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Age-group differences in facets of positive and negative affect

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Objectives: The higher order structure of Positive Affect (PA) and Negative Affect (NA) is comparable in self-report affect data from younger and older adults. The current study advances this work by comparing the factor structure of *facets* of PA and NA in older and younger adults using exploratory and confirmatory factor analyses.
Method: Older ($N = 203$; M age = 73.5 years, range 65–92) and younger ($N = 349$; M age = 19.1 years, range 18–30) adults completed the Positive and Negative Affect Schedule–Expanded Form (PANAS-X) (Watson, D., & Clark, L.A. (1999). *Manual for the Positive and Negative Affect Schedule – Expanded Form*. Iowa City, IA: The University of Iowa), which measures General PA and NA as well as three facets of PA (Joviality, Self-Assurance, and Attentiveness) and four facets of NA (Fear, Sadness, Guilt, and Hostility).
Results: Item-level exploratory factor analyses of the facet scales revealed structures that were similar in older and younger adults; however, older adult solutions were more diffuse and diverged more from the PANAS-X scale structure. The facet of Sadness exhibited the largest age-group difference, relating more to guilt and anxiety in older than younger adults.
Conclusion: Older adults may discriminate less amongst specific affect terms or may experience greater affective heterogeneity. Further, Sadness may manifest in age-specific ways. The construct variance of Sadness, and how this issue might be related to the assessment of depression in older adults, is discussed.

Keywords: positive affect; negative affect; older adults; younger adults; aging; sadness

Introduction

Many years ago, Powell Lawton and colleagues made the intriguing suggestion that Positive Affect (PA) may change in age-specific ways across the adult lifespan (Lawton, Kleban, & Dean, 1993). This notion was prescient of current research findings that facets (i.e., specific aspects) of PA, indeed may change differentially with age (Kessler & Staudinger, 2009; Terracciano, McCrae, Brant, & Costa, 2005). In the 15 years since Lawton's work was published, interest in developmental and age group differences in PA, as well as in Negative Affect (NA), has increased dramatically, and now the study of age and affect is at a critical juncture: there is consensus about certain important age-related trends in affect, such as the decrease in NA that occurs from young adulthood into early older age (Consedine & Magai, 2006; Kunzmann, Little, & Smith, 2000; Roberts, Walton, & Viechtbauer, 2006), and investigators now are digging deeper into potential age-group differences in affect and their developmental significance. The current project advances this research by examining age-group differences and similarities in lower order *facets* of PA and NA in younger and older adults.

The structure of affect in older and younger adults

It is important to establish structural convergence in affect ratings for different age groups, because structural similarity allows for meaningful comparisons across age groups and for investigation of change in affect across development. Further, structural similarity of affect in adults of different ages, or lack thereof, has implications for the applicability of models of stress and coping, psychotherapeutic techniques, and models of psychopathology and well-being—all of which incorporate affect as a core feature (Beck, Rush, Shaw, & Emery, 1979; Diener, 1994; Labouvie-Vief, 2003; Mineka, Watson, & Clark, 1998; Zautra, Affleck, Tennen, Reich, & Davis, 2005) – for persons of different ages.

There is consistent evidence that the broad, largely independent dimensions of PA and NA capture the structure of affect in younger and older adults equally well. In an early study, Lawton et al. (1992) compared the factor structure of brief five-item PA and NA scales in younger, midlife, and older adults. Exploratory and confirmatory factor analyses established the existence of comparable factors of PA and NA across the groups.

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The Positive and Negative Affect Schedule (PANAS) is the most widely used measure of PA and NA whose structure has been evaluated in older adults. Several factor-analytic studies of the PANAS indicate that two factors comprising PA and NA provide a parsimonious structure for self-reported affect (Crawford & Henry, 2004; Kercher, 1992; Kunzmann et al., 2000). Kercher (1992) gathered self-report data using a short, 10-item version of the PANAS in 804 adults, aged 72 or older. Exploratory and confirmatory factor analyses revealed that PA and NA factors accounted for much of the variation between items. Further, item loadings on these factors were parallel to results for younger adults in other studies. PA and NA scales correlated -0.02 in the older adults, similar to previous findings with younger samples (Watson & Clark, 1999), indicating that the PA and NA scales were largely independent. Using the same scale with a large Australian sample ($N = 2,651$), Mackinnon et al. (1999) found that the structural characteristics of PA and NA scales were robust across differences in age, sex, and other demographic variables. The correlation between PA and NA did not increase or decrease as a function of age.

Kunzmann et al. (2000) ran a principal-components analysis on the full 20-item PANAS administered to adults, aged 70 to 103. Again, results supported the two-factor PA-NA structure. Crawford and Henry (2004) administered the PANAS to 1003 persons in Britain, aged 18–91, and found the two-factor PA-NA structure to be invariant across younger (<43 years) and older participants (age >43 years). These studies did not examine PA and NA correlations by age.

Thus, in broad strokes, PA and NA emerge in self-report data from older adults, and exhibit a structure that is similar to that identified in younger adults. However, lurking beneath the surface of these generalities are some potentially meaningful age-group differences in the details of structural components of affect. In factor analyses of 46 affect terms rated by younger and older adults, Lawton et al. (1993) found seven factors (PA, Anxiety/Guilt, Contentment, Depression, Hostility, Interpersonal Warmth, and Shyness). Confirmatory factor analyses indicated that older adults differed significantly from younger adults in the magnitude of factor loadings on PA and Depression: loadings were smaller in older than younger adults. Data from another early factor-analytic study suggested that PA and NA might be more strongly negatively associated in older adults than in younger and midlife samples (Benin, Stock, & Okun, 1988). Shapiro, Roberts, and Beck (1999) found that some PANAS items loaded less than 0.50 on their intended factor in healthy older adults over age 65. Thus, despite overall similarities in the structure of PA and NA, factor solutions might not be as 'clean' in older relative to younger adults.

