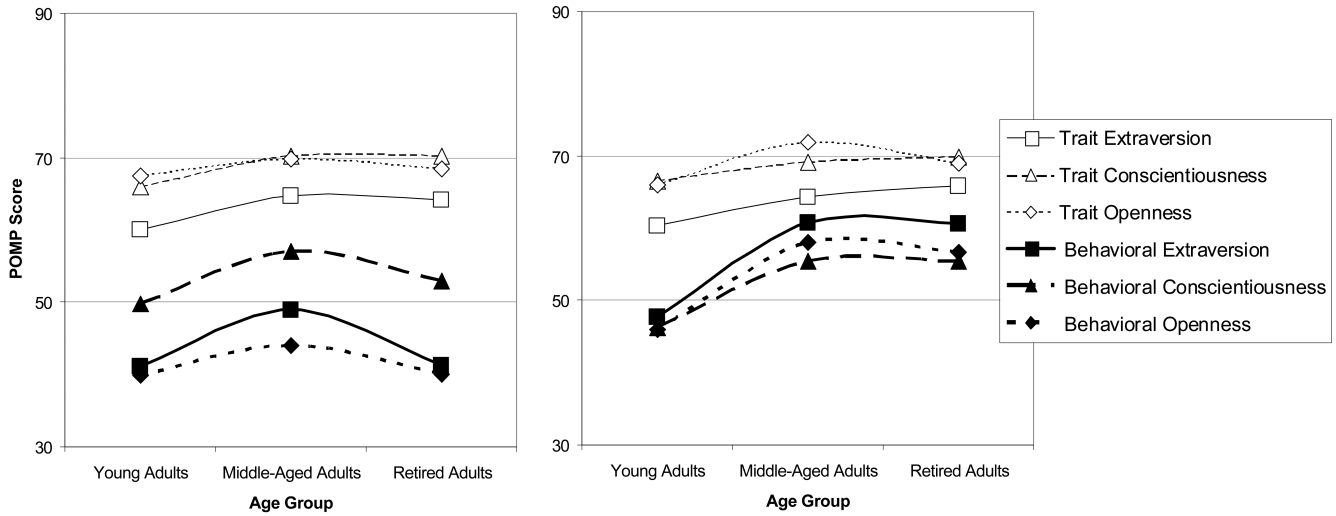



**Figure 1.**
Development of density distributions according to the GLIDE-STRIDE model.




*Note*. $N = 76$ individuals.

**Figure 2.**
Age differences in daily life behavior averages versus trait questionnaire scores for extraversion, agreeableness, and emotional stability (Study 1).




*Note*. $N = 228$ individuals (Panel 1); $N = 132$ individuals (Panel 2).

**Figure 3.**

Age differences in daily life behavior averages versus trait questionnaires (Panel 1; Study 2) and laboratory session behavior averages versus trait questionnaires (Panel 2; Study 3) for extraversion, conscientiousness and openness.

## Table 1

Density Distributions of State Extraversion, Agreeableness, and Emotional Stability in Daily Life (Study 1)

| Distribution Parameter | Extraversion | Agreeableness | Emotional Stability |
|---|---|---|---|
| Average level | 3.41 | 5.18 | 4.97 |
| Variance between individuals | .29 (19%) | .22 (37%) | .41 (47%) |
| Variance within individuals | 1.23 (81%) | .37 (63%) | .47 (53%) |
| Stability of individual differences | | | |
| In average level | .84** | .88** | .92** |
| In amount of variation | .72** | .65** | .61** |

*Note*. Results of three unconditional multilevel models, one for each state ($N$ = 80 individuals, $N$ = 3784 to 3969 occasions). The average level shows the typical participant's mean level of the state. Percentages indicate that the percents of total variance in states that occurred within participants were much greater than the percentage of total variation in states that occurred between participants. Nonetheless, the stability lines indicate that individual differences in average state level and in amount of variation in states were both stable from one week to the next.

** $p < .01$.

**Table 2**

Age Differences in Behavior Averages and Variabilities of Extraversion, Agreeableness, and Emotional Stability in Daily Life (Study 1)

| Trait | Aspect of Behavior | Young Adults | Middle-aged Adults | Older Adults | *F* |
|---|---|---|---|---|---|
| Extraversion | Behavior averages (*M*) | $3.56_{a}$ | $3.52_{a}$ | $3.21_{b}$ | $3.09^{\dagger}$ |
| | Behavior variability (*Var*) | $1.28_{ab}$ | $1.42_{a}$ | $1.00_{b}$ | $3.71^{*}$ |
| Agreeableness | Behavior averages (*M*) | $4.84_{b}$ | $5.27_{a}$ | $5.42_{a}$ | $12.92^{**}$ |
| | Behavior variability (*Var*) | $.54_{a}$ | $.31_{b}$ | $.33_{b}$ | $7.75^{**}$ |
| Emotional Stability | Behavior averages (*M*) | $4.58_{b}$ | $5.01_{a}$ | $5.34_{a}$ | $10.61^{**}$ |
| | Behavior variability (*Var*) | $.62_{a}$ | $.44_{b}$ | $.38_{b}$ | $4.74^{*}$ |

*Note*. Different subscripts indicate significant differences between values in each row. $N = 80$ individuals.

