



Discrete affects across the adult lifespan: Evidence for multidimensionality and multidirectionality of affective experiences in young, middle-aged and older adults

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ABSTRACT

Research on emotional functioning in adulthood has focused primarily on positive and negative affect rather than on discrete emotions. To close this gap, 948 adults aged 18–78 years reported their affect on a German version of the Positive Affect Negative Affect Schedule – Extended (PANAS-X). Besides positive and negative affect, the scale assessed discrete negative affects (fear, hostility, guilt, sadness), discrete positive affects (joviality, self-assurance, attentiveness), and other affective states (shyness, fatigue, serenity, surprise). Findings showed divergent shapes across the adult lifespan documenting multidimensionality and multidirectionality. Personality factors explained a large portion of interindividual differences in discrete affects; however, after controlling for sociodemographic and personality factors, age showed still significant associations to some but not all discrete affects.

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1. Introduction

Throughout life, people experience different affective states, such as fear, sadness, guilt, or happiness. However, how frequently these feelings occur and how intensely they are experienced can change across the lifespan. Among others, differences in social roles (e.g. parenting, retirement), life experiences (e.g. traumatic events, getting married), or vulnerabilities of the biological and psychological system (e.g. chronic pain due to arthritis) may explain why certain feelings are more prevalent in one age period than in others (for an overview, see Scheibe & Carstensen, 2010). From the theoretical perspective of lifespan developmental psychology (Baltes, Lindenberger, & Staudinger, 2006), affect is characterized by multidimensionality (i.e., it consists of different dimensions such as sadness or happiness) and multidirectionality (i.e., the various dimensions may show different developmental trajectories across the lifespan). Despite these obvious characteristics of affect, the emotion literature for adulthood and old age focuses primarily on positive and negative affect, thereby neglecting the many other discrete facets of affect. To fill this gap, the goal of the present cross-sectional study was to investigate age-related differences in discrete affects across the adult lifespan. In addition, we examined the role of sociodemographic and personality factors in explaining interindividual differences in discrete affects beyond chronological age.

The majority of studies concerning age-related differences in and developmental trajectories of affective experiences across the adult lifespan have examined broad positive and negative affect domains. The resulting empirical findings are mixed. For positive affect, some cross-sectional (Costa, McCrae, & Zonderman, 1987; Diener & Suh, 1997; Isaacowitz & Smith, 2003; Kunzmann, Little, & Smith, 2000) and longitudinal studies (Charles, Reynolds, & Gatz, 2001; Stacey & Gatz, 1991) found an age-related decline in positive affect. Some cross-sectional (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Lawton, Kleban, & Dean, 1993; Lawton, Kleban, Rajagopal, & Dean, 1992; Malatesta & Kalnok, 1984) and longitudinal studies (Kunzmann et al., 2000) reported no age differences in positive affect. And some studies reported an age-related increase in positive affect based on cross-sectional data (Mroczek & Kolarz, 1998). For negative affect, the majority of studies showed an age-related decline in cross-sectional (Barrick, Hutchinsen, & Deckers, 1989; Carstensen et al., 2000; Costa et al., 1987; Gross et al., 1997; Lawton et al., 1992, 1993) and longitudinal research (Charles et al., 2001; Stacey & Gatz, 1991). Some studies, however, revealed no significant association between chronological age and negative affect cross-sectionally (Diener & Suh, 1997; Levine & Bluck, 1997; Malatesta & Kalnok, 1984; Mroczek & Kolarz, 1998) or longitudinally (Kunzmann et al., 2000). Taken together, although there is a broad literature on positive and negative affect, there is still no consensus on the exact developmental pattern of positive and negative affect.

One central reason for the inconsistent picture of findings might be the broadness with which positive and negative affect is assessed. Both affect dimensions consist of several discrete affective

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states, such as anger, fear, sadness, joviality, and attentiveness, which have rarely been captured as separate entities in previous research. These affective states, however, might show divergent developmental patterns (i.e., multidirectionality) within the positive and the negative affect dimensions. Thus, the mixed pattern of findings across the adult lifespan might be due to different contributions of discrete affects underlying the broader positive and negative affect dimensions.

Despite the growing literature on the role of affect in adulthood and old age, the empirical investigation of discrete affects is relatively scarce and the few existing studies have been mainly concerned with different negative affects. Gross and colleagues (Gross et al., 1997), for example, reported two (out of four) studies on age-related differences in subjective experiences of discrete affect: In a sample of Norwegians from two age groups (ages 20–35 and 70+, Study 3) and in a sample of American nuns (ages 24–91, Study 4) age was significantly associated with a decreased subjective experience of anger (Studies 3 and 4), sadness, and fear (Study 4). In contrast, no age differences were found in the experience of disgust. Schieman (1999) investigated the experience of anger in two cross-sectional samples of Canadian and US adults ranging from 18 to 96 years in age. Overall, and consistent with the findings by Gross and colleagues (1997), he found that older adults were less likely to experience anger than middle-aged and younger adults. The latter group reported the most anger. Lawton and colleagues (1993) investigated age differences in the frequency of different reported affects of young (ages 18–30), middle-aged (ages 31–59), and older adults (ages 60–87). Older adults reported feeling contentment more frequently than young adults. In contrast, young adults reported feeling depression, anxiety-guilt, hostility, and shyness more often than older adults did. Middle-aged adults showed a mixed pattern with greater similarity to young adults for contentment, depression, and hostility and greater similarity to older adults for anxiety-guilt and shyness. No age differences were found for other positive affects. Taken together, evidence from the few existing studies regarding age differences in discrete affects is suggestive of decreases in many facets of negative affectivity and increases or stability in different facets of positive affectivity. Moreover, the mixed pattern for middle-aged adults is suggestive of non-linear effects across the adult lifespan.