Further, facets of PA and NA may be differentially interrelated in younger and older adult data. Lawton et al. (1993) reported that the association between two distinct PA facets (PA and Contentment) was stronger in older ($r = 0.76$) than midlife persons ($r = 0.64$). Contentment and Depression were more strongly correlated in older ($r = -0.68$) than in younger persons ($r = -0.51$) and all three age groups differed in associations between Contentment and Hostility, with the lowest correlations for the youngest adults (younger $r = -0.20$, midlife $r = -0.58$, older $r = -0.41$). Thus, associations among facets of PA and between facets of PA and NA may be stronger in older than younger adults.

Mean level differences in affect

Relative to structural analyses, more attention has been devoted to age-group differences in mean levels of affect in cross-sectional and longitudinal analyses; there are several excellent reviews of this literature (Consedine & Magai, 2006; Kunzmann et al., 2000). In general, NA tends to decrease across the adult lifespan; the decline slows into older age and may reverse in old-old age (Barrick, Hutchinson, & Deckers, 1989; Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Charles, Reynolds, & Gatz, 2001; Crawford & Henry, 2004; Griffin, Mroczek, & Spiro, 2006; Lawton et al., 1993). Results for PA are more equivocal: some data suggest decreased PA in older relative to younger adults (Griffin et al., 2006; Mackinnon et al., 1999), whereas other data indicate increased PA with age (Mroczek & Kolarz, 1998), and some studies indicate little or no change (Barrick et al., 1989; Carstensen et al., 2000; Crawford & Henry, 2004; Lawton et al., 1993).

Mixed results for PA may be due to failure to control for important individual-difference factors, such as health (Kunzmann et al., 2000) and to the fact that specific facets of PA may *change differentially* across adult development. Lawton et al. (1993) found decline in some aspects of PA across different age groups (e.g., energy, excitement) but increases in others (e.g., interest). More recently, in an elegant study, Kessler and Staudinger (2009) measured self-reported high arousal PA, low arousal PA, high arousal NA, and low arousal NA in persons aged 20 to 80. High arousal PA did not significantly differ by age but low arousal PA increased with age.

In contrast to PA, facets of NA tend to decrease uniformly across age and are consistently lower in older than younger age groups. Kessler and Staudinger (2009) found that NA facets were lower in older age than at midlife. Teachman (2006), also in a cross-sectional study, reported that different measures of NA showed similar curvilinear age-related differences: There was evidence for increased NA in younger adulthood, then a decrease in middle adulthood and into older age, and finally an increase in old-old age.

Facets of the personality dimensions of Extraversion and Neuroticism, which are closely related to PA and NA respectively, show parallel

patterns with age (Terracciano et al., 2005). Facets of Neuroticism tend to be uniformly lower with age, whereas longitudinal trajectories of change are different for facets of Extraversion. For example, excitement seeking and activity appear to decline the most (although via different trajectories), whereas assertiveness increases, at least until approximately age 70, and gregariousness holds fairly steady across the lifespan. Similarly, in a review of several studies, two facets of Extraversion changed differentially with age; social dominance increased and social vitality decreased (Helson & Kwan, 2000). This finding was confirmed in a subsequent meta-analysis (Roberts et al., 2006).

The current study

The current study sought to advance knowledge about mean-level differences and the structural invariance of facets of self-reported affect in younger and older adults. Affect data were collected with the Positive and Negative Affect Schedule–Expanded Form (PANAS-X) (Watson & Clark, 1999), which measures General PA and NA as well as three facets of PA (Joviality, Self-Assurance, and Attentiveness) and four facets of NA (Fear, Sadness, Guilt, and Hostility). Age-group differences in mean levels for NA facets were expected to be uniformly significant, with consistently lower NA in older than younger persons. In contrast, we expected to find greater PA in older adults only for lower-activation (e.g., Attentiveness) aspects of PA.

The structures of facets of PA and NA were compared in older and younger adults using exploratory and confirmatory factor analyses. This aspect of the study was particularly novel because most studies on the age-invariance of the structure of affect have focused only on the higher order dimensions of PA and NA and not on lower order scales and thus have not addressed the construct invariance of affect at lower levels of the hierarchy.

Method

Participants and procedure

Participants were older ($N = 203$; M age $= 73.5$ years, range 65–92; 33.8% male; 95.6% Caucasian) and younger adults ($N = 349$; M age $= 19.1$ years, range 18–30; 28.9% male; 86.5% Caucasian) who took part in a larger study on the structure of depression and anxiety-related symptoms (Koffel & Watson, 2009). Younger participants were undergraduate students who received credit for research participation. After providing informed consent, they completed the PANAS-X in small group sessions. Older participants were community-dwelling adults from a local senior center. They completed the PANAS-X at home and returned it in a pre-paid envelope.

