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Mixed emotions across the adult life span in the United States

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Abstract

Mixed emotions involve the co-occurrence of positive and negative affect, such that people feel happy and sad at the same time. The purpose of the present study was to investigate age-related differences in the experience of mixed emotions across the adult life span in two nationally representative samples of U.S. residents. Data collected by the Princeton Affect and Time Survey (PATS, n = 3,948) and by the 2010 Wellbeing Module of the American Time Use Survey (ATUS, n = 12,828) were analyzed. In both surveys, respondents (aged 15 years or older) provided a detailed time diary about the preceding day and rated their happiness and sadness for three of the day's episodes. From these reports, three different indices of mixed emotions were derived. Results indicated small, but robust, increases in mixed emotions with age. Linear age increases were consistently evident in both PATS and ATUS, and replicated across the different indices of mixed emotions. There was no significant evidence for curvilinear age trends in either study. Several sociodemographic factors that could plausibly explain age-differences in mixed emotions (e.g., retirement, disability) did not alter the age-effects. The present study adds to the growing literature documenting vital changes in the complexity of emotional experience over the lifespan.

Keywords

mixed emotions; poignancy; happiness; sadness; age differences

A growing body of research suggests that while aging is associated with declines in some areas of functioning (e.g., physical and cognitive performance), levels of emotional or hedonic wellbeing are generally maintained and to some extent even improve across adulthood. Evidence from several large-scale studies suggests remarkable stability in both positive and negative affect across adulthood, even though the particular age patterns are complex and differ for specific emotions (Blanchflower & Oswald, 2008; Mroczek & Kolarz, 1998; Stone, Schwartz, Broderick, & Deaton, 2010; Sutin et al., 2013). While age differences in the *levels* of hedonic wellbeing have been repeatedly examined, there is a burgeoning interest in how the *complexity* of hedonic experiences changes with age (Scheibe & Carstensen, 2010). The present study focuses on one selected aspect of emotional

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complexity, mixed emotions. The ability to experience positive and negative emotions in concert -- such as happiness mixed with sadness – has been viewed as a marker of more competent and nuanced emotional lives (Carstensen, Fung, & Charles, 2003; Labouvie-Vief & Medler, 2002). Mixed emotions have been associated with greater resiliency, more adaptive emotion regulation, and improved physical health (Carstensen et al., 2003; Davis, Zautra, & Smith, 2004; Hershfield, Scheibe, Sims, & Carstensen, 2013; Larsen, Hemenover, Norris, & Cacioppo, 2003). Compared with the large body of work examining age differences in positive and negative affect levels, far less is known about how mixed emotions change with age. The present study examined age differences in mixed emotions across the adult life span in two large and nationally representative samples.

Theoretical proposals about mixed emotions and age

Theories of emotion have for a long time debated whether it is possible to experience mixed emotions at all (Larsen, McGraw, & Cacioppo, 2001; Russell & Carroll, 1999). Even though every person will have periods of pleasant and unpleasant affect over time, prominent theoretical models posit that positivity and negativity are polar opposites that cannot be mixed together at a single point in time (Barrett & Bliss-Moreau, 2009; Russell & Carroll, 1999). Other theoretical perspectives like the Evaluative Space model (Cacioppo, Gardner, & Berntson, 1999) assume that even though positive and negative states are antagonistic and are usually reciprocally activated, they can also be coinhibited (neither positive nor negative feelings) or coactivated (i.e., mixed feelings). Increasing empirical evidence has documented that simultaneously mixed emotions do exist, for example in bittersweet situations (e.g., on graduation day, and after watching a nostalgic movie), even though they are relatively uncommon and fleeting (Larsen & McGraw, 2011; Larsen et al., 2001; Larsen, McGraw, Mellers, & Cacioppo, 2004; Williams & Aaker, 2002).

Several life-span theories of cognition and motivation suggest that the occurrence of mixed emotions changes with chronological age. From a cognitive perspective, Differential Emotions Theory (Consedine & Magai, 2006; Magai, Consedine, Krivoshekova, Kudadjie-Gyamfi, & McPherson, 2006) argues that as people get older, they acquire abilities for more differentiated emotional experiences and expressions as a result of more elaborated cognitive networks and increases in life experience. This is assumed to enable a greater degree of blending and overlap between negative and positive feelings – yielding a greater likelihood of mixed feelings – over the course of adulthood (Magai et al., 2006). Similarly, Dynamic Integration Theory (DIT), a cognitive-developmental perspective on affective representations (Labouvie-Vief, 2003; Labouvie-Vief, Grühn, & Studer, 2010; Labouvie-Vief & Medler, 2002) posits that the ability to generate ambivalent and mixed emotions gradually increases from childhood well into middle and late life as people increasingly learn to form and organize complex emotions and to accept hedonic conflict and contradiction (Labouvie-Vief, 2003; Labouvie-Vief et al., 2010). However, as cognitive resources decline in old age, the theory assumes that the differentiation and integration of emotions gradually diminishes and that optimization strategies of emotion regulation tend to predominate; that is, people may increasingly seek to maximize pleasant experiences and suppress unpleasant and ambivalent feelings to maintain subjective wellbeing (Labouvie-Vief, 2003).

Socioemotional Selectivity Theory (SST), a life-span theory of motivation, focuses on the perceived time that people have left in life as an important factor in emotional development (Carstensen et al., 2003; Carstensen, Isaacowitz, & Charles, 1999; Carstensen, Pasupathi, Mayr, & Nesselroade, 2000). The theory argues that when the future is seen as expansive as is the case in younger adulthood, people are predominantly motivated to acquire new information and pursue knowledge-related goals relevant to successful adaptation in the future. By contrast, as older adults become more aware of the limited future time they have left, they focus more on the here and now and prioritize emotionally meaningful goals in the present. This, in turn, generates emotional experiences that become more complex and increasingly mixed. Specifically, SST refers to the co-occurrence of happiness and sadness as "poignancy" (Carstensen et al., 2000; Ersner-Hershfield, Mikels, Sullivan, & Carstensen, 2008; Zhang, Ersner-Hershfield, & Fung, 2010). When time is perceived as constrained and people become progressively aware that life is ultimately going to end, moments of happiness are sought out more, yet they are more likely tinged with sadness in the anticipation of endings and loss, creating feelings of poignancy.

Thus, both theories of cognitive (DIT) and motivational (SST) development posit that mixed emotions increase over much of adulthood, but they make somewhat divergent predictions about the changes of mixed emotions in older age. Based on DIT, decreases in mixed emotions may be expected in old age paralleling cognitive declines (a downward curvilinear trend), whereas based on SST, further increases would be expected that may even accelerate in old age as the experience of poignancy becomes increasingly salient (i.e., a potential upward curvilinear trend over the adult life span).

