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Age-Related Differences and Change in Positive and Negative Affect Over 23 Years

Susan Turk Charles
University of California, Irvine

Chandra A. Reynolds and Margaret Gatz
University of Southern California

Positive and negative affect, measured by the Bradburn Affect Balance Scale, were studied in a longitudinal sample spanning from 1971 to 1994. The sample (N = 2,804) represented 4 generations of families. Linear trend analyses compared generations over time for positive and negative affect and also examined the possible influences of neuroticism and extraversion on initial levels of affect and patterns of change in affect. Negative affect decreased with age for all generations, although the rate was attenuated among the oldest adults. Higher neuroticism scores also attenuated the decrease in negative affect across time. For positive affect, the younger and middle-aged adults showed marked stability, but the older group evidenced a small decrease over time. Higher levels of extraversion were related to more stability in positive affect.

Overall, people are generally happy (Diener & Diener, 1996). People in the United States report their lives as more positive than negative regardless of their socioeconomic status and functional disability and across samples of both Caucasians and African Americans (Andres & Withey, 1976; Chwalisz, Diener, & Gallagher, 1988; Veenhoven, 1993). A question among life span researchers is whether this positive outlook changes over time. Is well-being stable over the adult life course, or does it change? If it does change, do people experience the "golden years" in old age and feel even more content and satisfied, or is midlife a time of crisis, and are the multiple losses of old age accompanied by a more somber, less positive view of life?

Age Differences in Well-Being

The first theorists to address possible developmental trends in affect concluded that emotional well-being would parallel physical functioning, with both reaching their greatest peak in young adulthood and declining thereafter (Banham, 1951; Buhler, 1935; Frenkel-Brunswik, 1968). In addition, middle age was often considered a crisis point when people would begin to question their purpose in life when facing the "depressing" realization of mortality (e.g., Levinson, Darrow, Klein, Levinson, & McKee, 1978).

Empirical findings, however, have not supported these theories. Both earlier studies (Neugarten, Havighurst, & Tobin, 1961) and more recent ones (Diener & Diener, 1996; Lucas & Gohm, 2000; Malatesta & Kalnok, 1984) using cross-sectional data have found negligible age differences in life satisfaction and well-being (for a complete review, see Diener & Suh, 1998). In addition, researchers have failed to find evidence for a mid-life crisis (McCrae & Costa, 1990; Wethington, Cooper, & Holmes, 1997). Some studies have found even greater well-being among older adults, in that older adults report less anxiety and greater contentment (e.g., Lawton, Kleban, & Dean, 1993) and have a higher balance of positive to negative affect than their younger counterparts (Ryff, 1989).

Psychological well-being can be measured with a variety of scales, but for most researchers, well-being consists of both positive and negative affect. Studies have found that positive and negative affect are only moderately correlated (Bradburn, 1969; Carstensen, Pasupathi, Mayr, & Nesselroade, 2000) and are not related to the same events in a person's life (Baker, Cesa, Gatz, & Mellins, 1992; Diener & Larson, 1984; Watson, Clark, & Tellegen, 1988). Therefore, the underlying mechanism behind potential age changes in well-being is best understood when positive and negative affect are examined separately. Because well-being is often conceptualized as the balance between positive and negative affect (e.g., Mroczek & Kolarz, 1998; Ryff, 1989), an increase in well-being could be the result of an increase in positive affect, a decrease in negative affect, or a combination of the two factors. Without a separate examination of each factor, the nature of any difference in overall well-being is impossible to discern.

Although many cross-sectional studies have found differences in positive and negative affect for younger and older adults, few longitudinal studies have investigated whether these differences are the result of cohort effects or developmental trends across the life span. In this study, we examined the trajectory of change in positive and negative affect across a little more than two decades. The large sample used in this study represented people ranging from young adulthood to very old age who participated at the first time point and then were followed for the next 23 years. The availability of a large longitudinal sample including five time

Susan Turk Charles, Department of Psychology and Social Behavior, University of California, Irvine; Chandra A. Reynolds and Margaret Gatz, Department of Psychology, University of Southern California.

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Correspondence concerning this article should be addressed to Susan Turk Charles, Department of Psychology and Social Behavior, University of California, Irvine, 3340 Social Ecology II, Irvine, California 92697-7085. Electronic mail may be sent to scharles@uci.edu.

points allowed for the use of growth curve analyses to test for individual change in positive and negative affect over time. In addition, this sample contained people of different ages at each time point, thereby allowing for the comparison between same-aged individuals from different time periods to test for cohort effects. The unique qualities of these data and current methodological tools allowed for an extensive analysis into how positive and negative affect change over time for individuals and whether group differences exist between cohorts.

Age Differences in Negative Affect

Results from several studies suggest that older adults score lower on measures of both frequency and intensity of negative affect (e.g., Diener, Sandvik, & Larsen, 1985). Negative emotion is reported and observed less often in older adults than younger adults (Barrick, Hutchinson, & Deckers, 1989; Gross et al., 1997). Similarly, older adult couples express less negative affect when discussing areas of conflict with each other (Carstensen, Graff, Levenson, & Gottman, 1996) and display fewer negative emotions such as anger and disgust compared with middle-aged spouses (Levenson, Carstensen, & Gottman, 1994).

Not all studies, however, find decreases in negative affect across the life span. One cross-sectional study including people from 25 to 74 years old found that self-reported negative affect was negatively correlated with age only among married men and did not differ with age for unmarried men or for women regardless of their marital status (Mroczek & Kolarz, 1998). Another study found that negative affect decreased from age 18 until about age 60 but did not change from age 60 to age 94 (Carstensen et al., 2000). Similarly, a larger study with participants from 43 nations found that self-reported negative affect decreased until about age 60, when it increased slightly with age (Diener & Suh, 1998). Other cross-sectional studies have found that negative affect, defined by depressive symptoms, declines in the middle years but increases in very old age, with rates highest among the youngest and oldest age groups (Gatz, Johansson, Pedersen, Berg, & Reynolds, 1993; Kessler, Foster, Webster, & House, 1992). Furthermore, another study found that negative affect was higher for old-old than for young-old individuals (Smith & Baltes, 1993).

The aforementioned cross-sectional findings compared people representing most of the life course, from 16 to 68 years old in one study (Diener et al., 1985), from 18 to 94 years old in another study (Carstensen et al., 2000), and from 70 to 103 years old in a third study (Smith & Baltes, 1993). No longitudinal study of positive and negative affect has followed people across such an extensive period of time. One longitudinal study reported stability for negative affect across two points 10 years apart (Costa et al., 1987), and another study found not only great consistency but also a slight decrease in negative affect between two time points over a 13-year interval (Stacey & Gatz, 1991). Taking cross-sectional and longitudinal evidence together, findings suggest a great deal of intraindividual stability for negative affect but also a decrease in successive age groups until very old age, at which time there is an upturn in levels of negative affect.

Age Differences in Positive Affect

For positive affect, the pattern of age-related differences is less clear. One study found that older adults reported slightly higher levels of positive affect than younger adults (Gross et al., 1997). Another study found an increase in positive affect with age among women but only among men who scored low on extraversion (Mroczek & Kolarz, 1998). In contrast, large cross-cultural studies have found consistent decreases in positive affect with age (Diener & Suh, 1998; Lucas & Gohm, 2000). Still others have found no significant differences in positive affect between younger and older adults (Barrick et al., 1989; Vaux & Meddin, 1987). In longitudinal analyses, positive affect was found to be stable across a 10-year span (Costa et al., 1987). Another study found that, across 13 years, positive affect was relatively stable but declined slightly, particularly for the oldest adults (Stacey & Gatz, 1991). Overall, the findings for positive affect are less consistent than those for negative affect. For the most part, few age differences exist, and when differences have been found, some suggest greater positive affect (e.g., Mroczek & Kolarz, 1998) and others a slight decrease in positive affect with age (Diener & Suh, 1998; Stacey & Gatz, 1991).

Developmental Processes and Cohort Effects

Researchers have developed models to explain affective experience along the life span. Action theorists, such as Brandstädter and his colleagues, describe intentional actions that people take to maintain their level of functioning (Brandtstädter, 1999). Accordingly, people use either accommodative or assimilative techniques to adjust to biological and environmental changes in their lives and maintain their levels of functioning (Brandstädter & Greve, 1994). This model would explain the stability of positive and negative affect as the use of intentional actions on the part of older adults. A change in affect would most probably be interpreted as a decline—the result of not adapting to accumulated physical and social losses.