The intensity and frequency with which individuals experience affect differ from person to person. For instance, older persons who are in good health, who have high intelligence scores, and who show strong social engagement are likely to report higher positive affect than persons with more negative expressions on the outlined variables (Isaacowitz & Smith, 2003; Kunzmann, 2008). In the present study, our focus is on two factors that may explain some of the interindividual differences in affect: sociodemographic and personality characteristics. Even though empirical findings suggest that sociodemographic factors, such as gender, marital status, and education, only explain a small part – if any – of the interindividual differences in affect (Diener, Suh, Lucas, & Smith, 1999; Eid & Larsen, 2008; Kahneman, Diener, & Schwarz, 1999), there is some evidence that sociodemographic factors might modulate the age-affect association: For example, unmarried men showed no association between negative affect and age, whereas married men showed a clear negative correlation between both variables (Mroczek & Kolarz, 1998). Although these findings highlight the importance of sociodemographic factors in moderating the age-affect relationship, clear replications of these effects are missing, particularly with regard to potentially differential patterns across the different discrete affects.

One of the strongest predictors of interindividual differences in affect is personality (Diener & Lucas, 1999). Most studies that investigated the relationship between personality and affect focused on extraversion and neuroticism – two major dimensions

of the Big Five personality traits. In particular, two meta-analyses revealed a strong link between extraversion and positive affect as well as between neuroticism and negative affect (DeNeve & Cooper, 1998; Steel, Schmidt, & Shultz, 2008). The relation between the other Big Five dimensions – openness, agreeableness, and conscientiousness – and affect is less clear. The two meta-analyses suggest that positive affect is weakly and positively associated with openness, agreeableness, and conscientiousness; and negative affect is weakly and negatively associated with agreeableness and conscientiousness (DeNeve & Cooper, 1998; Steel et al., 2008). To our knowledge there is no study reporting relationships between discrete affects and personality factors. Besides the direct association between personality and affect, there is some evidence that personality factors might also mediate or moderate the relationship between affect and age. For example, men low in extraversion showed a stronger association between age and positive affect than men high in extraversion (Mroczek & Kolarz, 1998). Women's extraversion did not moderate the age-affect association.

In sum, studies have shown that sociodemographic and personality variables account for some of the between-person differences in positive and negative affect. In addition, there are indications that people who differ from each other with respect to sociodemographic or personality characteristics might also show different relationships between affect and age. The question remains whether this is also the case for discrete affects. Uncovering whether and how sociodemographic or personality characteristics play a differential role across various discrete affect domains regarding age differences and in moderating the age-affect association will shed light upon the complex nature of affective well-being across the lifespan.

The goal of the present study was threefold: First, we investigated age-related differences in discrete positive and negative affects across the adult lifespan. The empirical pattern of the age-affect association for positive and negative affect is inconsistent. Similarly, clear age patterns for discrete affects have yet to be established. The present study attempts to fill this gap by considering linear and quadratic effects of age on discrete affects in a continuous age sample of adults between 18 and 78 years. In general, we expected a pattern of age-related decline in negative affects (fear, hostility, guilt, and sadness) and no age differences or age-related increases in positive affects (attentiveness, joviality, and self-assurance). For other affective states (shyness, fatigue, serenity, and surprise), the analyses were exploratory. Second, we examined the relationship between sociodemographic as well as personality factors and discrete affects. Personality factors explain a considerable amount of interindividual differences in broader positive and negative affect factors. Beyond these associations on the broad factor level, personality factors might show stronger links to certain discrete affects than others. For instance, agreeableness is probably negatively associated with hostility, whereas agreeableness is not necessarily related to sadness. In this context, we also examined the unique explanatory power of age regarding individual differences in discrete affects over and above sociodemographic and personality factors. Third, in order to replicate and extend previous studies that suggested differential age-affect associations based on gender, marital status, and personality (Mroczek & Kolarz, 1998), we examined whether the associations between age and discrete affects are qualified by sociodemographic or personality factors.

To investigate the three goals, we asked a large sample of adults aged 18–78 years to complete the Positive and Negative Affect Schedule – Extended (PANAS-X; Watson & Clark, 1994). The PANAS-X is a self-report instrument measuring two broad dimensions of positive and negative affect as well as eleven discrete affects. The discrete affects are organized into three categories: (a) *basic negative emotions*, including fear, hostility, guilt, and sad-

ness; (b) *basic positive emotions*, including attentiveness, joviality, and self-assurance; and (c) *other affective states*, including shyness, fatigue, serenity, and surprise.

2. Method

2.1. Participants

Participants were recruited through newspaper advertisements in Berlin, Germany. The sample consisted of 948 adults ranging continuously in age from 18 to 78 years ($M = 46.1$; $SD = 17.8$, 58.4% females).

Out of the 948 participants, 583 were married or living in a long-term relationship, 256 were single and 109 were divorced or widowed. The sample was well balanced in education: 53.8% of the participants had a German Abitur (i.e., the general qualification for university entrance in Germany). Years of education ranged from 8 to 26 years ($M = 13.5$ years, $SD = 3.9$ years).