As mentioned, college students comprised the younger sample. Older participants had considerably more variability in their educational background: 4.9%

had not completed high school, 25.5% had a high school diploma or GED, 27.4% had a vocational, technical, or associate's degree or some college experience, 20.1% had a college degree, and 22.1% had a master's or doctorate-level degree. In the older sample, 49.5% of individuals were married, 24.0% were widowed, 18.1% were divorced, and 7.4% had never married. Relationship status was not collected on the younger group but most were unlikely to have been married.

Measure

Positive and Negative Affect Schedule–Expanded Form (PANAS-X)

The PANAS-X includes the identical measures of general PA and general NA as the original 20-item PANAS. It also has three additional PA subscales (Joviality, Self-assurance, Attentiveness) and four additional NA subscales (Fear, Sadness, Guilt, Hostility; see Appendix for items). The PANAS-X was created because, although the broad, general dimensions of PA and NA account for much of the variance in self-reported affect (roughly 50% to 75%), specific affective dimensions also can be identified in the same data. Thus, to develop the PANAS-X, pools of affect terms were factor analyzed in several large samples in an iterative manner to create internally consistent and differentiated measures of general and specific affects (Watson & Clark, 1999).

Internal consistencies for all PANAS-X scales generally are strong: 0.83 to 0.90 for the General PA and NA scales, 0.79 to 0.92 for the specific NA scales, and 0.70 to 0.93 for the specific PA scales. Attentiveness is the shortest facet scale and consequently, tends to have the lowest internal consistency reliability. The structure of the PANAS-X has been replicated by factor analyses in several independent samples, and its scales exhibit strong convergent validity with those of the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971). Correlations between General PA and NA tend to be low, ranging from -0.05 to -0.35; thus, they are best characterized as 'quasi-independent'.

Data analyses

Preliminary analyses compared the groups on mean PANAS-X scores and also determined the internal consistency reliabilities of these scales. The primary analyses were Exploratory Factor Analyses (EFAs) to determine the factor structure of self-report affect in older and younger adults and to quantify the comparability of the factor structures. EFAs are well-suited for initial analyses of the factor structure of an instrument and to date, no EFA studies have been conducted with PANAS-X data in older adults. In the EFAs, optimal factor solutions were based on analyses of scree plots and eigenvalues, as well as the number

Table 1. Descriptive statistics and internal consistency reliabilities for the PANAS-X scales for younger and older adults.

Scale	α	Younger	Older	t	Cohen's d
NA scales					
General NA	0.87/0.89	20.85 (6.54)	16.89 (6.05)	−7.05*	−0.63
Fear	0.83/0.86	12.15 (4.24)	10.39 (4.11)	−4.74*	−0.42
Sadness	0.87/0.88	11.59 (4.54)	9.64 (4.54)	−4.85*	−0.43
Guilty	0.89/0.89	12.01 (5.13)	10.08 (4.48)	−4.46*	−0.24
Hostility	0.79/0.83	11.33 (3.74)	9.90 (3.37)	−4.49*	−0.40
PA scales					
General PA	0.87/0.89	32.67 (6.50)	34.27 (6.89)	2.72*	0.24
Joviality	0.93/0.91	26.62 (6.24)	27.22 (6.22)	1.09	0.10
Self assurance	0.81/0.82	18.03 (4.33)	18.01 (4.54)	0.05	0.00
Attentiveness	0.75/0.76	13.10 (2.78)	14.35 (2.67)	5.18*	0.46

Notes: Younger $N = 349$; older $N = 203$. NA = Negative affect; PA = Positive affect. α = Cronbach's α for younger/older participants.
*$p < 0.01$.

and content of items with primary and strong loadings on the factors (Gorsuch, 1997); we defined a strong factor loading as $|0.50|$ or higher because correlation in this range reflect large effect sizes (Cohen, 1992). The EFA was followed by Confirmatory Factor Analyses (CFA) to provide a final test on the factorial invariance of PANAS-X facets in younger and older adults. All analyses were conducted with SPSS, version 18 (SPSS/PASW, 2009), except for the CFA, for which Mplus was used (Muthén & Muthén, 1998–2010).

Results

Internal consistency reliabilities and age-group mean differences

Internal consistency reliabilities for younger and older adults were strong and comparable for General PA and NA, as well as for the specific facet scales (Table 1). As expected, older adults reported significantly lower scores on the General NA scale, as well as on all four NA facets ($ps < 0.001$; Table 1). Older adults reported higher overall General PA ($p < 0.01$) and Attentiveness ($p < 0.01$), supporting predictions.

Affect scale inter-correlations

Inter-correlations among the PA scales were significantly more positive for older (mean $r = 0.69$) than younger participants (mean $r = 0.51$; Table 2); in contrast, there were no significant age-group differences in correlations among NA facets (mean $r = 0.63$ and 0.66 for younger and older adults, respectively; Table 3). For across-valence associations, several correlations between PA and NA facets were significantly more negative in older (mean $r = -0.42$) than in younger adults (mean $r = -0.30$; Table 4).

Table 2. Convergent correlations for the PANAS-X PA scales for younger and older adults.

	1	2	3
1. Joviality	–	**0.74**	**0.70**
2. Self-assurance	0.53	–	**0.64**
3. Attentiveness	0.56	0.43	–

Notes: Younger participant ($N = 349$) correlations shown below the diagonal; older participant ($N = 203$) correlations are shown above the diagonal. All correlations are significant at $p < 0.005$. Correlations in bold are significantly different from the corresponding correlations for younger adults.