Socioemotional selectivity theory (Carstensen, 1993, 1995) makes specific predictions about developmental change in emotional well-being. According to this theory, people are consciously aware of time left in life, and their goals reflect this awareness. Older adults, recognizing that time is limited, optimize emotional meaning in their lives. This optimization often includes structuring their lives to avoid potentially negative events and choosing well-known social partners who are most affectively salient (Carstensen, 1995; Fredrickson & Carstensen, 1990). This theory posits that negative affect decreases as a result of older adults restructuring their goals to maximize positive interactions and minimize negative encounters with others.

Although developmental models do not dismiss the possibility of cohort effects also influencing emotional processes, cohort effects may in and of themselves explain age differences in affective experience (e.g., Felton, 1987). According to this model, sociocultural processes are paramount in forming and maintaining affective experience. The sweeping geopolitical and social changes of the 20th century have led to cohort differences in attitudes, for example, differences in social and political opinion (e.g., Alwin, 1996). Subjective well-being, dependent on internal perceptions and evaluations, may be sensitive to these cohort effects (Felton, 1987; Klerman & Weissman, 1989). In a review of epidemiological studies, Wittchen, Knauper, and Kessler (1994) suggested that successively more recently born cohorts in the 20th century have greater depression and more depressive symptoms compared with

earlier born cohorts. Age differences in depression reported in the literature may reflect historical effects, and differences in well-being may mirror this pattern.

In sum, studies of age differences in well-being must address not only whether these changes in affect, if they are indeed present, are the result of developmental processes or cohort effects but also whether these changes occur in positive affect, negative affect, or both. To further complicate the issue, other factors may influence the relationship between age and affect. For example, personality traits hold predictive power that varies for positive and negative affect (DeNeve & Cooper, 1998; Diener, 1996). Neuroticism is predictive of depression (Costa & McCrae, 1990), and extraversion correlates with positive affect. Both of these variables have been shown to influence the relationship between age and affect (Mroczek & Kolarz, 1998), but how these variables influence intraindividual change in positive and negative affect has not been explored.

The Present Study

In this study, we examined self-reported positive and negative affect across 23 years for people who at the first time point ranged from 15 to 90 years old. This study extended research by Stacey and Gatz (1991), who investigated age group differences in positive and negative affect over a 14-year period. They found marked stability in affect, although negative affect showed slight decreases over time and positive affect also showed a slight decrease, particularly among the oldest adults. By using linear trend analyses, we were able to examine individual differences in change in affect across five time points over 23 years for four generations, representing adolescents to people in their mid-80s. This methodology extended the age range of analysis and allowed for a more precise measurement of change over time. In addition, we examined the frequency of endorsement for scale items. Older adults report less emotional surgency with age (e.g., Lawton, Kleban, Rajagopal, & Dean, 1992); therefore, it is of interest whether any age-related decrease in negative or positive affect can be attributed to a decrease in the endorsement of questions related to emotional surgency, for example, feeling restless or excited. On the basis of previous findings and current theory (e.g., Carstensen & Charles, 1998), we hypothesized that negative affect would decrease over time, with an upturn only in very old age. For positive affect, we predicted stability across time. However, because other variables might interact with age and affect, such as life events (Stallings et al., 1997) and personality variables (Mroczek & Kolarz, 1998), we expected considerable interindividual variability (variance) in the findings. We also examined how individual differences on baseline measures of personality would influence positive and negative affect. We hypothesized that high levels of neuroticism would be associated with high levels of negative affect and that high levels of extraversion would be associated with high levels of positive affect. We made no specific predictions about the influences of these personality traits on changes in either positive or negative affect.

In addition, we explored possible covariates that may account for the relationship between age and affect. Both health status and education are related to age, with older age associated with poorer health (e.g., Gatz, Harris, & Turk-Charles, 1995) and older cohorts having a lower education level (e.g., Mroczek & Kolarz, 1998). In addition, health status has also been related to negative affect and depression (Blazer & Koenig, 1996; Halpert, Braunschweig, & Peters, 1998). Worse health, therefore, is predictive of both higher negative affect and older age, and any interaction between health, age, and affect would run counter to our hypotheses. We included these covariates to ensure that any age differences that were found, either confirming or disconfirming the hypotheses, could not be viewed as a result of these covariates.

Age-sequential analyses investigated the possibility of historical effects. Because greater evidence of depressive disorders appears in successive cohorts born in this century (Wittchen et al., 1994), we hypothesized that same-aged adults in 1991 compared with those in 1971 would have lower levels of positive affect and greater negative affect.

Method

Sample

The Longitudinal Study of Generations. The sample was derived from participants in an ongoing longitudinal study of four generations of family members. The study began in 1971 when the records of a prepaid health plan in the Los Angeles area were used to identify men who were 55 years of age and older who had a dependent enrolled in the plan. A screening questionnaire was sent to a random subset of this group (1 in 6) to see if they had an adult living child and also a grandchild who was between 16 and 26 years old. In 1971–1972, questionnaires were sent first to the grandchildren (the third generation), these children's parents (the second generation), and then the grandparents (the first generation)—consisting of the men who responded to the original screening questionnaire and their wives. The overall response rate for the initial 26-page survey was 64% (N = 2,044). In 1984–1985, a second questionnaire was sent to these original participants, creating an almost 14-year interval between Time 1 and Time 2. At Time 2, family members were added who were on the original list and had not responded at Time 1, as well as new spouses or respondents who were unknown at Time 1. From Time 2, participants were contacted every 3 years—in 1988 at Time 3, in 1991 at Time 4, and in 1994 at Time 5. At Time 3, spouses from the third generation (n = 203) and additional family members from the second (n = 38) and first (n = 8) generations who had not heretofore responded were added. At Time 4, the fourth generation, children of the third generation (n = 196) who were at least 16 years old, was included. At Time 5, more spouses were added (n = 18), as well as children who had not been included from the second generation (n = 1) or the third generation (n = 7). Even if someone who had participated before had not responded to the most recent survey, that person was contacted again for the following surveys. Thus, some people had sporadic response patterns (e.g., 150 participants responded at Times 1 and 3 but not at Time 2). The response rate for all eligible family members was 62% at Time 2 (N = 1,333), 66% at Time 3 (N = 1,482), and 71% at Time 4 (N = 1,734). In 1994, 1,682 participants responded, including 79% who had responded at the previous time point. Participants were dropped from the study if they divorced a member of the family being studied. The sample was predominantly Caucasian American (85%), 2.6% were Hispanic American, 1.6% were African American, 0.7% were Native American, and 0.3% were Asian American. In addition, 4.9% reported another ethnicity outside of the aforementioned groups, and 5% declined to state their ethnicity. Tracking these family members was as comprehensive as possible, especially at Time 2 when almost 14 years had passed since the initial contact, and included mail and phone contact and regular updates on deaths and the marital status of the participants. When the reason for nonparticipation was known, death and disability were the most common reasons for dropout (Bengtson & Roberts, 1991). Table 1 presents the

Table 1
Reason for Not Participating at Each Time Point, by Age Group

Reason for not participating	Time 2			Time 3			Time 4		
	Young	Middle	Older	Young	Middle	Older	Young	Middle	Older
Responded to survey but missing data for affect items	8	17	23	3	15	12	6	12	17
Dead	12	32	194	1	18	36	4	17	20
Incapacitated	2	0	16	2	1	10	1	3	6
Refused	8	26	17	10	10	5	18	8	2
Unable to locate	64	17	27	17	9	4	8	2	1
Dropped from the study	19	7	7	1	2	0	8	5	1
Reason unknown	232	134	42	65	35	5	107	67	2
Total	345	233	326	99	90	72	152	114	49

Note. The breakdown, as displayed for Times 2 to 4, was unavailable at Time 5. Young group = Generation 3; middle group = Generation 2; older group = Generation 1.

number of respondents and reasons for not responding at each time point, with Generation 1 representing the oldest age group, Generation 2 the middle age group, and Generation 3 the youngest age group. For a complete description of the Longitudinal Study of Generations, refer to Bengtson and Roberts (1991).