2.2. Measures

2.2.1. Discrete affects

Affect was assessed with a German translation of the Positive and Negative Affect Schedule – Extended (PANAS-X; Watson & Clark, 1994). The PANAS-X is an extended form of the standard 20-item Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS-X has a total of 60 affect items including the 20 items for positive and negative affect from the shorter 20-item PANAS version. In addition to positive and negative affect measured by the 20-item PANAS, the PANAS-X also assesses affective states in three broad categories: (a) *basic negative emotions*: fear, hostility, guilt, and sadness (b) *basic positive emotions*: attentiveness, joviality, and self-assurance, and (c) *other affective states*: shyness, fatigue, serenity, and surprise. The PANAS-X is conceptualized in a hierarchical fashion: The so-called basic negative emotions (fear, hostility, guilt, and sadness) and basic positive emotions (attentiveness, joviality, and self-assurance) are thought to be lower-order factor for the higher-order factors of negative and positive affect, respectively. Participants indicated to what extent they experienced each affect in general during the past year on a 7-point scale ranging from *very slightly or not at all* (1) to *extremely* (7). Internal consistencies were high for all subscales. Table 1 provides the internal consistencies as well as corresponding German and English items for each dimension.

2.2.2. Personality

Personality was assessed with a German version of the Big Five Inventory (BFI; Lang, Lüdtke, & Asendorpf, 2001). The German BFI has 42 items and assesses extraversion, neuroticism, agreeableness, conscientiousness, and openness. Internal consistencies were high for all subscales (extraversion: $\alpha = .79$; neuroticism: $\alpha = .83$; agreeableness: $\alpha = .74$; conscientiousness: $\alpha = .83$; openness: $\alpha = .74$).

2.3. Procedure

Participants in the current sample were initially recruited for different studies (Grühn, Scheibe, & Baltes, 2007; Grühn, Smith, & Baltes, 2005; Kotter-Grühn, Scheibe, Blanchard-Fields, & Baltes, 2009).¹ In order to investigate age differences in affect in a large and heterogeneous sample, we combined datasets from these stud-

ies. In all studies, the PANAS-X scale and the BFI were included in the initial background questionnaires. Due to time constraints in some projects, not all participants completed all subscales from the PANAS-X. All participants ($N = 948$) completed the two general affect dimensions of positive and negative affect as well as the so-called *basic negative emotions* (fear, hostility, guilt, sadness) and *basic positive emotions* (attentiveness, joviality, self-assurance) from the PANAS-X. Nearly half of the sample ($n = 451$, $M = 47.0$ years, $SD = 18.3$ years, 68.8% females) completed the *other affective states* subscales (i.e., shyness, fatigue, serenity, surprise) as well. Participants, who completed all subscales, and participants, who completed only the basic negative and basic positive affect subscales, did not differ significantly on any affect dimension, personality factor or other background variable (all $p > .05$, $\eta^2 < .01$).

3. Results

Results are organized into three sections: First, we investigated the age-affect association for different discrete affects. We analyzed linear and quadratic associations between affect and age. Second, we examined the predictive power of sociodemographic and personality factors for discrete affects. Moreover, we examined whether age added explanatory value over and above sociodemographic and personality factors. Third, we tested whether the relationship between age and affect was moderated by sociodemographic and personality factors.

Throughout this article we use an alpha level of $\alpha = .01$. Despite this more rigorous alpha level, even very small effects (e.g., $\eta^2 = .02$) reached significance due to the large sample size. The presentation and discussion of findings focus on effect sizes and the shape of age patterns rather than p -values.

3.1. Age differences in discrete affects

In order to investigate linear and non-linear effects of age, we conducted a hierarchical regression analysis for each affect dimension with the linear and the quadratic term (age²) of age as predictors. Age was centered in all analyses. We entered age in the first step and age² in the second step.² Table 2 provides the results of the regression analyses. With two exceptions (positive affect and joviality), age showed significant linear associations to all discrete affect dimensions. Specifically, negative affect, fear, hostility, guilt, sadness, self-assurance, shyness, fatigue, and surprise showed significant age-related declines, whereas attentiveness and serenity showed significant age-related increases. Some of the linear relationships were further specified by curvilinear associations. Three dimensions – joviality, serenity, and surprise – showed significant U-shaped patterns across the adult lifespan. Thus, (late) middle-aged adults reported lower joviality, serenity, and surprise than young and older adults. Negative affect and sadness showed significant inverted U-shaped patterns, that is, (late) middle-aged adults reported higher values on these dimensions than younger and older adults. The different age patterns for the discrete affects are indicative of different age-related trajectories (i.e., multidirectionality) of affective experience across the adult lifespan.

3.2. The role of age compared to sociodemographic and personality factors for discrete affects

In a next set of analyses, we examined the predictive power of sociodemographic and personality factors for discrete affects. We conducted hierarchical regression analyses to test whether these

¹ There are no overlaps between these studies and the reported results here. In addition, the data source, that is in which study persons participated, did not moderate the findings.

² We also tested for higher-order effects of age (cubic effects: age \times age \times age, quartic effects: age \times age \times age \times age). None of these higher-order effects reached significance.

Table 1
Item composition of the German PANAS-X scales.