Empirical findings on age differences in mixed emotions

To date, several studies have investigated age differences in mixed emotions, with inconsistent results. In an experience sampling study by Carstensen et al. (2000), 184 adults aged 19 to 94 years provided momentary affect ratings five times a day for one week. The correlation between positive and negative affect ratings was computed for each individual as an index of mixed emotions. Averaged over persons, this correlation was negative ($r = -.35$), in accordance with the notion that momentary positive and negative affect tend not to co-occur. As predicted, the correlation was less strongly negative for old adults ($r = -.25$) than young and middle aged adults ($r = -.42$), suggesting that positive and negative feelings were less antagonistic and mixed effects more likely in older adults. This age effect was confirmed longitudinally with the same sample in a follow-up study of two additional experience-sampling waves after 5 and 10 years (Carstensen et al., 2011). However, other experience sampling studies used the same analysis strategy and found no relationship between age and mixed emotions in participants aged 23 to 90 years ($n = 109$; Grühn, Lumley, Diehl, & Labouvie-Vief, 2013) and when comparing younger (mean age 26 years, $n = 101$) and older (mean age 71 years, $n = 103$) adults (Brose, De Roover, Ceulemans, & Kuppens, in press). In addition, several daily diary studies found no age differences in the correlation between positive and negative daily affect in samples ranging from 18 to 89 years ($n = 239$; Hay & Diehl, 2011)), 60 to 85 years ($n = 40$; Ong & Bergeman, 2004)) and when comparing groups of younger (mean age 24 years, $n = 21$) and older (mean age 72 years, $n = 28$) people (Ready, Carvalho, & Weinberger, 2008, study 1). Furthermore, a 4-day

diary study found that the negative association between positive and negative affect was stronger for older (mean age 69 years, $n = 17$) than younger (mean age 23 years, $n = 17$) participants (Ready et al., 2008, study 2), and a 9-day experience sampling study (n = 378, age range 14 to 86) similarly indicated less mixed emotions in older compared to younger participants (Riediger, Schmiedek, Wagner, & Lindenberger, 2009).

The inconsistent results of previous studies may in part be due to the relatively limited sample sizes of most studies and reliance on convenience samples. Age differences, if present, may be small and studies may have lacked adequate statistical power to detect linear or curvilinear age effects [curvilinear effects, where tested, were not significant in any study (Carstensen et al., 2000; 2011; Grühn et al., 2013; Hay & Diehl, 2011)]. In the present study, we sought to overcome this limitation by utilizing data from the Princeton Affect and Time Survey (PATS; n ≈ 4,000) and the 2010 Wellbeing module of the American Time Use Survey (ATUS; n ≈ 12,000). These surveys were conducted to provide representative estimates of how adults above 15 years of age spend their time and how they feel during the various episodes of the day, thus providing an opportunity to examine daily episodes of mixed emotions over the adult life span in the USA.

Challenges in the measurement of mixed emotions

Several methodological challenges associated with the measurement and operationalization of mixed emotions further complicate research on age effects. One challenge concerns the definition of mixed emotions as the *simultaneous* experience of positive and negative affect. Self-report measures commonly used in large-scale surveys ask people to report summaries of their emotional experience over extended periods of time (e.g., an average over the past week). While these measures may be useful for examining levels of positive and negative affect separately, it cannot be inferred from these reports whether positive and negative were experienced simultaneously or, conversely, at different times over the reporting period. Shorter reporting periods allow for the capture of simultaneous occurrence of emotions and not a “vacillation” between positive and negative emotions (Larsen & McGraw, 2011; Larsen et al., 2001) that may occur in longer reporting periods. Previous studies on age differences in mixed emotions have employed momentary (Carstensen et al., 2000; 2011; Grühn et al., 2013) or end-of-day (Hay & Diehl, 2011; Ong & Bergeman, 2004; Ready et al., 2008) assessment techniques to address this problem; however, these strategies of data capture do not lend themselves to addressing population-level questions, given their laborious nature and the high participant burden imposed (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). A unique feature of ATUS and PATS surveys used in the present study is the measurement of episodic experiences paralleling the Day Reconstruction Method (DRM; Kahneman et al., 2004). This method has respondents reconstruct the sequence of episodes of the previous day and rate their emotions during these episodes. It provides ratings comparable with experience sampling and, because data are collected in a single assessment, allows for much larger samples (Kahneman et al., 2004).

A second methodological issue concerns the selection of items used for assessing positive and negative affect. Composites of multiple items tapping pleasant and unpleasant affective states are commonly used, yet these items often differ on more than one dimension (e.g.,

valence and arousal), and the interpretation of mixed emotions becomes more difficult when factorially diverse items are examined (Kessler & Staudinger, 2009; Russell & Carroll, 1999). The present study focuses on assessments of happiness and sadness, given that these consistently emerge as polar opposites on the valence dimension of the circumplex model of emotion (Remington, Fabrigar, & Visser, 2000), and have been repeatedly used in studies examining evidence for the experience of mixed emotions in experimental research (Carrera & Oceja, 2007; Larsen & Green, 2013; Larsen et al., 2001). Moreover, the co-occurrence of happiness and sadness has been considered to be paradigmatic of experiences of "poignancy" (Ersner-Hershfield, Carvel, & Isaacowitz, 2009; Ersner-Hershfield et al., 2008).

A third methodological issue is that there are several ways of defining mixed emotions from ratings of positive and negative affect, and different definitions yield indices that are often only modestly related and that can yield disparate findings (Grühn et al., 2013; Larsen & McGraw, 2011; Schimmack, 2001). In the following, we refer to these definitions as "*covariation* approach", "*ambivalence* approach", and "*classification* approach" (see Figure 1).

Traditionally, mixed emotions have been measured by examining the *covariation* between positive and negative affect ratings, and this method has been applied by most of the studies in the above review of the empirical literature. As illustrated in Figure 1A, this approach is based on the assumption that if happiness and sadness are experienced as polar opposites by a given individual, then the ratings would be perfectly negatively related (i.e., a correlation of minus one), such that higher happiness comes with commensurate lower sadness and vice versa. To the extent that ratings deviate from the perfect negative regression line, the correlation becomes less pronounced, suggesting the presence of mixed emotions (i.e., happiness and sadness co-occurring). However, this approach is not without problems and has been criticized for not adequately capturing mixed emotions (Diener & Iran-Nejad, 1986; Russell & Carroll, 1999; Schimmack, 2001). Specifically, it exclusively focuses on the relationship between the two emotions, but ignores their intensity: high levels of both emotions (e.g., *very* happy and *very* sad) and low levels of both emotions (e.g., *not at all* happy and *not at all* sad) are viewed as equally indicative of mixed emotions in that they equally deviate from the perfect negative regression line (see Figure 1A).

By contrast, the *ambivalence* approach takes the intensity of the emotions explicitly into account. This approach does not assume that happiness and sadness are strictly inverse (as is implicit in the covariation approach), but the two are assumed to be mutually incompatible when mixed emotions do not occur (Larsen & McGraw, 2011). That is, mixed emotions are absent as long as either happiness or sadness are not experienced (rated "not at all"), and mixed emotions are experienced at increasing levels to the extent that both happiness and sadness simultaneously occur at higher levels (see Figure 1B). The ambivalence approach emerged in the domain of attitudes research (Kaplan, 1972; Priester & Petty, 1996), but has been increasingly applied in emotion research (Ersner-Hershfield et al., 2009; 2008; Schimmack, 2001; Wildschut, Sedikides, Arndt, & Routledge, 2006). The ambivalence metric is defined by the intensity of the weaker of the two emotions. A potential shortcoming of the approach is that it assumes that respondents use the scales for positive

and negative emotions in the same way, such that happiness and sadness scores of the same magnitude are interchangeable in terms of the underlying intensity of the emotional experience.