Sample for the present study. Table 2 presents the number of people, mean age, and education level for each generation (young, middle, and older) at each time point that had responded to the questionnaire and completed the affect questions. Comparisons between people who did not participate at the next time point and those who continued to the next time point showed no significant differences in positive and negative affect, suggesting that the dependent variables of interest were not related to attrition. Nonetheless, because random attrition may have biased the sample, latent growth curve analyses included all possible respondents regardless of response pattern (McArdle & Hamagami, 1992).

Because this sample included multiple members of the same family, dependency of the data was a concern. Therefore, an independent subsample from the group of participants eligible to participate (displayed in Table 2) was derived by randomly including one member from each family to ensure that dependency was not biasing the results. All reported results include both the full sample—including all family members—and the independent sample.

Table 2
Participants Used in the Linear Growth Curve Analyses, the Age-Sequential Analyses, or Both

Statistic	1971	1985	1988	1991	1994
			Generation 1 (Oldest adults)		
n	487	190	151	112	85
Mean age	67.03 (6.44)	77.06 (5.91)	79.53 (4.99)	81.63 (4.61)	84.36 (5.41)
Age range	44–90	57–98	61–95	64–92	67–102
			Generation 2 (Middle-aged adults)		
n	691	536	543	474	519
Mean age	43.81 (5.29)	56.58 (5.29)	59.87 (5.25)	62.89 (5.21)	66.13 (5.35)
Age range	30–67	37–80	41–76	40–86	43–90
			Generation 3 (Younger adults)		
n	814	546	734	678	699
Mean age	19.44 (2.86)	32.11 (3.03)	35.84 (3.80)	38.77 (4.00)	42.15 (4.02)
Age range	15–30	17–42	19–55	24–60	26–63
			Generation 4 (Youngest adults)		
n				196	149
Mean age				20.13 (4.00)	22.99 (4.02)
Age range				14–38	17–41

Note. Ages are expressed in years. Standard deviations are presented in parentheses. On average, Generation 1 had completed some high school. Generation 2 had completed high school or vocational school. Generation 3 had completed high school and some additional vocational training. Generation 4 had completed high school or vocational school. Generation 4 adults were not used in the linear growth curve analyses because they lacked the longitudinal data necessary to study trends over time, but their 1991 data were used in the age-sequential analyses.

Measures

Demographic questions. Demographic information was obtained from self-reported responses by the participants for questions asking about their date of birth and the number of years of education they had obtained. In addition, participants were asked about their marital status at every time point.

Bradburn Affect Balance Scale. The Bradburn Affect Balance Scale (Bradburn, 1969), included at every time point, consists of 10 questions answered with "yes" or "no," 5 concerning positive affect and 5 concerning negative affect. The positive affect questions were as follows: During the past few weeks, did you ever feel particularly excited or interested in something? proud because someone complimented you on something you had done? pleased about having accomplished something? on top of the world? that things were really going your way? The negative affect questions read as follows: During the past weeks, did you feel so restless that you couldn't sit long in a chair? very lonely or remote from other people? bored? depressed or unhappy? upset because someone criticized you? Separate scores for positive and negative affect were obtained by summing the number of endorsed positive and negative questions separately, giving a score of 1 for each "yes" response and a score of 0 for each "no" response. Scores ranged from 0 to 5 for both positive and negative affect, with higher scores indicating higher positive and higher negative affect.

Self-rated health measure. Self-rated health was measured with one item asking people to rate their health as compared with that of their peers, using a 3-point rating of 1 (*excellent*), 2 (*good*), or 3 (*fair to poor*). Data were collected using this question at Times 2, 3, 4, and 5. At Time 1, only the two oldest age groups were asked about their health, and two different questions were used. These two questions—whether their health was excellent and whether they had poor health—were answered with "yes," "not sure," or "no." These last two questions were combined to form one measure of health. People who said they had excellent health were scored as 1 (*excellent*), people who said they had poor health were given a 3 (*fair to poor*), and people who said they were not sure if they had excellent health but reported that they did not have poor health were given a 2 (*good*).

Functional health. Functional health was assessed at the last four time points by five questions asking about the respondents' ability to perform activities of daily living, consisting of their ability to walk up and down stairs; walk more than one block; prepare meals; do household chores; and take care of their own personal hygiene needs, such as bathing themselves and cutting their toenails. Participants responded on a 4-point scale, with 1 indicating that they were able to do the task without difficulty and 4 indicating that they could not do the task at all. Scores from all five questions were summed, with a higher score indicating worse health.

Neuroticism. Neuroticism was measured at Time 2 by using a short form (Form B) of the Eysenck Personality Inventory (Eysenck & Eysenck, 1964), which has been used in previous studies (e.g., Floderus-Myrhed, Pedersen, & Rasmuson, 1980). For each question, people responded with either 1 (*yes*) or 0 (*no*), for a total score ranging from 0 to 9. Extremely high scores represent people who tend to be moody, touchy, anxious, and restless, whereas extremely low scores represent people who are very stable, calm, even-tempered, and reliable.

Extraversion. Like neuroticism, extraversion was also measured at Time 2 by using a short form (Form B) of the Eysenck Personality Inventory (Eysenck & Eysenck, 1964; Floderus-Myrhed et al., 1980), with each person responding either 1 (*yes*) or 0 (*no*) to nine questions, for a total score ranging from 0 to 9. Extremely high scores represent someone who is outgoing and socially oriented, whereas extremely low scores represent someone who is more introverted.

Analyses

Latent growth curve analyses. The method used to examine change was based on structural equation models of latent growth curves (for details, see McArdle, Prescott, Hamagami, & Horn, 1998). The model presented in Figure 1 is a slope and intercept model of change on the affect scores. This model is akin to a random coefficients model (Bryk & Raudenbush, 1992) in which individual regression models are fitted to each participant's longitudinal profile of data as well as an average model of growth for the entire sample. The variation in individual regression coefficients from the group model may then be examined for their relationship to selected covariates (for purposes of Figure 1, neuroticism). Typical of many representations of structural equation models, the squares in Figure 1 represent observed, or measured, variables, whereas the circles denote latent variables; single-headed arrows represent regression coefficients, and double-headed arrows denote covariation. The triangle, though less customary, represents a unit constant that allows for the estimation of means; the circles within squares represent data that are available for an individual participant at some but not necessarily all time points (McArdle et al., 1998).

According to the model used in these analyses (shown in Figure 1), individual scores at any one time are a linear function of a latent intercept (I), slope (S), and random error ($u_0 - u_4$). I* and S* refer to the standardized scores of I and S, respectively. The model fitting procedure entails fitting individual growth models to all available data; repeated measurements on the affect measure are indicated by the y_0 through y_4 variables. The paths from the latent slope to the observed scores are the age basis coefficients, B_1–B_4, which are defined in the present case as an individual's observed age minus the median age of the sample at Time 1 (35.5 years). The random errors or uniquenesses ($u_0 - u_4$) represent unaccounted variation by fitting the linear growth model to the affect scores; note that, by definition, they are fixed at the same u value at all time points. The means (M_i = the mean intercept and M_s = the mean slope) are the estimates of the growth model for the entire sample, centered at a particular age (in this case, 35.5 years). That is, the model estimates, specifically M_i and M_s, pertain to the centering age (i.e., the expected intercept and slope at 35.5 years in the present case). A different centering age would make no difference in terms of absolute fit of the models; however, the group intercept and slope parameters, M_i and M_s, would adjust to reflect level and slope for that centering age. Deviations from the group shape are captured by parameters reflecting deviations from the group intercept (D_i) and slope (D_s). Furthermore, the relationship between initial level and slope is represented by the correlation between level and slope (r_{is}). Figure 1 also depicts a measured covariate (i.e., neuroticism) that is correlated with both the intercept (e.g., level) and the slope. For each covariate used in the latent growth models, data from only one time point were used.

Models were fit to the independent sample as well as to the full sample. In addition, models were often compared with one another to find the best fitting model for the data. For example, two models were fit to the data to test hypotheses regarding growth and change over time. First, as a baseline, a "no growth" or level-only model was fit by essentially estimating only intercepts (denoted "I" in the model shown in Figure 1). Next, rate of change was considered by adding the slope effect (denoted "S" in the model). We compared the two nested models by using the difference chi-square test obtained by taking the difference between the obtained model fits (i.e., $-2ln[likelihood]$) and testing its significance with the degrees of freedom equal to the difference in the number of parameters of the two models. Tests of equality of parameters by sex (i.e., comparing whether men and women had significantly different parameters) and by generation (i.e., whether the age groups had the same parameters) were also made in a similar fashion. If the difference chi-square is not significant, then the more parsimonious model should be chosen; if it is significant, then the less constrained model should be chosen.