Table 3. Convergent correlations for the PANAS-X NA scales for younger and older adults.

	1	2	3	4
1. Fear	–	0.71	0.64	0.68
2. Sadness	0.62	–	0.74	0.58
3. Guilt	0.64	0.72	–	0.63
4. Hostility	0.60	0.57	0.60	–

Notes: Younger participant ($N = 349$) correlations shown below the diagonal; older participant ($N = 203$) correlations are shown above the diagonal. All correlations are significant at $p < 0.005$.

Age-group differences in affective structure

Exploratory factor analyses

General PA and NA scales. Exploratory factor analyses (i.e., principal factor analyses with varimax rotation) were conducted on the General PA and NA scales, using the 20 items that comprise the original PANAS. The two-factor solutions were optimal and consistent with previous research, these easily could be interpreted as NA and PA.

Upon visual inspection, results were highly similar across the age groups (Table 5), but we sought to confirm this hypothesis via quantitative methods. To assess factor similarity, the factor scores

Table 4. Discriminant correlations between PANAS-X PA and NA scales for younger and older adults.

Scale	Gen. PA	Joviality	Assurance	Attention
Younger adults				
General NA	−0.32	−0.34	−0.26	−0.32
Fear	−0.20	−0.22	−0.18	−0.22
Sadness	−0.40	−0.45	−0.31	−0.32
Guilt	−0.42	−0.39	−0.37	−0.36
Hostility	−0.24	−0.30	−0.08	−0.27
Older adults				
General NA	**−0.48**	**−0.49**	−0.33	**−0.44**
Fear	**−0.46**	**−0.44**	−0.34	**−0.39**
Sadness	**−0.57**	**−0.58**	−0.44	**−0.51**
Guilt	−0.48	−0.48	−0.36	−0.43
Hostility	−0.34	−0.34	−0.15	−0.35

Notes. Younger $N = 349$; older $N = 203$. All correlations significant at $p < 0.05$. Gen = General, PA = Postive affect, NA = Negative affect. Correlations in bold are significantly different from the corresponding correlation for younger adults.

generated by each solution were correlated (Everett, 1983; Gorsuch, 1983). To calculate factor scores, a set of regression-based weights were generated separately from the factor analyses on the younger and older adult data and these weights were applied to the item-level data to calculate factor scores for each participant. Thus, four factor scores were generated for each participant: two NA factor scores (one each from the factor weights for the NA factor from younger and older adults) and two PA factor scores (one each from the factor weights for the PA factor from younger and older adults). Calculating and correlating factor scores is a well-established way to quantify factor reliability (Dindo, McDade-Montez, Sharma, Watson, & Clark, 2009; Everett, 1983; Watson, Clark, & Chmielewski, 2008; Watson et al., 1995).

For PA and NA, the factor scores correlated 0.99. Everett (1983) suggested that a correlation of 0.90 or greater indicates that the factors converge with one another; thus, there is strong quantitative support that the factor solutions for the two groups are convergent.

Facet-level Exploratory Factor Analysis (EFA). The facet scales of the PANAS-X were entered into EFAs separately for older and younger adults. These analyses were conducted prior to the item-level facet analyses, which were of primary interest, to determine first if the scales behaved in broadly similar ways across the two age groups. As expected, two-factor solutions were best for both age groups and the factor loadings for the resulting NA and PA factors were highly comparable across the groups (Table 6). Factor scores generated from the two factor analyses were convergent and correlated 0.99 for PA and NA.

NA facets: item-level analyses. Four-factor solutions were the best models to capture variability in the NA facet items for younger and older adults (Table 7; Younger factors: Guilt, Fear, Hostility, Sadness; Older factors: Guilt/sadness, Fear, Hostility, Lonely/anxiety). The Guilt factor was defined, for both groups, by strong and primary loadings (≥ 0.50) from *angry at self, disgusted with self, dissatisfied with self, guilty,* and *ashamed. Blameworthy* loaded more strongly and specifically on this factor in younger than older adults. For older adults, *sad, downhearted,* and *blue* also had strong, primary loadings on the first factor, whereas *loathing* and *disgusted* had moderate but primary loadings; thus, the first factor was more broadly defined in older than younger adults, particularly because it included items relating to sadness, which usually defines a separate scale on the PANAS-X.

The Fear factor was defined by strong and primary loadings (≥ 0.50) in both age groups by *afraid, scared,* and *frightened.* Younger adults had slightly weaker but still primary loadings for *nervous, shaky,* and *jittery.* The Hostility factor was defined strongly and primarily (≥ 0.50) by *scornful, angry,* and *hostile* in both groups. *Irritability* and *disgusted* also were primary aspects of this dimension for both groups. For younger adults, *loathing* had a primary loading on the Hostility factor whereas, as noted earlier, it loaded on Guilt/Sadness for older adults.