A third approach proposed in this study, *classification*, assumes that mixed emotions are, at least to some extent, qualitatively different from other feeling states. In other words, the blending of happiness and sadness represents a distinctive type of emotion (e.g., "poignancy", following the terminology of SST), which is present when both happiness and sadness co-occur at sufficiently high levels (based on conceptually or empirically derived cut-offs) and that can be distinguished from other types of emotions (e.g., relatively "pure" happiness or sadness), see Figure 1C. In the present study, latent profile analysis (LPA; Bauer & Curran, 2004; Gibson, 1959) was used to obtain an empirically optimal emotion classification. LPA flexibly accommodates nonlinear relationships between happiness and sadness, thereby relaxing the assumption of the ambivalence approach that people rate happiness and sadness on the same scale. Whereas the ambivalence approach measures the intensity of mixed emotions, the classification approach examines the prevalence or frequency of mixed emotions.

Which of these approaches is preferable has been widely debated (Diener & Iran-Nejad, 1986; Larsen et al., 2001; Schimmack, 2001) and depends on various factors that are often not directly tangible; one important aspect is how an individual interprets the options of the response scale. Conceptually, it has been argued that the covariation approach is most appropriate if the emotion scales are interpreted as bipolar (i.e., from negative to positive), whereas the ambivalence and classification approaches are preferable if they are construed as unipolar (i.e., from absent to intense) by respondents (Russell & Carroll, 1999). Most response formats leave some room for interpretation and can be implicitly construed as bipolar or unipolar (Schimmack, Bockenholt, & Reisenzein, 2002; Schwarz, Knauper, Hippler, Noelleneumann, & Clark, 1991), and evidence suggests that people of different ages may interpret response scales differently (e.g., Schwarz & Knauper, 2000). Therefore, we applied each of the three approaches of mixed emotion in this study to evaluate the extent to which age effects are method-dependent. Converging evidence across alternative approaches would enhance confidence in the validity of the results.

The present study

In sum, the present study expands upon prior research on age differences in mixed emotions in several ways. We analyzed two large-scale studies to detect potentially small or curvilinear patterns across the adult life span, and to examine the replicability of findings across studies. The diary-based strategy of sampling affective experiences for episodes within a single day implemented in PATS and ATUS further provided an opportunity to capture mixed emotions as the simultaneous occurrence of positive and negative affect much more appropriately than afforded by other large-scale surveys assessing longer-term summary experiences. Using happiness and sadness ratings as prototypical emotions of opposing valence, we employed three plausible alternative operationalizations of mixed emotions to evaluate the extent to which potential age-effects are method dependent or

replicate across measurement approaches. Finally, sociodemographic covariates associated with age that might account for age-related patterns of mixed emotions were also examined.

Methods

Samples and procedures

Data collected by the Princeton Affect and Time Survey (PATS) and by the 2010 Wellbeing Module of the American Time Use Survey (ATUS; http://www.bls.gov/tus/) were analyzed. The PATS was administered by the Gallup Organization (Omaha, NE, USA) from May to August, 2006. Individuals aged 15 years or older were contacted using random digit dialing with equal probability of selection for all U.S. residential telephone numbers (Krueger & Stone, 2008). The 2010 ATUS Wellbeing Module was conducted with participants drawn from the Census Population Survey of U.S. residents in noninstitutional settings who are aged 15 years and older.

Both surveys were conducted over the telephone to elicit a detailed time diary from respondents capturing the temporal sequence of episodes and activities of the preceding day. In a series of questions, respondents were asked to describe each episode of the day, starting at 4 AM of the previous day and ending at 4 AM of the survey day. Information about the activity, others present, and location were collected for each episode. After the entire day was sequenced in the time-use interview, three segments were randomly selected from the non-sleeping portion of the day for which the respondents provided affect ratings. Three intervals were sampled to reduce respondent burden. The interviewing procedures were the same for both surveys, but the selection of time-segments was somewhat different. In PATS, affect ratings were obtained for 15-minute intervals from three different episodes, whereas in ATUS, affect was rated for entire episodes, regardless of their length (episodes were not eligible for the affect ratings if they were shorter than 5 minutes or involved private or intimate activities).

Measures

Happiness and sadness for each of the selected episodes were rated on a 7-point scale. In PATS, the questions were “From 0 to 6 how (happy/sad) did you feel during this time?” (0 = did not experience the feeling at all; 6 = feeling was extremely strong). In ATUS, the questions were “From 0 to 6, where a 0 means you were not (happy/sad) at all and a 6 means you were very (happy/sad), how (happy/sad) did you feeling during this time?”[1]

Information on demographic characteristics was collected as part of the interview in PATS. For ATUS, these are available from the Census Current Population Survey (CPS) conducted 2-5 months prior to ATUS (age of the respondent was re-assessed in the ATUS interview). Age was treated as a continuous variable in the analyses, centered around 45 years, and coded such that a 1-unit difference represents 10 years. For descriptive purposes, age was also treated as a categorical variable using 2-year age blocks (e.g., 20-21 years, 22-23 years, etc.), thereby not imposing restrictions on the empirical pattern of age-differences. In

[1]Additional aspects of wellbeing (pain, tiredness, stress, interest) were also assessed for the episodes but are not considered here.

addition to age, sociodemographic background variables that have known relationships with age were included the analysis as explanatory variables. These were gender, marital status (married vs. other), education (at least some college education vs. less than college education), race (White vs. other), retirement status (retired vs. not retired), and disability status (presence of a disability vs. not).

Sampling weights

Sampling weights were applied to adjust for several aspects of the complex survey design. Weights for PATS developed by the Gallup Organization are provided on the individual respondent level (i.e., weights are constant for episodes within respondents) to make the sample representative of the U.S. population with regard to geographic region, sex, age, and ethnic origin. Weights for the 2010 ATUS wellbeing module adjust for oversampling of demographic subgroups and different days of the week on the respondent level. In addition to these respondent-level weights, ATUS uses episode-level weights to adjust for unequal probability of episode selection due to differing total numbers of episodes in each person's diary, as well as unequal durations of episodes. Pseudomaximum likelihood (PML) estimation was used to incorporate the sampling weights in the analyses, which were scaled to sum to the cluster size (within person) and sample size (between person) in multilevel analyses, and were used as combined weights in all other (i.e., "single-level") analyses (Asparouhov, 2005, 2006)[2]. Analyses were conducted using maximum likelihood parameter estimation with standard errors robust to non-normality in M*plus*, version 7.11 (Muthén & Muthén, 1998-2012).

Results

Descriptive statistics

Ratings of happiness and sadness were available from 3,948 respondents (11,786 episodes) in PATS and 12,828 respondents (38,081 episodes) in ATUS. Participants provided ratings for an average of 2.99 episodes (0.49% missing) in PATS and 2.97 episodes (1.05% missing) in ATUS. The mean episode length was 136 min (*SD* = 123, range 2 to 1380 min) in PATS and 67 min (*SD* = 96, range 5 to 1107 min) in ATUS. Sample characteristics of respondents are presented in Table 1.