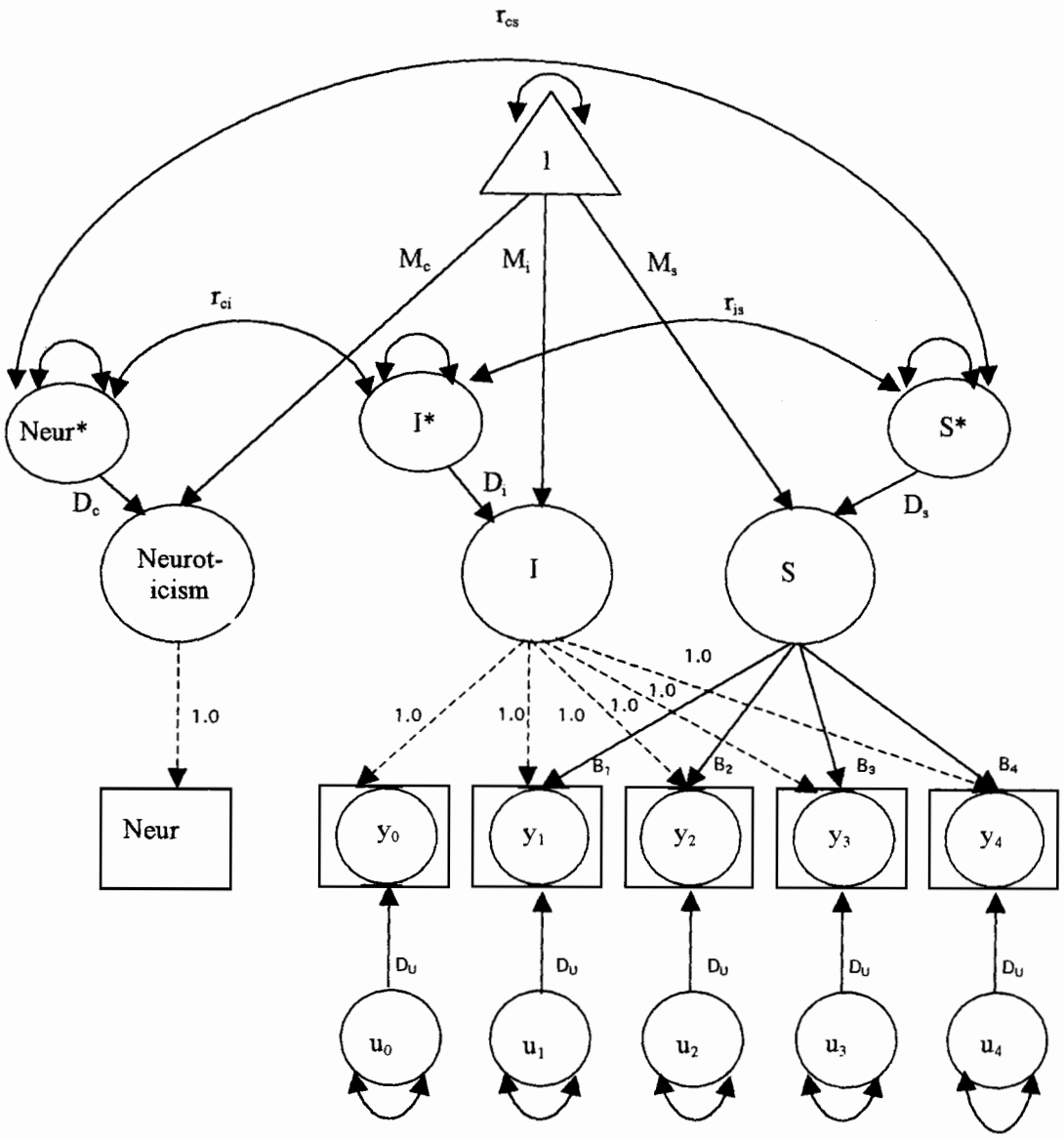

Figure 1. Latent growth model for complete and incomplete longitudinal data with covariate. Typical of many representations of structural equation models, the squares represent observed, or measured, variables, whereas the circles denote latent variables; single-headed arrows represent regression coefficients, and double-headed arrows denote covariation. The triangle, though less customary, represents a unit constant that allows for the estimation of means; the circles within squares represent data that are available for an individual participant at some but not necessarily all time points. r_{cs} = correlation between the slope and the covariate; M_c = mean of the covariate; M_i = mean of the intercept; M_s = mean of the slope; r_{ci} = correlation between the covariate and the intercept; r_{is} = correlation between the slope and the intercept; Neur* = standardized score of the covariate (in this case neuroticism); I* = standardized score for the intercept; S* = standardized score for the slope; D_c = deviation from the covariate mean; D_i = deviation from the intercept; D_s = deviation from the slope; I = intercept; S = slope; B1–B4 = age basis coefficients; Neur = the covariate neuroticism; y_0–y_4 = affect scores at each time point; u_0–u_4 = random components from the affect scores; D_u = the constant deviation from the affect scores.

Parameters from the growth model can be used to calculate several expected statistics over age, such as the explained variance of the growth model at a particular age or the curve of the reliability of the growth factors (see McArdle, 1996; McArdle et al., 1998; McArdle & Woodcock, 1997). Therefore, in addition to reporting the model fits and parameters, we present several figures that indicate the average scores, variability, and reliability ratio of the growth model (i.e., proportion of variance explained by the growth model) across age on the basis of the parameters obtained from the growth model. Although there is only one group slope and intercept estimated from a growth model (fitted within sex and within age

group as described below), the group shape and the estimated variance–covariance parameters may be used to calculate affect scores and variances by ages.

Initially, models were compared to test whether men and women could be equated for positive and negative affect (i.e., had the same parameters) or whether they were significantly different from each other. Afterward, a latent model assuming linear change was compared with one showing no change to see whether affect changed significantly over time. For these models, both the independent and full samples were tested. Afterward, tests compared the first, second, and third generations, referred to as the oldest, middle, and younger age groups, respectively, to test for similar patterns among the age groups.

After looking at each affect alone, we analyzed linear growth models with covariates. In addition to growth curve analyses, we also performed age-sequential analyses and several post hoc analyses using more traditional procedures.

Age-sequential analyses. We examined age-sequential effects with *t* tests, using both independent and full samples. People who responded in 1971 were compared with same-aged adults who responded in 1991 from three different age groups: young (1971 group: M = 20.18 years old and 1991 group: M = 20.13 years old), middle-aged (1971 group: M = 39.40 years old and 1991 group: M = 39.00 years old), and older (1971 group: M = 64.40 years old and 1991 group: M = 63.50 years old) adults. Only participants in the middle and older age groups who had responded at all time points from 1971 to 1991 were used in the analyses to control for possible attrition biases when the 1971 and 1991 subgroups were compared. The analyses were completed using (a) an independent and randomly selected group of people from 1971 and 1991 who were equivalent in age and (b) the entire sample for each age group at each time point, thereby including all eligible family members who fit the age criteria. In addition, men and women were examined both separately and also pooled together to examine overall differences between cohorts.

Results

Latent Growth Curve Analyses by Sex

Table 3 displays the results for the analyses that examined whether the same growth model could be fit for both men and women and then whether change over time (i.e., a significant slope parameter) was evident. For each affect measure, an analysis constraining men and women to be equal was compared with one that specified a different model for each sex. If these two analyses were not significantly different from one another, then the model constraining men and women to be equal was preferred for reasons of parsimony. After we found the best fitting model, the slopes were dropped from this model, and then this analysis was compared with the equation in which the slope was not dropped to see which model best fit the data. If the model with the dropped slope revealed a significantly worse fit, this would suggest that the slope—the parameter that represents change over time—must remain in the model, as change is evident. The results are discussed separately below for each affect.