$^{\dagger}p < .10$

$^{*}p < .05$

$^{**}p < .01$.

## Table 3

Density Distributions of State Extraversion, Conscientiousness, and Openness in Daily Life (Study 2)

| Distribution Parameter | Extraversion | Conscientiousness | Openness |
|---|---|---|---|
| Average level | 3.16 | 3.63 | 3.04 |
| Variance between individuals | .33 (19%) | .43 (22%) | .53 (35%) |
| Variance within individuals | 1.40 (81%) | 1.50 (78%) | 1.00 (65%) |
| Stability of individual differences | | | |
| In average level | .68** | .77** | .82** |
| In amount of variation | .51** | .62** | .58** |

*Note*. Results of three unconditional multilevel models, one for each state ($N$ = 233 individuals, $N$ = 5317 occasions). For the Stability analyses, the N is smaller because of missing data ($N$ = 173 individuals). The average level shows the typical participant's mean level of the state. Percentages indicate that the percents of total variance in states that occurred within participants were much greater than the percentage of total variation in states that occurred between participants. Nonetheless, the stability lines indicate that individual differences in average state level and in amount of variation in states were both stable from one week to the next.

** $p < .01$.

**Table 4**

Age Differences in Behavior Averages and Variabilities of Extraversion, Conscientiousness, and Openness in Daily Life (Study 2)

| Trait | Aspect of Behavior | Young Adults | Middle-aged Adults | Older Adults | *F* |
|---|---|---|---|---|---|
| Extraversion | Behavior averages (*M*) | $3.07_b$ | $3.42_a$ | $3.06_b$ | $7.07^{**}$ |
| | Behavior variability (*Var*) | 1.36 | 1.39 | 1.30 | .26 |
| Conscientiousness | Behavior averages (*M*) | $3.50_b$ | $3.84_a$ | $3.66_{ab}$ | $4.62^{*}$ |
| | Behavior variability (*Var*) | 1.31 | 1.59 | 1.51 | 2.41 |
| Openness | Behavior averages (*M*) | 3.00 | 3.18 | 2.99 | 1.29 |
| | Behavior variability (*Var*) | $.78_b$ | $1.11_a$ | $1.10_a$ | $8.19^{**}$ |

*Note*. Different subscripts indicate significant differences between values in each row.

*N* = 233 individuals, *N* = 5317 occasions

$^{*}$ $p < .05$

$^{**}$ p < .01.

## Table 5

Density Distributions of State Extraversion, Conscientiousness, and Openness in Standardized Laboratory Situations (Study 3)

| Distribution Parameter | Extraversion | Conscientiousness | Openness |
|---|---|---|---|
| Average level | 3.81 | 3.61 | 3.67 |
| Variance between individuals | .35 (27%) | .36 (31%) | .39 (29%) |
| Variance within individuals | .94 (73%) | .80 (69%) | .96 (71%) |

*Note*. Results of three unconditional multilevel models, one for each state ($N$ = 134 individuals, $N$ = 2776 to 2883 occasions). The average level shows the typical participant's mean level of the state. Percentages indicate that the percents of total variance in states that occurred within participants were much greater than the percentage of total variation in states that occurred between participants.

**Table 6**

Age Differences in Behavior Averages and Variabilities of Extraversion, Conscientiousness, and Openness in Standardized Laboratory Situations (Study 3)

| Trait | Aspect of Behavior | Young Adults | Middle-aged Adults | Older Adults | *F* |
|---|---|---|---|---|---|
| Extraversion | Behavior averages (*M*) | $3.39_b$ | $4.06_a$ | $4.03_a$ | $22.35^{**}$ |
| | Behavior variability (*Var*) | 1.02 | .84 | .81 | 2.16 |
| Conscientiousness | Behavior averages (*M*) | $3.31_b$ | $3.80_a$ | $3.76_a$ | $9.68^{**}$ |
| | Behavior variability (*Var*) | .71 | .80 | .79 | .56 |
| Openness | Behavior averages (*M*) | $3.29_b$ | $3.93_a$ | $3.84_a$ | $15.22^{**}$ |
| | Behavior variability (*Var*) | .95 | .85 | .94 | .50 |

*Note*. Different subscripts indicate significant differences between values in each row. ($N$ = 134 individuals, $N$ = 2551 to 2883 occasions).

$^{**}p < .01$