Age differences in happiness and sadness levels

In an initial set of analyses, we examined age differences in the levels of happiness and sadness separately. Each emotion variable was regressed on age and age-squared, using cluster-robust standard errors to correct the standard errors for the nesting of episodes within participants. The mean ratings for happiness were 4.13 (*SD* = 1.68) in PATS and 4.24 (*SD* = 1.66) in ATUS, and mean ratings for sadness were 0.66 (*SD* = 1.41) in PATS and 0.67 (*SD* = 1.41) in ATUS. Data from PATS showed small but statistically significant linear increases in both happiness (b = .040, p = .01; R^2 = .002) and sadness (b = .037, p %lt; .01; R^2 = .002) with age; curvilinear age-trends were not significant (ps > .37). Ratings from ATUS showed

[2]Using the sampling weights is strongly recommended by the Bureau of Labor Statistics (for ATUS) and the Gallup Organization (for PATS); analyses without weights yielded the same age effects.

similar increasing trends but curvilinear age effects were also significant: age differences followed a U-shaped pattern for happiness (linear age $b = .045$, $p < .001$; quadratic age $b = .023$, $p < .001$; $R^2 = .005$) and an inverted U- shaped pattern for sadness (linear age $b = .053$, $p < .001$; quadratic age $b = -.016$, $p = .001$; $R^2 = .005$).

Age differences in mixed emotions using the covariation approach

To obtain an index of mixed emotions using the covariation approach, most previous studies have computed the correlation between positive and negative affect ratings across sampling occasions separately for each respondent (Carstensen et al., 2000; Grühn et al., 2013; Hay & Diehl, 2011; Ong & Bergeman, 2004). This procedure is viable only when a large (and preferably equal) number of sampling occasions is available for each person, but it is problematic with only 3 sampling episodes obtained in PATS and ATUS: the correlation would not be defined for individuals with no observed variation in happiness or sadness across the 3 episodes, and the resulting missing data could yield biased inferences (Schwartz & Stone, 1998). An alternative is to use a multilevel random effects model, and we applied this strategy here. Using multilevel regression, the variation in the happiness-sadness relationship is estimated using the data from all individuals simultaneously (instead of computing a correlation for each person separately), which greatly enhances efficiency and precision of the parameter estimates (Singer & Willett, 2003). Specifically, happiness was regressed on sadness (within-person centered) on the within-person level, allowing for variation in the happiness-sadness relationship (random regression slopes) on the between-person level (Rafaeli, Rogers, & Revelle, 2007; Ready et al., 2008). Linear and quadratic age were entered as predictors of the between-person differences in the happiness-sadness relationship. The mean regression slope of sadness on happiness ratings was negative in PATS ($b = -.332$, $p < .001$) and ATUS ($b = -.284$, $p < .001$), indicating that happiness and sadness were on average negatively associated within individuals. However, significant random effects in the regression slopes indicated that this association varied between individuals (PATS: $\sigma^2 = .282$, $p < .001$; ATUS: $\sigma^2 = .337$, $p < .001$). Linear age significantly predicted the random regression slopes both in PATS ($b = .031$, $p = .03$) and ATUS ($b = .028$, $p = .007$); the positive sign of the age-effects suggests that the slope becomes less strongly negative as age increases. The linear age effects remained significant ($ps < .05$) when controlling for between-person differences in sadness levels. Similarly, the results did not change ($ps < .05$) when participants were removed from the analysis for whom there was no variation either in happiness (PATS: $n = 921$, ATUS: $n = 3396$) or in sadness (PATS: $n = 2496$, ATUS: $n = 8801$) ratings. Quadratic age effects were not significant in either study (PATS: $b = .004$, $p = .59$; ATUS: $b = .009$, $p = .10$).

A potential shortcoming of the multilevel regression approach is that the within person (residual) variances are assumed identical for all respondents, which may not be realistic given that the variability of emotions has been found to differ by age in prior research (Grühn et al., 2013; Röcke, Li, & Smith, 2009). To address this, we conducted additional analyses estimating the average within-person correlation between happiness and sadness for individuals in a given age category (i.e., in each of the 2-year age blocks) using a multilevel multiple-groups analysis. In these models, the means, variances (between- and within-person), and covariances (between- and within-person) were freely estimated in each

age group. The resulting within-person correlations are shown in Figure 2. In PATS, the average within-person correlation was $r = -.24$ ($SE = -.019$, $p < .001$), and the correlation decreased in magnitude from about $r = -.28$ at age 30 to about $r = -.18$ at age 70. In ATUS, the average correlation was $r = -.19$ ($SE = .014$, $p < .001$), and it decreased from $r = -.22$ at age 30 to about $r = -.14$ at age 70 years. Linear trends of age differences in the fisher r-to-z transformed correlations in Figure 2 were significant ($z = 2.48$ for PATS and $z = 2.83$ for ATUS, ps ≤ .01). Curvilinear trends, although suggestive of U-shaped patterns in the magnitude of correlations, were not significant ($z = 1.90$ for PATS and $z = 1.59$ for ATUS, ps > .05)[3].

Age differences in mixed emotions using the ambivalence index

Kaplan (1972) proposed the ambivalence metric as a function of "total affect" (the sum of ratings for positive and negative affect) minus "polarity" (the absolute difference between ratings for positive and negative affect). Arithmetically, this formula is equivalent to taking (two times) the smaller value out of the two affect ratings (positive and negative) for each sampling occasion (Priester & Petty, 1996). Accordingly, we computed the ambivalence index as the minimum (i.e., smaller) value between happiness and sadness for each sampled episode (Ersner-Hershfield et al., 2008; Schimmack, 2001). For example, if a respondent scored 5 on happiness and 1 on sadness for an episode, the index would be 1. The index could range from 0 to 6, with 0 indicating no mixed emotions and 6 indicating the highest level of mixed emotions (cf. Figure 1B).

To examine relationships with age, scores on the index were regressed on age and age-squared, using cluster-robust standard errors to account for the nesting of episodes in respondents. In both studies, the ambivalence index increased with age, with significant linear effects; PATS: $b = .038$, $p < .001$, $R^2 = .004$; ATUS: $b = .046$, $p < .001$, $R^2 = .006$. Curvilinear age effects were not significant (PATS: $b = .006$, $p = .22$; ATUS: $b = -.006$, $p = .11$). Linear age effects remained significant when removing participants with no variability in happiness or sadness ratings (ps ≤ .05), and when statistically controlling for respondents' mean happiness and sadness ratings in multiple regression analysis (ps ≤ .05), suggesting that age effects in the ambivalence index could not be explained by age differences in happiness and sadness levels considered separately.

Age differences in mixed emotions based on episode classification

The third approach was based on an operational definition of mixed emotions as a discrete category or "type" of affective experience. Data analysis proceeded in two consecutive steps. The purpose of the first step was to classify the sampled episodes based on the pattern of happiness and sadness ratings of each episode. Latent profile analysis (LPA; Bauer & Curran, 2004; Gibson, 1959), a variant of latent class analysis for continuous observed data, was used for this purpose. The second step examined age differences in the prevalence of the latent classes (i.e., profiles) obtained in step one.

[3]Age trends in the fisher r-to-z transformed correlations were tested by weighting the correlations by 1/(standard error) for each age-group, consistent with meta-analysis principles.