Negative affect. Table 3 shows that for negative affect, men and women did not differ significantly: full sample, $\Delta\chi^2(6) = 7.51$, $p > .05$, so they were pooled together in the analyses; model comparisons with the independent sample indicated similar findings. Parameter estimates of the full, unconstrained model in which men and women were allowed to differ are presented in Table 4, showing the similar estimates for each sex. Results of the full sample, with men and women constrained to be equal, indicated an average negative affect score of 2.17 (M_i) at 35.5 years of age, with a declining curve suggesting a decrease in negative affect score of 0.04 points (M_s) per year. The deviations around the curve showed a large impact of initial level (D_i = 0.90) and a small but significant impact of linear slope per year (D_s = 0.01), which means that the greatest variance in this model came from people having differences in their average level (i.e., intercept) of negative affect. The variance unexplained by the linear model was quite large (D_u = 1.13), with reliability of the model ranging from .38 to .42 across the age range.

Positive affect. Similar to negative affect, model comparisons revealed that men and women did not significantly differ for positive affect: full sample, $\Delta\chi^2(6) = 4.81$, $p > .10$ (see Tables 3 and 4); model comparisons with the independent sample further suggested that the slopes could be dropped, indicating no change across time. The slope could not be dropped in the full model, but note that the estimates of rate of change, albeit significant for this sample, were quite small indeed. Parameter estimates of the full, unconstrained model in which men and women could differ are presented in Table 4 and show the similarity across the sexes. Results of the full sample, with men and women constrained to be equal, indicated an average positive affect score of 3.83 (M_i) at 35.5 years of age, with a declining curve suggesting a decrease of 0.01 points (M_s) per year. The deviations around the curve showed a large impact of initial level (D_i = 0.73) and a small but

Table 3
Model Comparison Across Men and Women

Affect and model	Full sample				Independent sample			
	$-2ln(L)$	df	χ^2	Δdf	$-2ln(L)$	df	χ^2	Δdf
Negative affect								
Model 1: Men and women unequal	26,295.209	21663			3,408.551	2879		
Model 2: Men and women equal	26,302.714	21669	7.51	6	3,411.405	2885	2.85	6
Model 3: Men and women equal—slopes dropped	27,367.478	21672	1,064.76*	3	3,554.405	2888	143.00*	3
Positive affect								
Model 1: Men and women unequal	24,299.761	21357			3,201.766	2855		
Model 2: Men and women equal	24,304.602	21363	4.84	6	3,208.232	2861	6.47	6
Model 3: Men and women equal—slopes dropped	24,428.873	21903	124.27*	3	3,215.987	2864	7.76	3

Note. The number of participants included in the analyses are as follows: negative affect, full sample (N = 2,804) and independent sample (N = 384); positive affect, full sample (N = 2,765) and independent sample (N = 379).
* $p < .001$.

Table 4
Parameter Estimates From Full, Unconstrained Linear Growth Models

Affect and group	M_i	D_i	M_s	D_s	r_{is}	D_u
Negative affect						
Men	2.13	0.91	−0.0343	0.01	−.21	1.11
Women	2.22	0.91	−0.0368	0.01	.19	1.15
Older adults	1.06	0.92	−0.0042	0.05	−.34	0.91
Middle-aged adults	1.85	1.17	−0.0379	0.03	−.68	1.02
Younger adults	2.95	0.91	−0.0471	0.05	−.42	1.15
Positive affect						
Men	3.81	0.73	−0.0089	0.01	.99	1.02
Women	3.84	0.73	−0.0065	0.01	.35	1.02
Older adults	3.41	0.81	−0.0188	0.03	.22	1.11
Middle-aged adults	3.78	0.91	−0.0001	0.02	−.28	0.96
Younger adults	3.92	0.58	−0.0044	0.02	.16	1.02

Note. M_i = mean of the intercept; D_i = deviation from the intercept; M_s = mean of the slope; D_s = deviation from the slope; r_{is} = correlation between the slope and the intercept; D_u = unaccounted variation.

significant addition of linear slope per year ($D_s = 0.01$). Again, the variation unexplained by the linear model was quite large ($D_u = 1.02$): Reliability estimates of the linear model ranged from .27 at age 15 to .54 at age 85.

Latent Growth Curve Analyses by Age Group

Table 5 shows results from analyses testing whether the same model fits across generational age groups for the full and independent random samples. These models tested whether the age groups could be constrained to be equal—meaning that the values and rates of change were similar across all age groups—or whether these values were different across age groups, a method described in the *Analyses* section and identical to that used to test for sex differences in the *Latent Growth Curve Analyses by Sex* section. Overall, similar patterns of results were found with the full and independent samples, although the estimates of the correlations between slope and level were less stable in the independent sample. In the text presented below, we focus primarily on the full-sample results because of the similarity between the full and independent analyses.

Negative affect. Models were fit where centering values varied by age group (centering ages of 18, 43, and 66 years for the youngest, middle, and oldest age groups, respectively). Comparing models with differing centering ages allowed us to test whether the group slopes (the M_ss) were similar across age groups despite differing centering ages, whereas using the same centering age allowed us to compare whether the group slopes (the M_ss) were similar given the same centering age. In the oldest and youngest age groups, few if any participants were observed at 35.5 years of age; thus, we report model results for which the centering ages varied. (Note that model fitting results led to identical conclusions whether a common centering value was used [i.e., 35.5 years] or whether centering values varied by age group [i.e., 18, 43, and 66 years for the youngest, middle, and oldest age groups, respectively]). Table 4 presents parameter estimates for the youngest, middle, and oldest age groups. Figure 2 illustrates the model for negative affect with estimated parameters based on the unconstrained model, in which the estimates of the three age groups were free to vary.

Results of the full sample, for which differences between groups were examined (see Table 5), suggested that the estimates could not be equated for negative affect (i.e., the rate and level of change differed between groups, so each group should be examined separately): full sample, $\Delta\chi^2(12) = 712.13$, $p < .001$. Table 5 also

Table 5
Model Comparisons Across Age Groups (Centering Values Vary)

	Full sample				Independent sample			
Affect and model	$-2ln(L)$	df	χ^2	Δdf	$-2ln(L)$	df	χ^2	Δdf
Negative affect								
Model 1: Age groups unequal	24,110.157	19284			3,316.902	2880		
Model 2: Age groups equal	24,822.284	19296	712.13*	12	3,423.693	2892	106.79*	12
Model 3: Age groups unequal—slopes dropped	24,747.053	19293	636.90*	9	3,392.555	2889	75.65*	9
Positive affect								
Model 1: Age groups unequal	22,470.538	18998			3,099.994	2819		
Model 2: Age groups equal	22,635.462	19010	164.92*	12	3,141.525	2831	41.53*	12
Model 3: Age groups unequal—slopes dropped	22,521.970	19007	51.43*	9	3,113.534	2828	13.54	9

Note. The number of participants included in the model are as follows: negative affect, full sample (N = 2,442) and independent sample (N = 384); positive affect, full sample (N = 2,405) and independent sample (N = 376).
* $p < .001$.

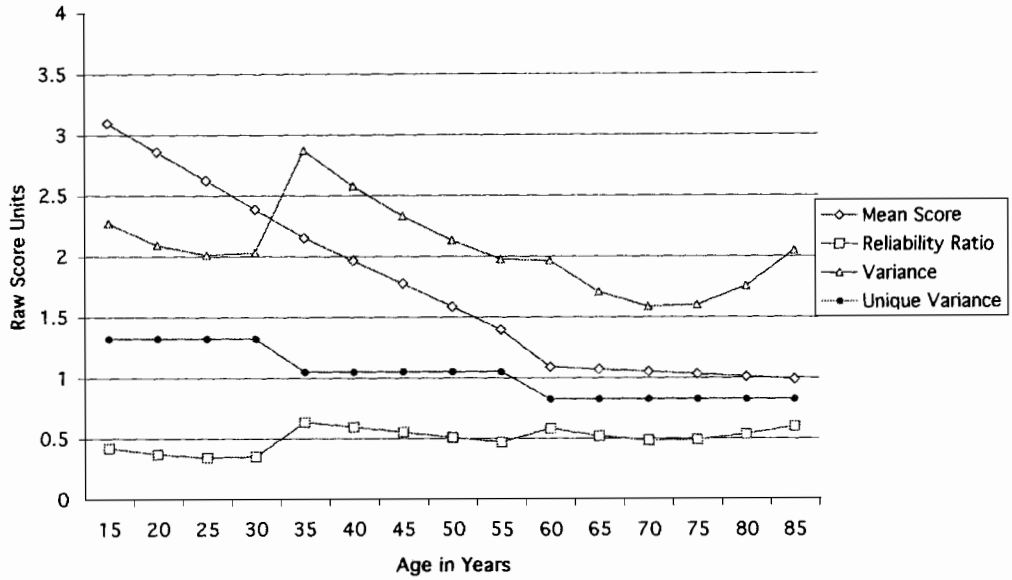

Figure 2. Estimated negative affect values from the latent growth model for three age groups.

shows that the slope could not be dropped, thus revealing a significant change in negative affect over time for all age groups: full sample, $\Delta\chi^2(9) = 636.90$, $p < .001$. Parameter estimates (see Table 4) suggested that negative affect (M_i) was lowest for the oldest age group, in which the centering value was 66 years; the slope was negative and largest for the younger age group. Among all age groups, the deviations around the group curves showed a large impact of initial level and small but significant impacts of linear slope per year.