Factor scores from the two solutions for the three broadly similar factors (Guilt, Hostility, and Fear) were highly convergent across the age groups, with intercorrelations ranging from 0.95 to 0.99. The fourth factor clearly was more discrepant between groups. For younger adults, the Sadness factor was defined by primary and strong loadings from *lonely, alone, sad,* and *blue,* whereas for older adults the fourth factor was marked by *lonely, alone, shaky, jittery* and *nervous,* with moderate cross-loadings by *frightened, blue, sad,* and *downhearted.* Thus, there was no clear Sadness factor for older adults; rather, the PANAS-X Sadness items split between the Guilt/Sadness and Lonely/Anxiety factors. Further, across all factors, there were more cross-loadings of 0.30 or greater for older than for younger adults, suggesting a less coherent and 'clean' structure for NA in older participants (Watson & Clark, 1999).[1]

PA facets: item-level analyses. Three-factor solutions (i.e., Joviality, Attentiveness, Self-Assurance) were the most parsimonious models to capture variability in the PA facet items for both younger and older adults (Table 8). Again, there were more similarities than differences in the factor loadings in the younger and older solutions. For both age groups, the Joviality factor was defined by strong and primary loadings (≥ 0.50) from *cheerful, excited, joyful, enthusiastic, happy, energetic, lively,* and *delighted,* which are the eight items that comprise the PANAS-X Joviality

Table 5. Exploratory factor analyses of feneral PA and NA items from the PANAS-X in younger and older adults.

Item	PA		NA	
	Younger	Older	Younger	Older
Enthusiastic	**0.72**	**0.79**	−0.11	−0.17
Interested	**0.66**	**0.67**	−0.10	−0.28
Excited	**0.65**	**0.58**	−0.13	−0.19
Inspired	**0.65**	**0.63**	0.05	−0.10
Active	**0.64**	**0.66**	−0.17	**−0.33**
Determined	**0.64**	**0.70**	−0.10	−0.15
Proud	**0.62**	**0.65**	−0.12	−0.07
Alert	**0.55**	**0.57**	−0.18	−0.24
Strong	**0.55**	**0.64**	−0.11	−0.15
Attentive	**0.52**	**0.56**	−0.19	−0.16
Afraid	−0.09	−0.13	**0.72**	**0.76**
Scared	−0.02	−0.07	**0.67**	**0.64**
Nervous	−0.13	−0.27	**0.64**	**0.69**
Ashamed	−0.22	−0.27	**0.64**	**0.57**
Guilty	−0.17	−0.24	**0.63**	**0.60**
Distressed	−0.18	−0.26	**0.63**	**0.71**
Upset	−0.24	−0.19	**0.62**	**0.76**
Jittery	0.07	**−0.33**	**0.58**	**0.60**
Hostile	−0.08	−0.04	**0.53**	**0.54**
Irritable	−0.16	−0.14	**0.51**	**0.63**
Rotation sums of squared loadings (% variance)	4.1 (20.5)	4.6 (23.2)	4.0 (20.0)	4.6 (23.2)

Note: Younger $N = 349$; older $N = 203$. Factor loadings ≥ 0.30 are in bold.

Table 6. Exploratory factor analyses of PANAS-X facet scales for younger and older adults.

Item	NA		PA	
	Younger	Older	Younger	Older
Fear	**0.79**	**0.79**	−0.10	−0.25
Guilt	**0.78**	**0.76**	**−0.34**	−0.30
Sadness	**0.75**	**0.75**	**−0.34**	**−0.41**
Hostility	**0.73**	**0.79**	−0.13	−0.10
Joviality	−0.21	**−0.31**	**0.79**	**0.84**
Self-assurance	−0.18	−0.13	**0.65**	**0.84**
Attentiveness	−0.20	−0.30	**0.63**	**0.72**
Rotation sums of squared loadings (% variance)	2.4 (34.6)	2.6 (37.1)	1.7 (24.3)	2.2 (32.1)

Note: Younger $N = 349$; older $N = 203$. Factor loadings ≥ 0.30 are in bold.

scale. *Confident*, *proud*, and *concentrating* also had primary loadings on this factor in older adults. Thus, the first factor was defined more broadly in older than younger adults.

Attentiveness was defined in both groups by primary loadings for *determined*, *alert*, and *attentive*. Younger adults also had primary loadings for *concentrating* and *proud*. Thus, the core features of this scale were similar in younger and older adults, but the younger adult solution was more consistent with previous results in other samples (Watson & Clark, 1999), given that there were more cross-loadings for older than younger adults.

In both age groups, Self-Assurance was defined strongly and primarily by *daring*, *bold*, *strong*, and *fearless*. It also had a primary loading for *confident* in the younger group. *Proud* also is scored on this PANAS-X subscale and younger adults produced a cross-loading for this term. Overall, the younger adult solution was largely consistent with results from analyses on other samples (Watson & Clark, 1999), whereas older adults had several cross-loadings on this factor.

In summary, although the factor solutions were more similar than different, the younger adult model was more consistent with the PANAS-X facet scale

Table 7. Exploratory factor analyses of NA facet items for younger and older adults.