Latent profile analysis solutions with 1 to 8 latent classes were examined to decide on the number of profiles in the data. Criteria recommended for this decision are the statistical adequacy and model fit of the solution, the theoretical conformity and heuristic value of the extracted profiles, and their replicability across samples (Marsh, Lüdtke, Trautwein, & Morin, 2009; Muthén, 2003; Nylund, Asparoutiov, & Muthen, 2007). The 4-class model was retained by inspection of "elbow-plots" (Nylund et al., 2007) of information criteria for model fit (Bayesian Information Criterion, Akaike Information Criterion, and log likelihood) and because the solution was comprised of clearly distinctive profiles of happiness and sadness ratings that replicated across PATS and ATUS (solutions with more than 4 profiles extracted additional intermediate variants of those in the 4-class model). Figure 3 shows the means and observed ranges of happiness and sadness ratings in each profile, with corresponding profile prevalence rates. The first and most frequent (about 65% of episodes) profile combined high happiness ratings (means > 5 on a 0 to 6 scale in both studies) with low sadness (means < 0.2) ratings, and was labeled "happy" episodes. The second profile was comprised of episodes with low happiness (means ≤ 1.0) and high sadness ratings (means > 4.5); this class of "sad" episodes was evident in 3.8% (PATS) and 2.8% (ATUS) of the episodes. The third profile consisted of relatively low happiness (means ≤ 2.2) and low sadness ratings (means < 0.4), and was labeled "neither happy nor sad" (22 to 25% of episodes). The fourth profile combined moderate to high ratings of happiness (means > 3.9) and sadness (means > 3.6) and was labeled "mixed" emotions; this profile was evident in 7.7% (PATS) and 9.4% (ATUS) of the episodes.

Age differences (linear and quadratic) in the prevalence of the latent emotion profiles were then examined using multinomial logistic regression analysis with cluster-robust standard errors. The "3-step" approach developed for latent class predictor variables (Asparouhov & Muthén, 2014) was applied for this purpose.[4] Plots of the predicted prevalence rates of each profile by age are shown in Figure 4. The prevalence of episodes with a "mixed" emotional profile increased from 5.1% (age 30 years) to 9.6% (age 70 years) in PATS, and from 7.3% (age 30 years) to 13.0% (age 70 years) in ATUS. In PATS, the odds of "mixed" emotion episodes increased for every 10 years of age by 1.16 (95% CI = 1.12 to 1.19, $p < .001$) compared to "happy" episodes, by 1.19 (95% CI = 1.13 to 1.24, $p < .001$) compared to "sad" episodes, and by 1.23 (95% CI = 1.19 to 1.27, $p < .001$) compared to "neither happy nor sad" episodes. In ATUS, the odds of "mixed" episodes increased for every 10 years of age by 1.17 (95% CI = 1.14 to 1.20, $p < .001$) compared to "happy" episodes, by 1.18 (95% CI = 1.14 to 1.23, $p < .001$) compared to "sad" episodes, and by 1.25 (95% CI = 1.22 to 1.28, $p < .001$) compared to "neither happy nor sad" episodes. The effects remained significant (ps < .05) when controlling for person average happiness and sadness ratings in multinomial multiple regression analyses. Quadratic age effects were not significant in PATS (ps > .40). In ATUS, the quadratic age trend was significant when comparing the prevalence of "mixed" with "happy" episodes (odds = .97, $p = .02$), and marginally significant when

[4]This approach ensures that tests of age differences are independent of the classification of emotion profiles while appropriately taking into account the classification error inherent in latent profile analysis. After running the latent profile models (step 1) and obtaining the classification probabilities (step 2), the most likely profile of each episode serves as observed outcomes in multinomial logistic regression analysis (step 3), with uncertainty rates prefixed at the probabilities obtained in step 2 (Asparouhov & Muthén, 2014).

comparing “mixed” with “sad” episodes (odds = 1.05, $p = .08$), but not for the comparison of “mixed” with “neither happy nor sad” episodes (odds = .99, $p = .45$); these quadratic age effects are largely attributable to curvilinear trends in episodes that were either exclusively “happy” or “sad” (cf. Figure 4). We also repeated the analyses removing respondents with no variation in happiness and sadness ratings. This yielded very similar latent profile patterns and linear age effects remained significant (ps < .01), whereas curvilinear age effects were no longer significant (ps > .24).

Correspondence between mixed emotion measures

Prior research has suggested modest congruence between different indices of mixed emotions (Grühn et al., 2013; Schimmack, 2001). To evaluate the degree of correspondence in the present study, we derived a score based on each of the 3 approaches for each individual and examined the correlations between the indices.[5] In PATS, the correlations were $r = .30$ (covariation – ambivalence), $r = .29$ (covariation – classification), and $r = .83$ (ambivalence – classification). In ATUS, the correlations were $r = .23$ (covariation – ambivalence), $r = .19$ (covariation – classification), and $r = .72$ (ambivalence – classification), all ps < .001. Thus, the ambivalence index and profile classification showed considerable correspondence, whereas the two were only modestly related to scores obtained from the covariation approach.

Demographic covariates

Finally, several sociodemographic factors that might account for the observed age differences in mixed emotions were examined. Even though no a priori hypotheses were specified, it is conceivable, for example, that reduced work strain due to retirement contributes to the age effects, in line with predictions from the dynamic model of affect (Reich, Zautra, & Davis, 2003; Zautra, Reich, Davis, Potter, & Nicolson, 2000), which postulates that mixed emotions are less likely under conditions of high stress or cognitive load. As would be expected, higher age was positively related with being retired, having a disability, being female, and white (ps < .001); age showed curvilinear relationships with being married and higher educational attainment (ps < .001), with steep increases until the ages of 35 to 40, and declines thereafter.

When these sociodemographic factors were statistically controlled in multiple regression models, the effects of age remained largely unchanged. Linear age effects remained significant for the *covariance approach* to mixed emotions using multilevel regression (PATS: $b = .039$, $p = .019$; ATUS: $b = .031$, $p = .018$) and in the prediction of the *ambivalence index* (PATS: $b = .050$, $p < .001$; ATUS: $b = .066$, $p < .001$); no quadratic age effects emerged. Table 2 shows the results for the *classification approach* predicting the prevalence of the latent emotion profiles from age and demographic covariates simultaneously in multinomial logistic regressions. Episodes with "neither happy nor sad" profile serve as the reference group in the table. In both studies, "mixed" emotions were

[5]The following strategies were used to obtain scores for individual respondents used in the correlation analyses: For the covariation approach, we saved the model-based (empirical Bayes) estimates of the individual slopes from the multilevel regressions of happiness on sadness. For the ambivalence index, we calculated the mean ambivalence rating for each person. For the classification approach, we saved a person’s proportion (log odds) of episodes classified as mixed emotion (versus any of the other latent emotion profiles).

significantly more prevalent in older people (*p*s < .001), and significantly less likely in white (*p*s < .01) and more educated (*p*s < .001) people. Having a disability was also associated with more frequent "mixed" emotions (*p*s < .05), as well as more frequent "sad" (*p*s < .001) and less "happy" (*p* < .05 in ATUS) episodes. Being married was associated with significantly more "happy" (*p*s < .01) and fewer "sad" (*p* < .05 in ATUS) episodes, but not with the occurrence of "mixed" episodes. In addition, women were significantly more likely than men to experience either "happy" (*p*s < .05) or "sad" (*p*s < .05) episodes, with no gender difference in "mixed" emotional episodes. Retirement was associated with more frequent "happy" episodes in ATUS (*p* < .05), but was otherwise not systematically related to the emotion profiles when age and other demographic factors were controlled.

Discussion

To the best of our knowledge, this is the first study examining age differences in the occurrence of mixed emotions across the adult life span in large, nationally representative U.S. samples. Across two different samples and three different operational definitions, the results provided consistent evidence of increases in mixed emotions with age, such that happiness and sadness were more likely to co-occur across the episodes of the day among older compared to younger adults. Notably, the effect sizes were very small in magnitude according to conventional standards (Cohen, 1988), with age generally explaining less than one percent of the variance. In combination with the generally small and often non-significant effects of prior research, this suggests that age-differences in mixed emotions may only be reliably detectable in large samples. However, the effects in this study were robust and could not be accounted for by other demographic factors that covary with age. Furthermore, the fact that the results replicated across three different definitions of mixed emotions enhances statistical conclusion validity and suggests that they may not be explained by response bias or age differences in the interpretation and use of response scales (Schwarz & Knauper, 2000).