Figure 2 shows results based on the linear growth model for negative affect with parameters estimated in the full, unconstrained model across each age group. The charting of extrapolated means, variances, and reliabilities is based on the model parameters (refer to Figure 1 for model) estimated within the three different age groups; for example, the mean at each age was calculated by the following equation: $M_i + M_s \times$ (Age − Centering Age). The mean negative affect over age, according to the estimated parameters, suggested a dramatic change in average negative affect until age 60, when average negative affect leveled off. The total variance was largest in the middle-aged group. Reliability of the factor growth (i.e., variance explained by the growth model) increased slightly with age. The reliabilities ranged between .34 and .63; indeed, across the ages, about half of the variance was unexplained by the model.

Positive affect. Models were fit where centering values varied by age group (18, 43, and 66 years). Again, model fitting results with common or differing centering values led to identical conclusions. Table 5 reports parameter estimates from models in which centering values (18, 43, and 66 years for the youngest, middle, and oldest age groups, respectively) varied, and Figure 3 illustrates the model with the estimated parameters based on this unconstrained model.

Results of the full sample indicated that the estimates could not be equated across the three age groups: full sample, $\Delta\chi^2(12) = 164.92$, $p < .001$, and the slope could not be dropped. Results from the random independent sample, however, could be equated, and indeed, the slope parameters could be dropped. We present the results from the full sample—the sample providing the most power—but note that the significance of the slope parameters may be of statistical but not practical significance. Parameter estimates (see Table 4) suggested that positive affect (M_i) was highest for the youngest age group, in which the centering value was 18 years; the slope was negative for the oldest group. The deviations around the group curves showed a large impact of initial level and small but significant impacts of linear slope per year.

Figure 3 shows results based on the linear growth model for positive affect with parameters estimated in the full, unconstrained model across each age group. The charting of extrapolated means, variances, and reliabilities was based on the model parameters estimated within the three different age groups as described above. The mean positive affect over age, according to the estimated parameters, suggested little change until age 60, when negative change began to accelerate. Whereas total variance increased with age, reliability of the factor growth remained fairly stable in the middle and older age groups, with the reliabilities ranging between .33 and .50. However, across most ages, more than half of the variance was unexplained by the growth model.

Covariates: Negative Affect

The covariates included a baseline measure of self-rated health (measured at the first available time point for each participant), education (measured by years of education), and measures of neuroticism and extraversion. Latent growth models that included covariates, described above, were investigated only in the full sample given the overall similarity of findings in the earlier analyses (see Tables 6 and 7). When one is making model comparisons, for example, comparing Model 2 (dropping the covariate's relationship with the slope) and Model 1 (including the correlation with the covariate), a significant difference indicates that including

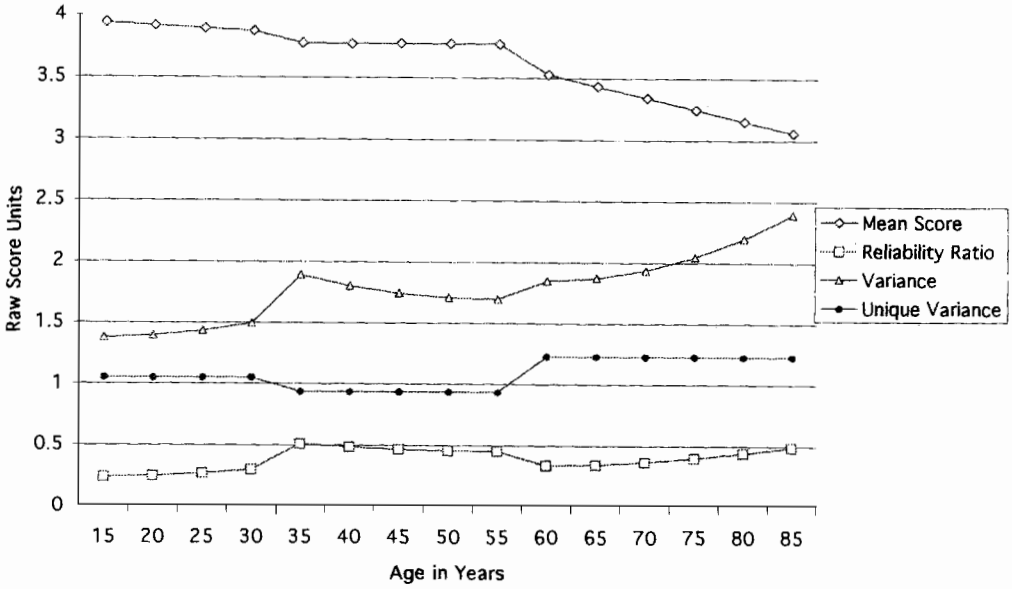

Figure 3. Estimated positive affect values from the latent growth model for three age groups.

the correlation with the covariate results in a significantly better fit. Individual significance of correlations within age groups (Table 7) was not tested beyond the omnibus test described.

Latent growth curve analyses. Neuroticism scores were significantly related to both average negative affect scores (intercept; Table 7) and rate of change (slope; Table 7). Dropping the correlation between neuroticism and the slope significantly worsened the fit of the model, $\Delta\chi^2(3) = 30.27$, $p < .001$, and dropping the correlation between neuroticism and the intercept also led to a worsening of fit, $\Delta\chi^2(3) = 269.86$, $p < .001$; higher neuroticism scores were related to higher negative affect scores and to less change in negative affect scores. Poorer health was related to higher initial negative affect, and years of education (a positive correlation for younger adults and a smaller but negative correlation for older adults) were related to average negative affect scores, but neither was related to rate of change. Extraversion was not significantly related to either slope or intercept.

Item endorsement. The percentage of people who endorsed each of the negative affect questions from the younger, middle-aged, and older subsamples was calculated (see Table 8). For the oldest group, the percentage of people who endorsed feeling criticized and the percentage who reported feeling restless decreased from Time 1 to Time 5, whereas loneliness increased slightly. Both feeling depressed and feeling bored differed negligibly across time points. In contrast, the younger and middle-aged groups showed decreases in every question from Time 1 to Time 5.

Age-sequential analyses. Younger, middle-aged, and older adults who responded in 1971 were compared with same-aged adults who responded in 1991 to examine possible historical effects for negative affect in both the independent sample and the

Table 6
Models With Covariates Across Age Groups (Full Sample, Different Centering Ages)

	Model 1: Correlations with covariates		Model 2: Drop correlation of covariate with slope		Model 3: Drop correlations of covariate with slope and intercept		Model comparisons: Model 2 − Model 1		Model comparisons: Model 3 − Model 2	
Affect and covariate	$-2ln(L)$	*df*	$-2ln(L)$	*df*	$-2ln(L)$	*df*	$\chi^2(3)$	*p*	$\chi^2(6)$	*p*
Negative affect										
Neuroticism	24,878.33	17149	24,908.603	17152	25,178.46	17155	30.27	<.001	269.86	<.001
Extraversion	24,113.56	17113	24,120.544	17116	24,121.73	17119	6.98	>.05	1.19	>.10
Health	24,456.03	17871	24,458.422	17874	24,483.18	17877	2.39	>.10	24.76	<.001
Education	28,986.44	18156	28,987.943	18159	29,001.36	18162	1.50	>.10	13.42	<.005
Positive affect										
Neuroticism	23,853.91	16899	23,863.840	16902	23,904.13	16905	9.93	<.025	40.29	<.001
Extraversion	22,750.09	16863	22,761.454	16866	22,846.31	16869	11.36	<.01	84.86	<.001
Health	23,133.52	17716	23,137.321	17719	23,212.05	17722	3.80	>.10	74.73	<.001
Education	27,665.69	18066	27,666.378	18069	27,730.25	18072	0.69	>.95	63.87	<.001

Note. For the analyses of negative affect and each of the covariates, $N = 2{,}020$. For the analyses of positive affect and each of the covariates, $N = 1{,}988$.