General dimensions	
Negative affect (10/.86)	ängstlich (afraid), bedrückt (distressed), beschämt (ashamed), feindselig (hostile), nervös (nervous), reizbar (irritable), schuldig (guilty), unruhig (jittery), verängstigt (scared), verärgert (upset)
Positive affect (10/.86)	aktiv (active), angeregt (inspired), aufmerksam (attentive), begeistert (enthusiastic), entschlossen (determined), freudig erregt (excited), hellwach (alert), interessiert (interested), stark (strong), stolz (proud)
Basic negative emotion	
Fear (6/.86)	ängstlich (afraid), furchtsam (frightened), nervös (nervous), unruhig (jittery), unsicher (shaky), verängstigt (scared)
Hostility (6/.82)	angeekelt (disgusted), feindselig (hostile), haßerfüllt (loathing), reizbar (irritable), voller Verachtung (scornful), wütend (angry)
Guilt (6/.80)	beschämt (ashamed), mit sich selbst unzufrieden, schuldig (guilty), tadelnswert (blameworthy), über sich selbst verärgert (angry at self), vor sich selbst geekelt (disgusted with self)
Sadness (5/.90)	allein (alone), einsam (lonely), niedergeschlagen (downhearted), traurig (sad), trübsinnig (blue)
Basic positive emotion	
Joyality (8/.92)	begeistert (enthusiastic), energiegeladener, erfreut (delighted), freudig (joyful), freudig erregt (excited), fröhlich (cheerful), glücklich (happy), lebhaft (lively)
Self-assurance (6/.78)	furchtlos (fearless), kühn (bold), selbstsicher (confident), stark (strong), stolz (proud), wagemutig (daring)
Attentiveness (4/.79)	aufmerksam (attentive), entschlossen (determined), hellwach (alert), konzentriert (concentrating)
Other affective states	
Shyness (4/.77)	scheu (bashful), schüchtern (shy), verlegen (sheepish), zaghaft (timid)
Fatigue (4/.83)	dösig (drowsy), müde (tired), schläfrig (sleepy), träge (sluggish)
Serenity (3/.81)	entspannt (relaxed), gelassen (at ease), ruhig (calm)
Surprise (3/.77)	erstaunt (astounded), überrascht (surprised), verblüfft (amazed)

Note: In the left column, the number of items comprising each scale as well as internal consistency values (Cronbach's Alpha) is reported in parentheses.

factors explained interindividual differences in affects and whether age had explanatory value over and above these factors. Sex (men = 0; women = 1), years of education,³ and marital status were entered into the regression model in the first step; the Big Five personality factors (neuroticism, extraversion, openness, agreeableness, and conscientiousness) were entered in a second step. In step 3, age and age2 were entered into the model.⁴ With this procedure, we determined linear and quadratic effects of age over and above the effects of other explanatory variables. Marital status was dummy-coded, resulting in two variables using married persons as the reference group (i.e., married vs. single; married vs. divorced/widowed).

Table 3 provides the final results of the regression analyses. The sociodemographic factors had only small explanatory value after personality factors were entered into the model.⁵ The amount of explained variance by sociodemographic factors for the discrete affects ranged from $R^2 = .00$ to $R^2 = .04$. In the final model, only marital status reached significance for positive affect and joviality. Singles reported lower positive affect and lower joviality than married people. No other single sociodemographic factor reached significance in the final regression model. In particular, there was no evidence for significant differences between men and women or between married and non-married people.

Personality factors, however, were strongly linked to discrete affects. The entering of the personality variables created a large increase in the amount of explained variance ranging from $R^2 = .08$ for surprise to $R^2 = .42$ for negative affect. The personality-affect associations showed divergent patterns depending on the discrete affects. As a rough generalization, positive affects (positive affect, attentiveness, joviality, and self-assurance) were negatively related to neuroticism ($-.30 \leq \beta \leq -.22$) and positively related to extraversion ($.15 \leq \beta \leq .33$), openness ($.09 \leq \beta \leq .18$), and conscientiousness ($.00 \leq \beta \leq -.30$). Negative affects (negative affect, fear, hostility, guilt, and sadness) were positively associated with neuroticism ($.32 \leq \beta \leq .58$) and negatively related to conscientiousness ($-.22 \leq \beta \leq -.10$). The other affective states showed a mixed pattern: Shyness was positively associated with neuroticism and negatively with extraversion and conscientiousness; fatigue was positively associated with neuroticism and negatively with conscientiousness; serenity was only negatively associated with neuroticism; and surprise was weakly associated with extraversion.

Most importantly, after entering sociodemographic and personality factors into the model, age and age2 still revealed explanatory

³ In the reported regression analyses, we used the continuous variable 'years of education' due to its superior psychometric properties. We reran the analyses with education defined as the educational degree obtained (having a German Abitur: yes/no). These analyses showed practically the same numerical results.

⁴ We also added measures of fluid (i.e. digit-symbol-substitution test) and crystallized intelligence (i.e. vocabulary) into the regression model. The cognitive variables were not related to the affects and were omitted from the final analyses.