Age and levels of happiness and sadness

The consistency of age-effects in mixed emotions across PATS and ATUS is noteworthy especially given that the two samples in this study provided somewhat inconsistent age patterns when levels of happiness and sadness were examined separately. Whereas PATS data suggested linear increases in both happiness and sadness with age, the larger ATUS data indicated U-shaped (happiness) and inverted U-shaped (sadness) age-patterns, with the lowest happiness and highest sadness levels occurring between 40 to 60 years of age. The latter patterns from ATUS are consistent with results from a previous large study that asked over 300,000 individuals in the U.S. whether they experienced happiness and sadness “a lot of the day” yesterday (Stone et al., 2010). Notably, however, a number of extant cross-sectional studies have yielded similarly equivocal findings with regard to age-differences in the intensity of emotions, especially for levels of positive affect, and have variously found increases, stability, or declines, with age (Carstensen et al., 2000; English & Carstensen, 2014; Kessler & Staudinger, 2009; Mroczek & Kolarz, 1998; Sutin et al., 2013). Our results suggest that meaningful and potentially more robust differences between age groups emerge

when positive and negative emotions are not examined in isolation but when their experience is regarded in concert.

Age pattern of mixed emotions

Drawing from life-span theories of emotional development, we speculated that age trends in mixed emotions may not be strictly linear. Specifically, from a cognitive-developmental perspective, it has been argued that the capacities for accepting emotional conflict and contradiction may eventually decline in old age (Labouvie-Vief et al., 2010), whereas the life-span motivational perspective of SST might suggest that increases in mixed emotions or "poignancy" are especially pronounced late in life as the experience of meaningful endings becomes more salient (Carstensen et al., 1999; Ersner-Hershfield et al., 2008). Our results did not provide evidence for curvilinear age-trends in either direction. There are several possible explanations for this finding. Age effects may in fact be strictly linear, or curvilinear age-trends are very subtle and require very large samples to be detected. It is also possible that nonlinear shifts occur only very proximal to the end of life as either cognitive declines or the salience of ultimate endings become especially pronounced (Lindenberger & Ghisletta, 2009; Scheibe & Carstensen, 2010). Another intriguing possibility is that cognitive and motivational changes in late life operate simultaneously, but their reciprocal influences cancel each other out. Importantly, measures stemming from a cognitive-developmental perspective have been based on emotion narratives in laboratory settings (Labouvievief, Chiodo, Goguen, Diehl, & Orwoll, 1995; Magai et al., 2006). While these measures have evidenced curvilinear age patterns congruent with those of cognitive developmental processes (Labouvie-Vief & Medler, 2002), the cognitive-affective parameters captured with these laboratory-based procedures may only be remotely related to people's experiences of mixed emotions in their natural daily environments. Similarly, while experimental research supports the relationship between perceived endings and mixed emotions postulated by SST (Ersner-Hershfield et al., 2008), little is known about the extent to which developmental changes in the awareness of time as limited mediate age-related changes in mixed emotions in natural contexts. To better understand the various processes underlying life-span changes in mixed emotions, future research would benefit from multimodal assessment studies that can link emotional processing abilities, motivational components of affect regulation, and affective experiences in daily life (Scheibe & Carstensen, 2010).

Sociodemographic factors and mixed emotions

It is also instructive to consider how emotional experiences differ by age and other sociodemographic variables. Our results on gender differences showed that women, compared to men, experienced more daily episodes in which they were either predominantly happy or predominantly sad. This finding is consistent with studies demonstrating that women respond more strongly to both positive and negative emotional sensations, in part due to cultural gender expectations that include greater caregiving responsibilities for women (Fujita, Diener, & Sandvik, 1991; Grossman & Wood, 1993). However, in contrast to the observed age-differences, there was no gender difference in the prevalence of daily episodes with mixed emotions, suggesting the possibility that women are more likely than men to oscillate between pleasant and unpleasant affect throughout the day.

Results showed that age, race, education, and disability were independent predictors of mixed emotional daily episodes. Lower education and the presence of disabilities were associated with more frequent mixed emotions, which, to our knowledge, is a new finding. Larsen et al.'s (2003) co-activation model suggests that activating positive feelings alongside negative ones might benefit individuals to successfully cope with adversities by allowing them to confront negative life events and to find meaning in life's stressors. Complementing the observed age differences, the effects for education and disability suggest that mixed emotions may be generally more likely when facing adverse circumstances in one's life, which may play an important role in the dynamics of emotional adjustment over the course of the life span.

In addition, we found that Whites were significantly less likely to experience mixed emotions compared with other racial and ethnic groups. Williams and Aaker (2002) argued that cultural differences (Western versus Eastern societies) and age differences would share common features in that both people in Western societies and younger people would be less likely to embrace the duality inherent in mixed emotions. In line with this hypothesis, they showed in several experiments that both Anglo Americans and younger people experienced more discomfort compared with Asian Americans and older people when they were exposed to mixed (i.e., simultaneously happy and sad) emotional stimuli (Williams & Aaker, 2002). Thus, differences in age and in culture may share similar features with regard to the acceptance of contradictory feelings involved in the experience of mixed emotions.

Strengths, limitations, and future directions

One strength of this study was the use of multiple operational definitions of mixed emotions. Past research has indicated that different definitions yield indicators that are often not highly related (Diener & Iran-Nejad, 1986; Schimmack, 2001), and we also found this to be the case in the present study. In particular, scores derived from the covariation approach showed only a very modest positive relationship with those derived from the ambivalence and classification approaches. It is possible that these alternative indices tap into quite distinct concepts that may reflect different developmental aspects of emotional experience, each of which changes in a similar fashion with age. Interestingly, covariation and ambivalence scores have each been found to be associated with adaptive outcomes (e.g., physical health, self-control, adaptive information processing; Davis et al., 2004; Ersner-Hershfield et al., 2009; Hershfield et al., 2013; Ong & Bergeman, 2004), suggesting that each may capture meaningful aspects of emotion regulation. In future research, direct comparisons of these different approaches in relation to indicators of successful aging could prove useful to compare their differential validity and utility.

The DRM method used by PATS and ATUS allowed the investigation of short-term emotional experiences from large and nationally representative samples. Compared with ratings involving global retrospective evaluations, assessment of yesterday's affect minimizes recall biases (Broderick et al., 2008) to which older people may be particularly prone. Moreover, the DRM procedure was specifically developed to evoke the contextual experience of participants' feelings during each episode of the day, as opposed to the semantic and decontextualized information involved in one's beliefs about emotions

(Kahneman et al., 2004; Robinson & Clore, 2002). Accumulating evidence suggests that DRM ratings can capture patterns of affect corresponding to those obtained with momentary assessments (Daly, Delaney, Doran, Harmon, & MacLachlan, 2010; Dockray et al., 2010; Stone et al., 2006). Nevertheless, a caveat is that the DRM still is a retrospective measure that does rely on participants' memory, as well as their ability to identify and "relive" the episodes of the previous day. Additional research is needed on the extent to which recall bias negatively affects the DRM procedure's ability to adequately measure the interplay of different feelings across time and daily contexts. In addition, some episodes in ATUS cover relatively longer time periods of several hours. Thus, it is not possible to exclude that individuals reporting a mix of happiness and sadness during such longer episodes actually experienced these emotions in a sequential fashion (i.e., they vacillated between happiness and sadness) rather than concurrently (Larsen & McGraw, 2011). However, all ratings in PATS were obtained for short (15-minute) intervals of the day, and age effects in ATUS did not change when longer episodes (>1 hour) were excluded from the analyses (results not shown).