Table 7
Correlations Between Model Coefficients and Covariates

Affect scale and covariate	Older adults		Middle-aged adults		Younger adults	
	Intercept	Slope	Intercept	Slope	Intercept	Slope
Negative affect						
Neuroticism	.35	.33	.40	.11	.28	.38
Extraversion	.10	−.20	−.02	.05	.10	−.20
Health	.16	.01	.04	.02	.11	.11
Education	−.08	.01	.00	.01	.20	−.10
Positive affect						
Neuroticism	−.21	−.56	−.10	−.23	−.25	−.12
Extraversion	.19	.43	.35	.05	.17	.43
Health	−.31	−.17	−.22	−.06	−.20	−.23
Education	.06	.08	.20	.05	.42	−.08

Note. Individual significance of correlations within age groups was not tested beyond the omnibus test described (see Table 6).

full sample of all eligible participants who participated at the time points (see Table 9). Age-sequential analyses yielded no significant differences when we examined men and women together and each sex separately for each of the three age groups.

Covariates: Positive Affect

Latent growth curve analyses. Models including covariates were investigated next in the full sample (see Table 6). Neuroticism scores and extraversion scores were each significantly related to both average positive affect scores (intercept) and rate of change (slope; see Table 7). Dropping the correlation between neuroticism and the slope significantly worsened the fit of the model, $\Delta\chi^2(3) = 9.93$, $p < .025$, as did dropping the correlation between neuroticism and the intercept, $\Delta\chi^2(3) = 40.29$, $p < .001$. Higher neuroticism scores were related to lower positive affect scores and to a greater decline in positive affect scores over time. Dropping the correlation between extraversion and the slope significantly worsened the fit, $\Delta\chi^2(3) = 11.36$, $p < .001$, as did dropping the correlation between extraversion and the intercept, $\Delta\chi^2(3) = 84.86$, $p < .001$. Higher extraversion scores were related to higher positive affect scores and to stability in positive affect scores; that is, rates of change were less likely to decline. Better health and

Table 8
Percentage of Endorsements to the Negative Affect Items at All Five Time Points

Question	Time 1	Time 2	Time 3	Time 4	Time 5
			Older adults		
	(n = 487)	(n = 190)	(n = 151)	(n = 112)	(n = 85)
Restless	35	22	25	21	19
Lonely	14	19	19	16	21
Bored	23	21	26	21	22
Depressed	21	16	19	19	22
Criticized	18	16	12	13	8
			Middle-aged adults		
	(n = 691)	(n = 536)	(n = 543)	(n = 474)	(n = 519)
Restless	48	28	33	32	25
Lonely	27	18	17	16	12
Bored	46	32	32	31	25
Depressed	34	25	22	23	17
Criticized	29	20	18	19	14
			Youngest adults		
	(n = 814)	(n = 546)	(n = 734)	(n = 678)	(n = 699)
Restless	68	45	52	47	44
Lonely	60	31	32	35	30
Bored	71	55	53	48	45
Depressed	61	40	39	40	37
Criticized	38	35	37	38	31

Note. Values are rounded to the nearest percentage point.

Table 9
Results of Age-Sequential Analyses for Younger, Middle-Aged, and Older Adults in 1971 Compared With Same-Aged Adults in 1991

	Independent sample				Full sample			
	1971		1991		1971		1991	
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
				Negative affect				
Younger adults	2.85	1.58	2.81	1.26	2.97	1.48	2.87	1.42
Middle-aged adults	2.11	1.71	2.26	1.52	2.08	1.63	2.09	1.52
Older adults	1.14	1.34	1.24	1.33	1.11	1.35	1.21	1.36
				Positive affect				
Younger adults	3.91	1.24	3.86	1.35	3.88	1.20	4.01	1.24
Middle-aged adults	3.74	1.30	3.90	1.28	3.81	1.29	3.89	1.30
Older adults	3.38	1.38	3.89_a	1.24	3.37	1.36	3.95_b	1.24

Note. The mean age for the younger adults was 20 years old. The mean age for the middle-aged adults was 39 years old. The mean age for the older adults was 64 years old. Means with different subscripts differ significantly at $p < .01$. The independent samples were reanalyzed using only people who participated at all four time points for the middle-aged and older age groups. Results did not differ from the finding presented above.

more years of education were related to higher average positive affect but not to rate of change.

Exploratory analyses of additional covariates. As we described earlier, positive affect declined only for the oldest sample. Therefore, exploratory analyses were conducted using possible covariates that may account for the decline—marital status, self-reported health, and functional health—among the oldest age group. Changes in marital status, functional health, and self-reported health over time were compared for three groups of people within the group of older adults—those who declined in positive affect versus those who remained stable in their scores and those who slightly increased in positive affect. Everyone in the older sample was either widowed or married, so marital status was examined to determine whether bereavement was related to a decrease in positive affect. Both functional and self-reported health were included to determine whether declines in health status over time, defined by decreases from their first to their last time point of measurement, could account for the decline. However, no differences in the degree of change or in current status for any of these variables were found between these three groups.

Item endorsement. The oldest group was examined to see which questions from the positive affect questionnaire showed a decline over time. The resulting percentages (see Table 10) showed that the greatest declines were for questions pertaining to excitement, feeling on top of the world, and feeling that things were "going my way." The first two of these items are obvious surgency variables. Feeling proud of something accomplished also showed evidence of decline but not to as great an extent.

Age-sequential analyses. Results for younger, middle-aged, and older adults who responded in 1971 compared with same-aged adults who responded in 1991 indicated significant differences only for the oldest group in age-sequential analyses. For the younger and middle-aged groups, no differences were found for either men or women when pooled together or analyzed separately. For the oldest group, people who were, on average, 64 years old in 1971 had lower levels of positive affect ($M = 3.38$, $SD = 1.38$) than same-aged adults in 1991 ($M = 3.89$, $SD = 1.24$), $t(233) = -2.98$, $p < .01$. When men and women were examined separately, significant differences were found only among the oldest group of men, again showing that those in 1971 ($M = 3.09$, $SD = 1.48$) had lower positive affect scores than those in 1991 ($M = 3.80$, $SD = 1.29$), $t(108) = 2.65$, $p < .01$.

Table 10
Percentage of Older Respondents Who Endorsed Each of the Positive Affect Items and Who Showed a Decline in Positive Affect Over Time

Question	Time 1 ($n = 53$)	Time 2 ($n = 44$)	Time 3 ($n = 49$)	Time 4 ($n = 38$)	Time 5 ($n = 35$)
Excited or interested in something	89	64	49	57	47
Proud because someone complimented you	84	68	66	66	57
Pleased about something you have done	96	84	87	71	88
On top of the world	47	38	28	21	12
That things were going your way	74	61	60	38	29

Note. Values are rounded to the nearest percentage point.

Discussion

The results paint a decidedly positive portrait of emotion in old age. Examining positive and negative affect separately revealed that age differences in well-being reflect both developmental and historical influences, but these influences vary according to the two types of affect (either positive or negative) that comprise the overall measure of well-being.

Negative Affect

For people at all ages, negative affect decreased over time. Linear growth trends indicated a fairly consistent decrease for younger and middle-aged adults. Older adults, in contrast, had a much slower rate of decrease. Looking at all three age groups together, negative affect decreased steadily until around age 60, at which time the rate slowed significantly. Unlike the hypothesized upturn in very old age, the decline continued even in very old age. This finding parallels robust decreases in negative affect found only until age 60 that have been documented in other studies (Carstensen et al., 2000; Diener & Suh, 1998); however, unlike these other studies, negative affect continued to decrease even in old age in the present study. Of note, however, is the fact that the decline in negative affect was minimal, albeit significant, in this oldest age group.