⁵ In concert with personality, the sociodemographic factors showed no or weak associations with discrete affects. When analyzed alone, however, some sociodemographic factors showed significant effects. Women reported more negative affect (Women: $M = 3.29$, $SD = 1.04$; Men: $M = 3.03$, $SD = 0.95$), fear (Women: $M = 3.46$, $SD = 1.28$; Men: $M = 3.11$, $SD = 1.10$), sadness (Women: $M = 3.83$, $SD = 1.43$; Men: $M = 3.38$, $SD = 1.30$), and less serenity, (Women: $M = 4.11$, $SD = 1.32$; Men: $M = 4.56$, $SD = 1.25$) than men, all $p < .01$, $\eta^2 = .02$. Marital status revealed significant effects for negative affect, hostility, and self-assurance, all $p < .01$, $\eta^2 = .02$. Married or living together people (negative affect: $M = 3.21$, $SD = 1.03$; hostility: $M = 2.24$, $SD = 1.31$) and single people (negative affect: $M = 3.26$, $SD = 0.98$; hostility: $M = 2.15$, $SD = 1.24$) reported more negative affect and hostility than divorced or widowed people (negative affect: $M = 2.84$, $SD = 0.93$; hostility: $M = 1.64$, $SD = 0.89$). Similarly, married or living together people reported significantly more self-assurance ($M = 4.30$, $SD = 1.14$) than divorced or widowed people ($M = 3.89$, $SD = 1.13$) with singles being in-between ($M = 4.17$, $SD = 1.15$). Education did not show any significant effects on reported affects. For gender, education, and marital status, there was no evidence for significant interactions with age in predicting discrete affects.

Table 2
Regression analyses for discrete affects by age and age2.

	Regression analyses			
	Age		Age2	
	β	R^2	β	ΔR^2
<i>General dimensions</i>				
Negative affect	-.28*	.08	-.12*	.02
Positive affect	.06	<.01	.07	.01
<i>Basic negative emotions</i>				
Fear	-.24*	.06	-.07	.01
Hostility	-.24*	.06	-.01	<.01
Guilt	-.14*	.02	-.02	<.01
Sadness	-.24*	.06	-.11*	.01
<i>Basic positive emotions</i>				
Attentiveness	.17*	.03	-.08	.01
Joviality	-.03	<.01	.13*	.02
Self-assurance	-.11*	.01	.04	<.01
<i>Other affective states</i>				
Shyness	-.31*	.09	.10	.01
Fatigue	-.29*	.08	.01	<.01
Serenity	.15*	.04	.24*	.06
Surprise	-.20*	.03	.25*	.06

* $p < .01$.

value for some but not all discrete affects. The explained variance of age and age2 range from $R^2 = .00$ to $R^2 = .07$ for surprise. Fig. 1 shows the predicted affect patterns based on regression estimates for age and age2 after controls for sociodemographic and personality variables. In Fig. 1, discrete affects are organized based on their age pattern. Positive affect, joviality, serenity, and surprise showed a U-shaped function; negative affect and sadness showed a reversed U-shaped function; self-assurance, fear, fatigue, and shyness showed a linear-decline pattern; and attentiveness, guilt, and hostility showed no significant association with age.

3.3. The role of sociodemographic and personality factors for the age-affect relationship

After we had identified explanatory factors for the discrete affects, we examined whether the above reported age-affect

Table 3
Estimated standardized regression coefficients (β) and explained variance (R^2) in predicting discrete affects by sociodemographic characteristics (Step 1), personality variables (Step 2), and age and age2 (Step 3).

Variable	PA	NA	FEA	HOS	GUI	SAD	ATT	JOV	SAS	SHY	FAT	SER	SUR
<i>Step 1</i>													
Sex ^a	-.04	.01	.00	-.07	-.08	.02	-.03	.00	-.03	.01	.00	-.01	.01
Education	-.01	-.03	-.03	.07	-.07	-.04	.05	-.04	-.02	-.03	-.05	-.07	-.03
Single ^b	-.08*	.02	.00	-.01	.04	.04	-.04	-.12*	-.06	-.02	.06	-.04	-.06
Divorced ^b	-.04	-.03	.00	-.02	-.01	.02	-.03	-.05	-.08	.01	.05	-.04	-.06
<i>Step 2</i>													
Neuroticism	-.26*	.54*	.58*	.32*	.38*	.51*	-.22*	-.30*	-.29*	.31*	.24*	-.44*	-.10
Extraversion	.29*	.00	.02	.04	.00	-.08*	.15*	.33*	.25*	-.30*	-.05	.04	.19*
Openness	.18*	.06	.03	-.01	.04	.07	.13*	.09*	.13*	.03	.00	.07	.12
Agreeableness	.02	-.09*	.05	-.28*	.01	.05	.04	.08	-.09*	.04	-.03	.10	-.03
Conscientiousness	.20*	-.12*	-.11*	-.13*	-.22*	-.10*	.30*	.00	.14*	-.14*	-.37*	.06	-.01
<i>Step 3</i>													
Age	-.05	-.16*	-.15*	-.09	-.05	-.16*	.04	-.09*	-.16*	-.25*	-.16*	.07	-.18*
Age2	.14*	-.09*	-.04	.05	-.02	-.09*	-.03	.18*	.08	.12	.02	.15*	.29*
<i>R² change per step</i>													
Step 1	.01	.03*	.02*	.03*	.01	.03*	.00	.01	.02*	.03	.02	.04*	.02
Step 2	.36*	.42*	.38*	.28*	.24*	.33*	.31*	.29*	.25*	.29*	.30*	.29*	.08*
Step 3	.02*	.03*	.02*	.01	.00	.03*	.00	.04*	.03*	.05*	.02*	.02*	.07*

Note: Values are estimates based on the final model.

^a Sex is coded 0 for men and 1 for women.