Item	Younger Guilt	Older Guilt/Sadness	Younger Fear	Older Fear	Younger Hostility	Older Hostility	Younger Sadness	Older Lonely/Anxiety
Angry at self	**0.72**	**0.78**	0.20	0.11	0.22	0.24	**0.31**	0.27
Dissatisfied with self	**0.65**	**0.73**	0.16	0.15	0.22	0.20	**0.37**	0.24
Disgusted with self	**0.64**	**0.71**	0.14	0.19	0.19	0.27	**0.37**	0.15
Ashamed	**0.62**	**0.64**	0.28	0.12	0.27	0.25	0.17	0.26
Blameworthy	**0.59**	**0.35**	**0.30**	0.09	**0.30**	**0.31**	0.18	**0.33**
Guilty	**0.57**	**0.73**	**0.33**	0.16	0.27	0.17	0.07	0.21
Downhearted	**0.44**	**0.58**	0.13	**0.32**	0.18	0.22	**0.33**	**0.38**
Afraid	0.21	**0.30**	**0.73**	**0.75**	0.24	0.24	0.21	0.25
Scared	0.09	0.21	**0.71**	**0.77**	0.27	0.26	0.19	0.10
Frightened	0.27	0.18	**0.63**	**0.53**	0.21	0.26	0.14	**0.46**
Nervous	**0.40**	0.27	**0.44**	**0.34**	0.15	**0.42**	0.25	**0.46**
Shaky	0.25	0.16	**0.42**	0.06	0.21	**0.34**	0.22	**0.55**
Jittery	0.23	0.22	**0.40**	0.22	**0.31**	**0.43**	0.10	**0.53**
Scornful	0.12	0.07	0.13	0.14	**0.67**	**0.63**	0.18	0.09
Angry	0.19	0.23	0.29	0.18	**0.66**	**0.66**	0.08	0.28
Hostile	0.21	0.22	0.22	0.10	**0.59**	**0.60**	0.11	0.12
Irritability	0.21	0.26	0.17	0.21	**0.49**	**0.66**	0.18	0.16
Loathing	0.26	**0.43**	0.15	0.31	**0.43**	**0.35**	0.25	**0.31**
Disgusted	0.20	**0.44**	0.24	0.18	**0.41**	**0.44**	0.12	0.01
Lonely	**0.32**	**0.39**	0.21	0.21	0.17	0.06	**0.78**	**0.63**
Alone	0.25	**0.34**	0.20	0.16	0.22	0.04	**0.75**	**0.58**
Sad	**0.32**	**0.65**	**0.37**	**0.41**	0.20	0.14	**0.61**	**0.38**
Blue	**0.40**	**0.56**	0.25	**0.40**	**0.35**	0.21	**0.53**	**0.39**
Rotation sums of squared loadings (% variance)	3.7 (15.9)	4.9 (21.5)	2.9 (12.5)	2.4 (10.6)	2.8 (12.2)	3.1 (13.3)	2.7 (11.9)	2.8 (12.3)

Notes: Younger $N = 349$; older $N = 203$. Factor loadings ≥ 0.30 are in bold.

structure, which was based on analyses with many other (primarily) younger adult samples (Watson & Clark, 1999). Further, the older adult solution had more cross-loadings greater than 0.30 than did the younger adult solution. Despite these differences, factor scores generated from the younger and older adult solutions were highly inter-correlated ($rs = 0.91$ to 0.95).

Confirmatory factor analyses

As noted, exploratory analyses indicated some differences in the structure of NA in the two age groups. Whereas items loading on the Guilt, Hostility, and Fear factors showed good convergence, a clear Sadness factor did not emerge in the older sample. Confirmatory factor analyses were conducted to determine whether it is *only* the Sadness factor that differed between the two groups. Specifically, we conducted item-level multi-group CFAs to determine whether the reduced three-factor solution (excluding Sadness content) was an equally good fit for the younger and older samples. We compared the fit of two models: in the first, factor loadings were allowed to vary between the two groups, whereas in the second, they were constrained to be the same. All other parameters including residual variances were allowed to vary in both models. The models were compared using Bayesian Information Criterion (BIC) and Draper's Information Criterion (DIC) fit indices; we also report the Root Mean Square Error of

Approximation (RMSEA) to establish the overall fit of each model (lower values of all of these indices indicate better fit). The second model in which the loadings were constrained proved to be a better fit (Table 9). Thus, once Sadness content is removed, older and younger subjects appear to have a similar, three-factor structure for NA.

To confirm the results of the EFA findings, we also conducted a second confirmatory analysis on the PA items using the multi-group procedure described above. Again, the constrained model was a better fit to the data indicating that the three-factor solution was an equally good fit for the two age groups (Table 9).

Discussion

Studying age group differences at both higher and lower levels of affect is critically important for a full understanding of the structure of affect across the lifespan. Recent data suggest, in fact, that analyses focused on specific subscales of PA and NA may be most informative in elucidating whether and how affect differs in younger and older persons (Kessler & Staudinger, 2009). The current study indicates both convergence and divergence in affect facets in older and younger adults. It is noteworthy that many significant findings of the current study would have been obscured by analyses focused only on higher order scales.

Table 8. Exploratory factor analyses of PA facet items for younger and older adults.

Item	Joviality		Attentiveness		Self-assurance	
	Younger	Older	Younger	Older	Younger	Older
Cheerful	**0.76**	**0.59**	0.19	0.10	0.08	0.13
Excited	**0.75**	**0.51**	0.18	0.27	0.24	0.28
Enthusiastic	**0.74**	**0.68**	**0.32**	**0.32**	0.17	**0.34**
Joyful	**0.74**	**0.83**	0.26	0.27	0.12	0.11
Happy	**0.73**	**0.73**	0.29	0.22	0.12	0.23
Energetic	**0.72**	**0.56**	0.28	**0.34**	0.23	**0.40**
Lively	**0.67**	**0.62**	**0.31**	**0.37**	0.25	**0.37**
Delighted	**0.66**	**0.68**	0.20	**0.34**	0.19	0.23
Proud	**0.31**	**0.53**	**0.41**	0.25	**0.40**	**0.37**
Concentrating	0.18	**0.48**	**0.70**	**0.47**	0.00	0.05
Determined	0.27	**0.40**	**0.64**	**0.53**	0.17	**0.33**
Alert	0.24	0.29	**0.56**	**0.61**	0.15	0.14
Attentive	0.27	0.17	**0.50**	**0.61**	0.09	0.20
Daring	0.12	0.09	0.20	0.04	**0.67**	**0.75**
Bold	0.26	**0.31**	0.03	0.17	**0.67**	**0.62**
Strong	0.24	**0.30**	0.24	0.37	**0.61**	**0.51**
Fearless	−0.01	0.18	0.10	**0.32**	**0.61**	**0.54**
Confident	**0.37**	**0.58**	**0.42**	**0.49**	**0.50**	0.23
Rotation sums of squared loadings (% variance)	4.8 (26.6)	4.8 (26.4)	2.4 (13.3)	2.5 (13.9)	2.4 (13.2)	2.5 (13.9)