This study focused on happiness and sadness ratings as a pair of oppositely valenced emotions, given that their co-occurrence has been considered prototypical for the experience of mixed emotions (Larsen & McGraw, 2011; Larsen et al., 2001) or poignancy (Ersner-Hershfield et al., 2008). We cannot say whether the findings generalize beyond combinations of happiness and sadness to other types of positive and negative affect. Recently, it has been argued that the age gradient in emotion levels may be differentially pronounced for high arousal emotions (e.g., enthusiastic, anxious) compared to low arousal emotions (e.g., relaxed, bored) due to age-related changes in emotion regulation strategies (English & Carstensen, 2014; Kessler & Staudinger, 2009). Using a wider range of emotion items is also necessary for examining additional aspects of emotional complexity that may be distinct from but related to the experience of mixed emotions, including indicators of emotion differentiation [e.g., changes in the factor structure of emotion across age, (Carstensen et al., 2000)] or of emotional granularity [the tendency to discriminate among specific positive or negative emotions, (Tugade, Fredrickson, & Barrett, 2004)]. For example, a clusterwise simultaneous component analysis of 20 emotion items (Brose et al., in press) showed that older adults displayed less complex structures of emotion ratings compared to younger adults in that the structure was more likely reduced to a positive affect component. Research is warranted to conceptually integrate the different aspects of mixed emotions and emotional complexity that can be derived from the emotion circumplex to better understand their relationships with successful aging and emotional wellbeing (Grühn et al., 2013; Larsen & McGraw, 2014).

An additional study limitation is that symptom ratings in ATUS and PATS were collected only for three randomly selected diary episodes per person to reduce participant burden. Data on more episodes per person would yield a more precise characterization of an individual's tendency to experience mixed emotions over the course of the day (e.g., diurnal cycles in mixed emotions). In response to reviewer concerns that three episodes may not be sufficient to yield robust estimates of age differences in the happiness-sadness relationship in multilevel models, we conducted a series of Monte Carlo simulations for the covariation approach in this study (see Appendix). Supporting our analyses, we found that parameter

estimates and standard errors were potentially biased in small samples of individuals, but not when using a small number of observations combined with a large sample as in the present study. The number of individuals in the sample also had a much greater impact on statistical power for detecting age differences than the number of observations per person (see also Maas & Hox, 2005; Snijders & Bosker, 2012).

Finally, due to the cross-sectional design of this study, it is not possible to distinguish changes in mixed emotions with increasing age from potential cohort effects. Disentangling these components is important, as has been demonstrated in studies focusing on age differences in affect levels. For example, a longitudinal study by Sutin et al. (2013) found that older birth cohorts had lower levels of affective wellbeing, but each cohort increased in wellbeing with age relative to their own baseline. Similarly, it is well possible that social, economic, and educational factors associated with different birth cohorts may impact the occurrence of mixed emotions and may have confounded the present study results. To date, only one study (Carstensen et al., 2011) has provided longitudinal evidence of age-related changes in mixed emotions.

In sum, the present study adds to the growing literature documenting vital changes in emotional experience and regulation over the course of adulthood. Our findings lend consistent support to the postulate that mixed emotions increase over the adult life span in the general U.S. population. Further research is needed to fully elucidate the cognitive, biological, and psychological processes underlying these age differences.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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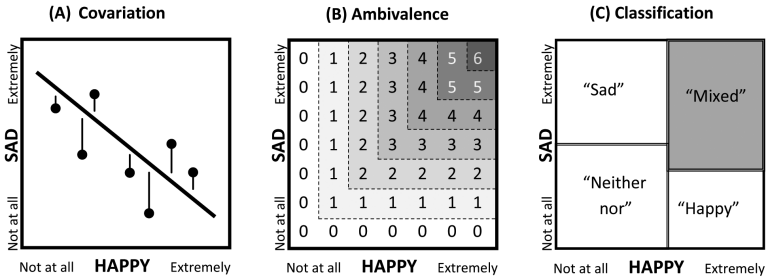

Figure 1.

Schematic illustration of three operational definitions of mixed emotional experiences. (A) Covariation approach: points that deviate from the perfect negative regression line are indicative of mixed emotions. (B) Ambivalence approach: darker shaded cells with higher numbers represent more intense mixed emotions. (C) Classification approach: mixed emotions represent a distinct category based on the bivariate pattern of happiness and sadness (areas for emotion categories are empirically determined and may differ in size and shape).

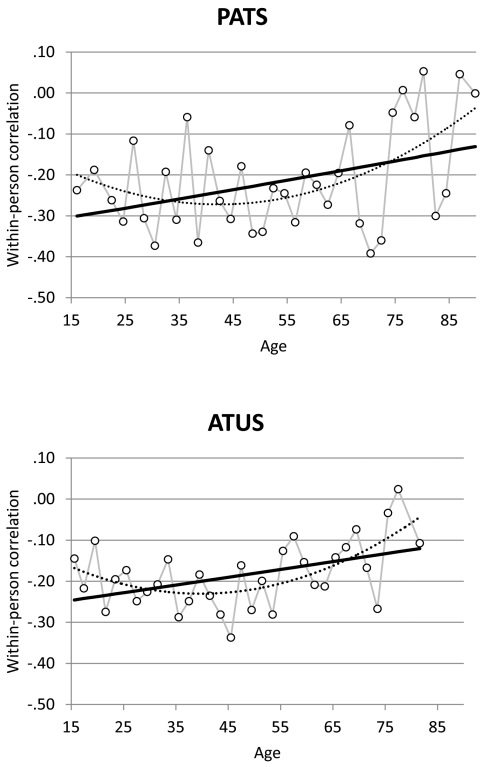

Figure 2.

Within-person correlations between happiness and sadness by age-groups (open circles), with predicted linear age trends (thick line) and curvilinear age trends (dotted line).

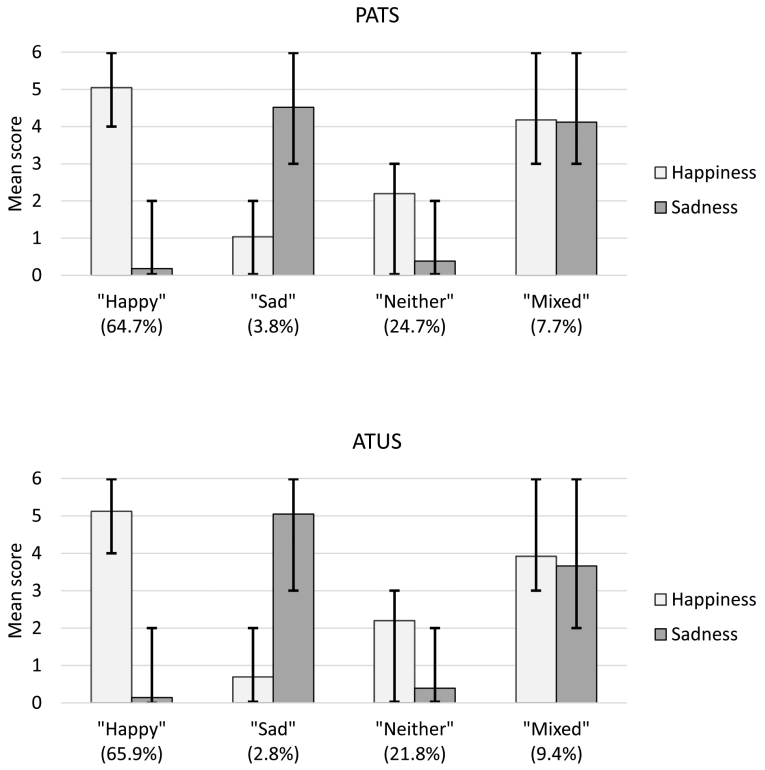

Figure 3.