^b Marital status was dummy-coded with married persons as the reference group (i.e., singles vs. married, divorced/widowed vs. married); a negative (positive) value would indicate that this group reported a lower (higher) score on the affect dimension than married people. PA = positive affect. NA = negative affect. FEA = fear. HOS = hostility. GUI = guilt. SAD = sadness. ATT = attentiveness. JOV = joviality. SAS = self-assurance. SHY = shyness. FAT = fatigue. SER = serenity. SUR = surprise.

* $p < .01$.

relationships were moderated by sociodemographic or personality factors. In a final set of hierarchical regression analyses, we tested for interactions between both linear and quadratic functions of age and the potential moderator variables. All continuous predictor variables were centered before computing the interactions; all nominal predictors were dummy-coded (sex: 0 = men, 1 = women; two dummy variables for marital status with married people as reference group: married = [0, 0], single = [1, 0]; divorced/widowed = [0, 1]). The linear and quadratic effects of age were entered into the regression model in the first step, followed by all sociodemographic and personality variables in a second step. In a third step, we entered all interactions between the linear age term and sociodemographic as well as personality factors. In a fourth step, we entered all interactions between the quadratic age term and sociodemographic as well as personality variables. We conducted the hierarchical regressions for all discrete affects testing for a total of 234 interactions (13 affects \times 18 interactions). We report unstandardized regression weights (B) for the full model (see recommendations by Cohen, Cohen, Aiken, & West, 2002).

With one exception, the analyses revealed that none of the tested sociodemographic or personality characteristics moderated the relationship between age and affect. The only significant interaction was found for shyness between extraversion and age2, $B = 0.000585$, $SE B = 0.000176$, $p < .01$. As presented in Fig. 1, shyness showed a slightly curved pattern across the adult lifespan. The interaction between extraversion and age2 suggested that levels of extraversion were particularly important in middle-aged adults: Middle-aged adults high in extraversion (+1 SD) reported lower shyness (about 1 scale point) than middle-aged adults low in extraversion (-1 SD). For young and older adults, extraversion was not related to shyness. In an attempt to replicate findings from previous studies (Mroczek & Kolarz, 1998), we reran the analyses separately for men and women and used only the predictor variables found significant in past research. However, none of the interactions reached significance.

4. Discussion

In this study, we investigated age-related differences in discrete positive and negative affects across the adult lifespan and the role

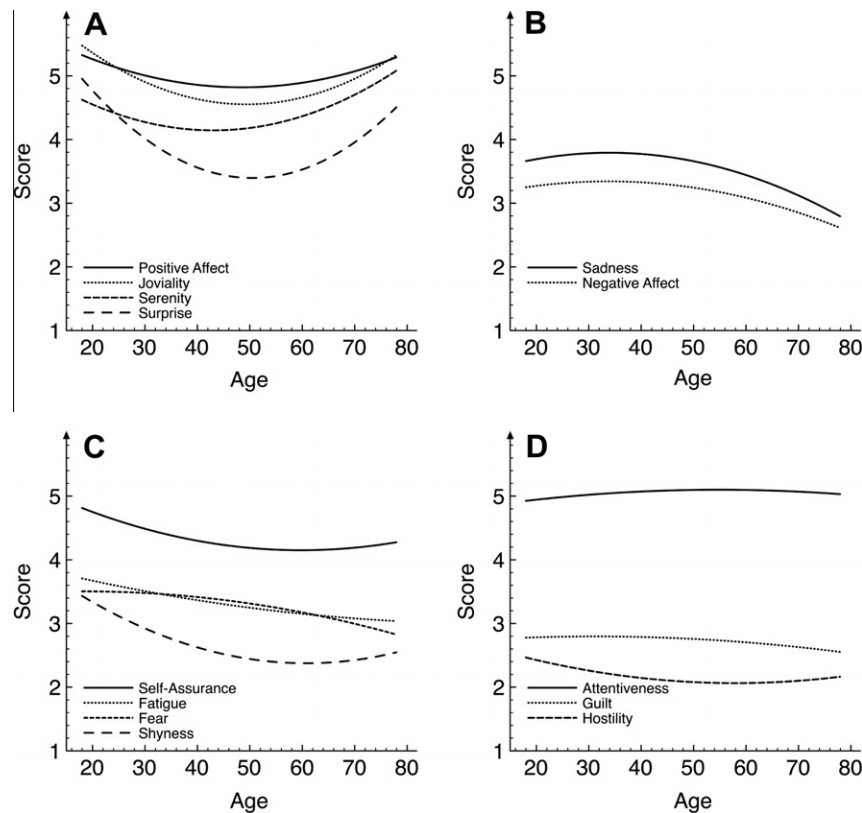


Fig. 1. Estimated age patterns for discrete affects after controlling for sociodemographic and personality factors. Discrete affects are organized by their shape over the adult lifespan: Panel A presents affects with a U-shaped function; Panel B presents affects with a reversed U-shaped function; Panel C presents affects with a linear-decline pattern; and Panel D presents affects that show no association with age.

of sociodemographic and personality variables in this context. We found four major results: First, the age-affect association showed different patterns for different affects. Second, personality factors explained a large portion of interindividual differences in affect. Sociodemographic factors explained hardly any interindividual differences after personality factors were controlled for. Most importantly, however, age and age² had unique explanatory power above and beyond personality and sociodemographic factors. Third, we found no evidence that sociodemographic or personality characteristics moderated the relationship between age and affect.