Notes: Younger $N = 349$; older $N = 203$. Factor loadings ≥ 0.30 are in bold.

Table 9. Fit indices for CFA model.

Model	$\chi 2$	ln(L)	k	RMSEA	BIC	*DIC*
NA items (excluding Sadness items)						
Three factors, loadings freed	909.60	−11,315.99	99	0.09	23,258.61	23,075.08
Three factors, loadings constrained	**945.71**	**−11,334.04**	**84**	**0.09**	**23,199.78**	**23,044.04**
PA items						
Three factors, loadings freed	984.57	−11,707.15	99	0.10	24,040.95	23,858.99
Three factors, loadings constrained	**1019.13**	**−11,724.43**	**84**	**0.09**	**23,980.56**	**23,826.17**

Notes: $N = 552$. Best fitting model shown in boldface. ln(L) denotes log-likelihood; k, the number of parameters; RMSEA, Root Mean Square Error Of Approximation; BIC, Bayesian Information Criterion; DIC, Draper's Information Criterion.

The structure of affect

The broad higher order factors of NA and PA were evident and highly comparable in older and younger adults, replicating previous work. Thus, the most interesting and novel findings pertained to the facet-level affective structure. First, there were stronger associations among PA subscales for older than younger persons (mean $rs = 0.69$ and 0.51, respectively), suggesting greater coherence in PA experienced by older than younger persons. Lawton et al. (1993) similarly found greater convergence in aspects of PA in older than midlife persons. In developing the PANAS-X, Watson and Clark observed that PA descriptors were more highly interrelated than NA descriptors and they speculated that PA facets might be less differentiable in self-report than NA facets (Watson & Clark, 1999). Our data suggest this might be particularly true for older adult data.

Why older adults exhibit greater correspondence among PA facets, however, is not entirely clear. It could be that older adults are less discriminating when reporting about their affect in general. Indeed, whereas NA facets were not significantly more intercorrelated for older than younger adults, older adult factor solutions for PA and NA items exhibited more cross-loadings than for younger adults. In a related vein, several cross-valence correlations between the PANAS-X PA and NA facet scales were significantly more negative in the older adults (mean $r = -0.42$) than in the younger adults (mean $r = -0.30$; Table 4).

Another perspective comes from Magai, Consedine, Krivoshekova, Kudadjie-Gyamfi, and McPherson (2006) Differential Emotions Theory (DET), which suggests that emotions become more complex with age due to increasingly elaborate

cognitive connections between different emotions. They speculated, and indeed found, greater heterogeneity in the co-occurrence of emotions with age, both within and across valence. Specifically, older adults manifested greater heterogeneity in emotional expression in narratives about sad and angry events. In the current study, as noted previously, older adults exhibited more cross-loadings in the facet-item solutions, suggesting more interrelations among affect terms than for younger adults. As noted, older adults also exhibited significantly stronger correlations across some PA and NA facets than younger participants. Similarly, Lawton et al. (1992) found that contentment and depression were more strongly correlated in older ($r = -0.68$) than younger adults ($r = -0.51$).

Carstensen et al. (2000) have used the term 'poignancy' to refer specifically to momentary, mixed emotions that blend aspects of PA and NA and that are more common in older than younger persons. It would be interesting to determine whether and how age group differences in affective structure relate to affective experience in daily life, such as fleeting poignant experiences. That is, a more diffuse structure in trait affect in older relative to younger adults, found in the current data, may be related to more momentary experiences of mixed emotions.

A second and somewhat related finding was that the factor solutions, although largely overlapping in the two age groups, also exhibited differences. Overall, the solutions for older adults were consistently *less* convergent with previous research on the PANAS-X, whereas models for the younger adults were highly similar to past findings (Watson & Clark, 1999). Again, self-reported affect seems to be more de-differentiated in older than younger persons, at least in between-person analyses.

One of the biggest age-group differences was on Sadness. A distinct Sadness factor did not emerge in analyses of the older adult data; rather, relevant items loaded more strongly with guilt, loneliness, and anxiety items. In contrast, whereas words such as *sad* and *blue* also exhibited cross-loadings for younger adults, their primary loadings were clearly on a Sadness factor.