Predicted means from latent profile analysis of happiness and sadness ratings. Error bars represent the ranges of the observed scores in each latent profile. Prevalence (percent episodes) of each profile is indicated in parentheses.

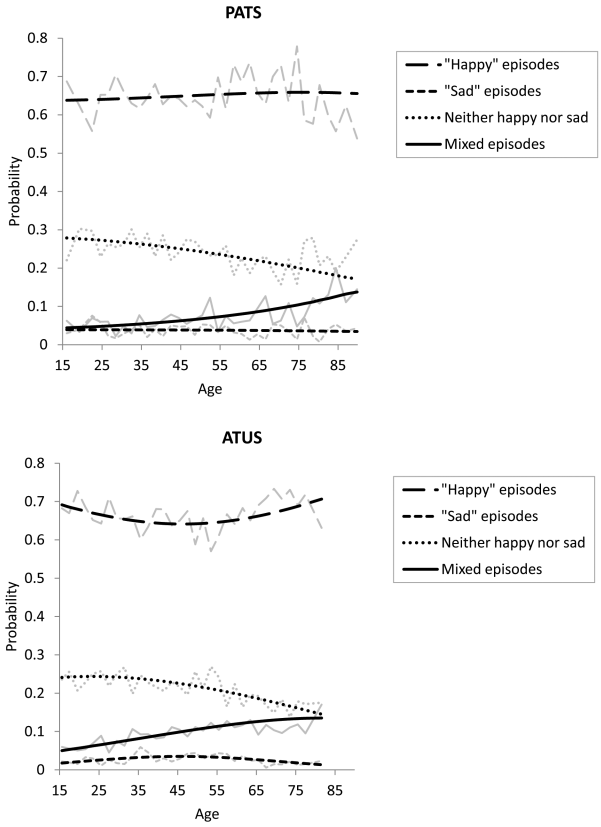

Figure 4.

Predicted probabilities of latent emotion profiles across age. Black lines represent effects based on linear and quadratic age. Grey lines represent effects based on 2-year age groups.

Table 1

Descriptive characteristics of study samples (unweighted)

	PATS (*n* = 3,948)	**ATUS (*n* = 12,828)**
Mean age (SD) in years	51.5 (17.9)	46.7 (17.6)
Age range [a]	15 - 90	15 - 85
Female (%)	61.4	56.1
Marital status (%)		
Married	55.1	49.5
Single / never married	22.7	25.6
Separated / divorced	10.8	16.3
Widowed	11.5	8.7
Racial/ethnic group (%)		
White	88.3	79.5
Black or African American	7.0	14.7
Asian	1.3	3.3
Other	3.4	2.5
Education (%)		
<1st grade through 8th grade	3.2	4.2
9th – 12th grade	7.1	11.7
High school diploma	25.2	25.5
Some college, no degree	17.9	18.0
Associate degree	11.4	9.2
Bachelor's degree	21.0	19.7
Masters / Doctoral degree	14.1	11.7
Retired (%)	10.1	16.7
Disability (%) [b]	17.2	10.9

Notes:

[a] For PATS, ages over 89 were aggregated into a single category of age 90 or older. For ATUS, ages over 84 were aggregated into a single category of age 85 or older.

[b] Disability was assessed with a single question in PATS ("Do you have a disability that limits the kind or amount of work that you can do?") and with multiple codes in ATUS ("Does this person have any of these disabilities?" difficulty dressing or bathing / seeing even with glasses / hearing / walking or climbing stairs / remembering, concentrating, decision making due to physical, mental, or emotional condition).

Table 2

Results from multinomial logistic regressions predicting the occurrence of latent emotion profiles from age and demographic covariates

	Comparisons with "Neither happy nor sad" episodes					
	"Happy" episodes		"Sad" episodes		"Mixed" episodes	
	Odds	95% CI	Odds	95% CI	Odds	95% CI
PATS						
Age (linear)	1.04	(0.99, 1.08)	1.03	(0.93, 1.13)	1.24***	(1.14, 1.36)
Age (quadratic)	1.01	(0.98, 1.03)	0.99	(0.94, 1.03)	1.00	(0.97, 1.04)
White	0.98	(0.79, 1.21)	0.74	(0.48, 1.12)	0.44**	(0.32, 0.62)
Married	1.24**	(1.07, 1.43)	0.77	(0.57, 1.04)	1.21	(0.94, 1.55)
Higher education	0.93	(0.80, 1.08)	0.74	(0.53, 1.04)	0.54***	(0.42, 0.70)
Female	1.33***	(1.18, 1.54)	1.89***	(1.41, 2.56)	1.16	(0.92, 1.47)
Retired	1.16	(0.90, 1.49)	0.97	(0.62, 1.52)	0.96	(0.68, 1.35)
Disabled	0.94	(0.76, 1.16)	2.26***	(1.57, 3.25)	2 38***	(1.76, 3.23)
ATUS						
Age (linear)	1.02	(0.98, 1.07)	1.06	(0.94, 1.20)	1.26***	(1.17, 1.36)
Age (quadratic)	1.02	(1.00, 1.04)	0.90***	(0.85, 0.95)	0.97	(0.94, 1.01)
White	0.99	(0.84, 1.16)	1.21	(0.84, 1.75)	0.66**	(0.51, 0.85)
Married	1.23**	(1.08, 1.40)	0.68*	(0.48, 0.98)	0.89	(0.72, 1.10)
Higher education	0.92	(0.81, 1.05)	0.62*	(0.42, 0.91)	0.60***	(0.49, 0.75)
Female	1.18*	(1.04, 1.33)	1.52*	(1.09, 2.13)	1.19	(0.97, 1.45)
Retired	1.31*	(1.04, 1.65)	1.04	(0.62, 1.76)	1.11	(0.77, 1.60)
Disabled	0.78*	(0.62, 0.99)	2.53***	(1.55, 4.13)	1.38*	(1.03, 1.86)

Notes:

CI = confidence interval. Age was entered as a continuous predictor, centered around 45 years of age, with one unit difference representing 10 years of age. Education was dichotomized into "less than college" versus some "college or more". For comparisons with other reference groups, effects of linear age in PATS are odds=1.20 (p<.001) for "mixed" versus "happy" and odds=1.21 (p<.01) for "mixed" versus "sad" episodes; in ATUS, odds=1.23 (p<.001) for "mixed" versus "happy" and odds 1.19 (p=.01) for "mixed" versus "sad" episodes in ATUS.

* p< .05,

** p < .01,

*** p < .001.