Our primary goal was to extend the literature by testing the age-affect association for discrete affects across the adult lifespan. As expected, and in line with the lifespan psychological notions of multidimensionality and multidirectionality (Baltes, 1987), the cross-sectional age differences that we found across discrete positive and negative affects point to different age-related trajectories of affective experience. Positive affect, joviality, serenity, and surprise – mainly positive emotions – showed a U-shaped function across the adult lifespan: People in late midlife (~40 to ~60 years) reported the lowest scores whereas people in young and old adulthood reported the highest scores. This non-linear pattern for positive affect might explain some of the previous mixed findings: Depending on the age composition, one might observe a pattern of age-related decline (Charles et al., 2001; Costa et al., 1987), no age differences (Carstensen et al., 2000; Lawton et al., 1993), or age-related increases (Mroczek & Kolarz, 1998) in positive affect. Consistent with the majority of past studies, negative affect declined with age (Barrick et al., 1989; Carstensen et al., 2000; Charles et al., 2001; Costa et al., 1987; Lawton et al., 1993). Specifically, negative affect and sadness showed an accelerated reversed U-shaped function with older adults reporting lower scores than young and middle-aged adults. For self-assurance, fatigue, fear,

and shyness older adults reported lower scores than middle-aged adults who reported lower scores than young adults. Finally, attentiveness, guilt, and hostility revealed no clear association with age.

Before interpreting these diverse age-affect relationships, we want to emphasize that age per se is not an explanatory variable (Wohlwill, 1970) but a proxy for many social, physical, and cognitive changes. The divergent age patterns for discrete affects suggest that single-cause explanations for age differences are insufficient. We can only speculate about potential developmental processes underlying the complex age-affect relationships. One process might be an experience-based competence in dealing with emotional situations. Following the literature on emotion-regulation (Gross, 1999), one might assume that experience-based competencies show – if any – a linear increase over the adult lifespan (Blanchard-Fields, 2007; Gross et al., 1997). This account might explain the linear age-related decline in fear and shyness, but would not explain the simultaneous decline in self-assurance and the quadratic age pattern for some other emotions.

Age-related changes in social interactions may be another explanation for the relatively low scores that older adults report for most negative emotions such as sadness, shyness, and fear and the relatively high scores they report for positive emotions. With increasing age, the frequency of social interactions is likely to decrease (Lang & Carstensen, 1994), which, in turn might lead to a decline in the number of opportunities to experience negative emotions in the first place. In addition, socioemotional selectivity theory states that with increasing age, individuals are more selective with respect to their interaction partners (Carstensen, Isaacowitz, & Charles, 1999). A focus on relationships with persons who are relatively close and emotionally supporting is also likely to decrease the frequency with which negative emotions are experienced and increase the likelihood with which positive emotions

are reported. We acknowledge that a decrease in social interaction might also result in an increase in sadness, fear, or loneliness for some older individuals. However, the data from the present study as well as previous research does not support this notion. When interpreting the relatively positive results for older adults, we should, however, take into account that the current study primarily included rather healthy elderly. There is some empirical evidence suggestive of a less positive profile in very old age (Charles et al., 2001; Chipperfield, Perry, & Weiner, 2003; Kunzmann et al., 2000) probably due to health-related limitations.

Given that (a) older adults on average report less energy than younger adults and (b) older adults' sleep is more fragmented and lighter than younger adults' sleep (e.g. Espie, 2002), the age-related decline in reported fatigue was a surprising finding. However, even though there is relatively little empirical data about age differences in fatigue, our finding is in accordance with several studies in the work context that also show an age-related decline in general and mental fatigue (Åkerstedt et al., 2004; Brown & Thorsteinsson, 2009; Donders, Roskes, & van der Gulden, 2007; Winwood, Winefield, & Lushington, 2006). At this point we can only speculate about possible explanations for the lower levels of fatigue in older adults. First, in comparison to the average elderly person, older participants in the current study might be healthier and have more physical, psychological, as well as material resources, all of which are likely to be related to lower levels of fatigue. Second, the general age-related decrease in resources that could lead to higher fatigue might be compensated by the fact that particularly after retirement older adults' schedules are likely to be less busy and under greater self-control. This leaves them more time and resources to deal with their daily demands and to do the things they like or are motivated to do. Finally, for various reasons (e.g., social demand characteristics or the desire not to fulfill typical age stereotypes), older adults might be particularly motivated and alert during their participation in the study, which is likely to positively influence their ratings of fatigue-related items.

One of the most striking findings in our study was that middle-aged adults showed, on average, the most negative profile: They reported low scores on positive affects and high scores on negative affects. This pattern suggests that middle adulthood is not simply a time between young and old age, but a time of distinct needs, problems, and resources. Mroczek (2004) points to the possibility that midlife may be the time in life when the simultaneous demands of work and family are highest, thereby creating more stress, which, in turn, may lead to more negative experiences of affect (e.g. Lachman, 2004). At the same time, midlife provides many opportunities for important experiences of job- and family-related successes (e.g., promotion on the job, children master milestones of education). Therefore, the low levels of positive affects are somewhat surprising.

In contrast to the popular stereotype that women are the more "emotional" gender, we found no empirical evidence for gender differences. This is consistent with other studies reporting no or small relationships between gender and affect. Similarly, we found hardly any evidence that reported affect differed by marital status. After adjusting for personality factors and age, these effects disappeared with the exception that married people reported more positive affect and joviality than singles, which is in accordance with results from previous studies (for an overview, see Diener et al., 1999). Education did not reveal any significant association with discrete affects.