The attenuated slope for older adults, compared with younger adults, can be interpreted in several ways. The estimated negative affect score at age 35.5 for the oldest group, calculated by continuing the curve's trajectory downward and estimating scores at younger ages than were collected for these older adults, was much lower than the scores at age 35.5 for the other two age groups, thus suggesting cohort effects. Age-sequential analyses, however, did not support this conclusion. No differences were found when we compared groups of people who were, on average, 19 years old, 39 years old, and 64 years old in 1971 with their same-aged counterparts who responded in 1991. A second possible interpretation is that this measure of negative affect, with a scale ranging from 0 to 5, has limited variability, so floor effects interfere with comparing age groups on rate of change. This, indeed, is a possibility. A last possible interpretation is that the rate of decrease in negative affect actually slows after age 60. Again, the lack of age differences in the age-sequential analyses and the consistency of these findings with other studies (Carstensen et al., 2000; Diener & Suh, 1998) make this a viable explanation.

The large amount of variance in negative affect suggests that the general decrease in negative affect over time is not universal and that other variables may account for interindividual differences in intraindividual change. To examine possible covariates, neuroticism had the strongest effect, such that people who scored higher on neuroticism also had higher ratings of negative affect, consistent with the view that neuroticism is representative of negative affect (Watson & Pennebaker, 1989). Results also indicate that those high in neuroticism were less likely to exhibit decreases in negative affect. No other variables analyzed in this study influenced change in negative affect over time.

When we examined the individual scale items for negative affect, questions about feeling restless and criticized appeared to decrease to a greater extent in the older sample than did the other questions. Similar declines have been found in other studies, suggesting both physiological and environmental etiologies. The decrease in restlessness is akin to findings that self-reported emotional surgency decreases with age (Lawton et al., 1992) and is consistent with findings indicating lower physiological arousal in reaction to emotional experiences for older adults than for younger adults (Levenson, Carstensen, Friesen, & Ekman, 1991). Concerning the decrease in criticism, researchers have posited that older adults are less preoccupied with concerns about how others view them (e.g., Peck, 1968) and that they are more likely to structure their environment to avoid negative interactions with others (Carstensen, Gross, & Fung, 1998).

Positive Affect

Unlike negative affect, positive affect was associated with marked stability in this study. The younger and middle-aged groups, representing people from adolescence into their mid-50s, showed almost no change over time. In addition, no significant cohort effects were found when we compared positive affect scores between 19-year-olds born in or around 1952 and who responded in 1971 and 19-year-olds born in or around 1972 who responded in 1991, or when we compared 39-year-olds born in approximately 1932 who responded in 1971 and 39-year-olds born around 1952 who responded in 1991.

Significant age-related differences in positive affect were found only among the older adults, and these differences indicate both developmental change and cohort effects. The oldest age group showed a gradual decline in positive affect when individuals were measured from, on average, their 60s to mid-80s. The decline was small but significant—about half a point over a little more than 20 years. In addition, cohort effects for positive affect were evident in that older male participants from the cohort who were born around 1907 and responded in 1971 reported lower positive affect than older men who were born around 1928 and responded in 1991.

Costa et al. (1987) found marked stability for positive affect over a 10-year period for people of all ages and suggested that the experience of positive affect is more stable and less responsive to changing life circumstances than one might have previously assumed. The findings in the present study also show that positive affect is indeed enduring. However, the results differ in that Costa et al. found no decreases among the oldest age groups. One possible explanation for the discrepancy is that 10 years may be too short a time to detect the decline. A decline is consistent with the age differences in positive affect documented in cross-sectional studies comparing older adults (65 to 75 years old) with the oldest old (Smith & Baltes, 1993). In addition, the present findings stand in contrast to those that have found a decrease in positive affect starting at a much earlier age in a much larger cross-sectional study (Diener & Suh, 1998). Perhaps differences do exist, but they were too small to be detected in the present study.

The cohort effects among the oldest adults in this sample contrast with findings showing higher positive affect among older adults than among younger adults (Gross et al., 1997; Mroczek & Kolarz, 1998) but are consistent with another study in which older cohorts reported lower positive affect than younger cohorts (Costa et al., 1987). Some of these discrepancies, however, may be resolved when one examines the cohorts used in these studies. Participants in the studies showing greater positive affect for older cohorts (Gross et al., 1997; Mroczek & Kolarz, 1998) consisted

mainly of people born in 1920 at the earliest. In the present study and that of Costa et al. (1987), the oldest adults were born, on average, in the first decade of the 20th century. Perhaps going through the Great Depression as an adult had a lasting influence on how people perceive and experience the world (Elder, 1999) and thereby rate their experience of positive affect, or perhaps older cohorts are more reluctant to express their feelings, as has been suggested previously (Costa et al., 1987).

The decrease in positive affect among older adults could not be attributed to changes in marital status or declines in self-reported or functional health. However, individual score items may be sensitive to age-related changes responsible for the decrease. Decreases in frequency of reports for scale items were most evident for questions about feeling on top of the world, excited about something, and "that things were going my way." Change in the frequency for endorsing questions tapping emotional surgency, such as feeling excited and on top of the world, is consistent with decreases in emotional surgency found in prior studies (Lawton et al., 1992). In addition, older adults have reported feeling that they have less control over their environment compared with younger adults (Heckhausen, 1997), which may explain, in part, the reduction in frequency for reporting "that things were going my way." Finally, the decline in frequency for the question asking about being complimented for something completed may be a result of older adults not engaging in as many activities, such as work or school, where opportunities for compliments about tasks completed may arise.

When we examined the effects of neuroticism and extraversion with positive affect and age, individual differences were apparent. People who scored higher on neuroticism were more likely to have lower initial scores on positive affect and were more likely to decrease in positive affect over time. In contrast, extraversion had the opposite effect, such that those scoring higher on extraversion were more likely to have higher initial scores on positive affect and were more likely to remain stable in their higher levels of positive affect than those who scored lower on the extraversion measure. These findings are consistent with past literature that has found a positive relationship between extraversion and positive affect and a negative relationship between neuroticism and positive affect (Costa, McCrae, & Arenberg, 1980; Mroczek & Kolarz, 1998). This study, however, was the first to examine how change in positive affect is also influenced by these variables, indicating that higher extraversion scores are protective against a decrease in positive affect over time. Of course, given that positive affect showed only a slight decrease in only the oldest age group over a long time span in our present findings, the significance of extraversion should be interpreted conservatively.

Affect, Aging, and Well-Being

In sum, the findings suggest that whereas positive affect remains fairly stable across time, negative affect decreases across the adult life span. What is it about aging that causes decreases in negative affect while positive affect remains relatively stable?

According to socioemotional selectivity theory, emotions become more salient for older adults, and older adults prioritize activities, including social interactions, along emotional lines to a greater extent than younger adults (Carstensen, 1993, 1995). In doing so, they are using emotional coping skills acquired over their life span, whereby potentially negative interactions are avoided and positive ones are maintained. This avoidance of negative affect may be one reason why older adults report that they are better able to control their emotions (Gross et al., 1997), because they are constructing environments that promote well-being. In addition, lower physiological arousal in response to emotional events (Levenson et al., 1991) may have a beneficial effect for the experience and control of negative affect across the life span, such that lower levels of physiological arousal result in less arousal (i.e., lower emotional surgency) that needs to be modulated and controlled.

Limitations

Limitations of the present study include the psychometric properties of the well-being scale (Bradburn, 1969). Although the scale was the best measure of well-being at the time of initial measurement in 1971, subsequent studies (e.g., Mroczek & Kolarz, 1998) have revealed the added advantage of having scales with wider ranges and, therefore, greater variance. The yes–no response option and the number of possible responses for positive and negative affect limited the affect measures to ordinal-type scales ranging from 0 to 5. This narrow range increased the risk of floor effects, the stability of the parameters, and Type II errors. However, the fact that this study revealed consistent age patterns strengthens the validity of the findings, in spite of the scale's limits. Another problem stems from the homogeneity of the participants, who were mostly married and predominantly Caucasian.

A further limitation is that the study could not explore further the mechanisms behind the age differences in negative affect. Although the covariates of neuroticism, extraversion, health status, and education were examined, other possible variables would be important to add. For example, studying cognitive processes involved when appraising negative events may clarify the mechanism underlying the age differences. Perhaps future studies will examine the processes driving these differences and what explains the great stability of positive affect and the decrease of negative affect seen across the adult life span.

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