In the present study, personality factors best explained inter-individual differences in discrete affects. As expected and in line with previous studies (e.g., DeNeve & Cooper, 1998; Steel et al., 2008), neuroticism was the best predictor for negative affect whereas extraversion was the best predictor for positive affect. For the discrete affects, personality variables show divergent patterns. Similar

to the results from two meta-analyses (DeNeve & Cooper, 1998; Steel et al., 2008), the present study found that positive emotions (positive affect, attentiveness, joviality, and self-assurance) showed strong associations with neuroticism and extraversion and weak associations with openness and conscientiousness. Negative emotions (negative affect, fear, hostility, guilt, and sadness) were primarily associated with neuroticism and weakly with conscientiousness. Thus, when comparing the differential effects of personality factors, it seems that neuroticism is the 'general emotion' factor related to the intensity of practically all (positive and negative) discrete affects whereas extraversion is the 'positive emotion' factor related to primarily positive experiences. The other personality factors (agreeableness, extraversion, and conscientiousness) showed a mixed pattern depending on the discrete affect. For example, shyness was more often reported from people high in neuroticism and low in extraversion and conscientiousness. Surprisingly, conscientiousness was associated with practically all discrete affects. This is consistent with the two meta-analyses (DeNeve & Cooper, 1998; Steel et al., 2008) reporting substantial associations between conscientiousness and indicators of subjective well-being (e.g. happiness, life satisfaction, positive affect, negative affect, and quality of life). But why conscientiousness is related to affective experiences in general seems to require additional investigations.

In contrast to previous reports (Mroczek & Kolarz, 1998), we found no evidence that the age-affect association was moderated by sociodemographic or personality factors with one exception: Middle-aged adults low in extraversion reported more shyness than middle-aged adults high in extraversion. Although this moderation makes sense and was substantial, we suggest caution in its interpretation. Given the number of tests (234) and the used alpha level ($\alpha = .01$), one would expect two significant effects ($234/100 \approx 2$) by chance. A replication of this effect is needed before interpreting it.

In sum, we extended previous research on affect by investigating multiple discrete affects over the lifespan. This approach goes beyond the examination of the two very broad affect dimensions of positive and negative affect and it will further our understanding of the complex nature of affective states. Supporting and highlighting the importance of this approach, our study revealed differential age patterns for discrete affects. In particular, the negative emotions showed the most diverse associations with age. For example, only age differences in sadness resembled the age pattern of the general negative affect dimension. Thus, inconsistent findings in previous studies might be due to assessing different aspects of positive and negative affect. We argue that emotion and well-being research needs to focus more on discrete emotions in late life.

4.1. Limitations and outlook

One clear limitation of the current study was its cross-sectional design. Although a cross-sectional design can give hints about potential age-related changes, cohort and age effects are likely to be confounded. Future research would benefit greatly from longitudinal or sequential designs providing more clear-cut data about age-related changes in discrete affects. These designs may also illuminate potential cohort effects in emotional experiences. Another limitation of this study concerns the age range of participants. The inclusion of participants beyond the age of 80 years might have revealed a less positive picture with respect to older adults' affect. In addition, there is growing evidence for age-related differences in short-term fluctuations of positive and negative affect (Carstensen et al., 2000; Röcke, Li, & Smith, 2009). Similarly, future research on discrete affects may benefit from more complex designs including assessments on much shorter time-scales. Moreover, different intensity levels of emotional experiences (low-

intense anger vs. high-intense anger) may provide new insights into discrete affects as well as their developmental trajectory (Kessler & Staudinger, 2009).

In conclusion, we found evidence for multidimensionality (affect encompassed different discrete affects, such as sadness and guilt) and multidirectionality (discrete affects showed divergent developmental patterns across the lifespan) in affect. The diverse pattern of age-related differences suggests that several mechanisms have to be involved and that single-cause explanations are not sufficient in accounting for the complex association between age and affect across the adult lifespan.

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Appendix A

A.1. Zero-order correlations between discrete affects

	1	2	3	4	5	6	7	8	9	10	11	12
1. Negative affect												
2. Positive affect	-.37**											
3. Fear	.88**	-.32**										
4. Hostility	.66**	-.30**	.53**									
5. Guilt	.70**	-.30**	.54**	.54**								
6. Sadness	.78**	-.45**	.70**	.48**	.53**							
7. Attentiveness	-.37**	.79**	-.32**	-.31**	-.32**	-.41**						
8. Joviality	-.36**	.81**	-.31**	-.36**	-.25**	-.45**	.54**					
9. Self-assurance	-.27**	.77**	-.27**	-.15**	-.24**	-.35**	.49**	.62**				
10. Shyness	.53**	-.22**	.61**	.36**	.51**	.46**	-.23**	-.20**	-.21**			
11. Fatigue	.59**	-.37**	.56**	.41**	.52**	.62**	-.41**	-.35**	-.28**	.42**		
12. Serenity	-.56**	.58**	-.58**	-.41**	-.44**	-.55**	.46**	.67**	.48**	-.21**	-.29**	
13. Surprise	.05**	.51**	.07**	.05**	.04**	-.09**	.29**	.50**	.47**	.16**	.00**	.25**

* p < .01.
 ** p < .02.

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