In previous work, Lawton et al. (1993) found that the items *blue*, *sad*, and *depressed* loaded saliently (loadings of 0.64 to 0.76) and similarly for younger, midlife, and older adults on a factor they labeled Depression. For younger and older adults, *depressed* also loaded secondarily on the Hostility factor (loadings of 0.36 and 0.33, respectively). For older adults, however, *sad* and *depressed* had further cross-loadings on an Anxiety/guilt factor (loadings of 0.34 and 0.32, respectively), but this did not occur for the other age groups. Thus, somewhat similar to current findings, items related to Sadness exhibited broader factor loadings for older relative to younger adults. Some data indicate that anxiety and depressive disorders are less distinct in older than younger persons

(Shapiro, et al., 1999; Wetherell, Gatz, & Pedersen, 2001) but there is inconsistent evidence because comorbidity rates may be similar in these gruop (King-Kallimanis, Gum, & Kohn, 2009).

These data raise questions about the construct invariance of the Sadness scale in younger and older adults. Similar questions about the construct invariance of depression in younger and older adults have been raised in other studies. In both cross-sectional and longitudinal analyses, Gallo and colleagues found that older adults were less likely to endorse Sadness than younger persons (Gallo, Anthony, & Muthen, 1994; Gallo, Rabins, & Anthony, 1999). Older adults also were more likely to endorse somatic symptoms of depression than core affective features, such as Sadness (Kim, Pilkonis, Frank, Thase, & Reynolds, 2002; King & Markus, 2000; Nguyen & Zonderman, 2006). In a review of the literature, for example, King and Marcus (2002) noted that older adults reported more somatic symptoms and anxiety, and were less likely to report a depressed mood or feelings of low self-esteem than younger adults. This may explain, in part, why rates of depressive disorders are lower in older than younger adults (Gum, King-Kallimanis, & Kohn, 2009). On the Geriatric Depression Scale (GDS), a popular measure of depressive symptoms in older adults, a factor comprised of withdrawal-apathy-lack of vigor (WAV) items has been identified and found to be the symptom cluster that is most often endorsed (Adams, 2001; Cheng & Chan, 2007). These findings fuel speculation that there might be a phenomenon of 'depression without Sadness' in older adults or that depression might manifest in different ways later in life (Gallo et al., 1994, 1999). These findings are consistent with normative declines in vitality with age (Roberts et al., 2006).

Further, in the current findings, Sadness and loneliness had primary loadings on different factors for older adults, but on the same factor for younger adults. There are other data to suggest that loneliness may have differential associations with NA in older adults because loneliness is not necessarily part of depression in later life (Adams, Sanders, & Auth, 2004). Loneliness may be more normative and less distressing for older than younger persons.

Although we cannot be certain what the Sadness findings in our study mean, it is reasonable to speculate that they may relate to normative experience at different ages. That is, older individuals experience some aspects of their energy levels to be somewhat lower than those of younger adults, based on normative reductions in social vitality (Roberts et al., 2006), so they may not experience low energy as negatively. Similarly, losing friends and loved ones is a more expectable part of the lives of older adults, so there is a greater acceptance of the loneliness and Sadness that results from such losses, so that they perhaps are not experienced as negatively as they are by younger adults.

Mean differences in affect

Age-group differences in affect were more uniform for facets of NA than for PA. For PA, similar to Kessler and Staudinger's (2009) findings, younger and older adults did not differ significantly on high arousal aspects of PA (i.e., Joviality, Assurance), but older adults reported greater Attentiveness, associated with lower arousal, than younger persons. Results for NA also were consistent with previous research (Kessler & Staudinger, 2009; Teachman, 2006) indicating that *all* aspects of NA were significantly lower in older than younger persons. Thus, our data contribute converging evidence that age-group differences are broader and more coherent for NA than for PA.

Limitations

Our data are cross-sectional and thus can neither reveal nomothetic change in the structure of affect over time nor can they address dynamic processes of *intra-individual* change over time; to address these issues, time series or ecological momentary assessment data are needed (e.g., Molenaar, Rovine, & Corneal, 1999). Further, there was no midlife group, which might have provided greater insight into the developmental nature of age-group differences in affect. Another limitation is that, while large, the samples were not large enough to split for independent analyses for the EFA and CFA, which would have been ideal. The next step in this line of research will be to conduct CFAs on independent samples. Despite these limitations, the sample sizes were sufficient for our initial analyses and the instrument that was used (the PANAS-X) assessed more aspects of affect than are typically measured in age-group comparative studies of affect.

Conclusions

As noted in the introduction, Lawton suggested nearly two decades ago that PA may need to be measured in age-specific ways (Lawton et al., 1993). This hypothesis is supported by our data insofar as different facets of PA may present differentially by age. Our results, in concert with intriguing findings from the geriatric depression literature, suggest that some facets of NA also may need to be approached in age-specific ways. A greater focus on discrete affects in aging and their interrelations will advance our understanding of when and how affect changes with age and when age-specific approaches to the measurement of affect are warranted.

Note

1. The EFA with the NA items was re-run without *loathing*, *disgusted*, and *nervous* because all had relatively low loadings for both age groups. The resulting factor solutions for both the younger and older adult data changed very little.

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Appendix

PANAS-X subscales and items.

PA Scales:

General PA – active, alert, attentive, excited, enthusiastic, interested, inspired, proud strong determined.

Joviality – happy, joyful, delighted, cheerful, excited, enthusiastic, lively, energetic.

Self-Assurance – proud, strong, confident, bold, daring, fearless.

Attentiveness – alert, attentive, concentrating, determined.

NA Scales:

General NA – afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, distressed.

Fear – afraid, scared, frightened, nervous, jittery, shaky.

Hostility – angry, hostile, irritable, scornful, disgusted, loathing.

Guilt – guilty, ashamed, blameworthy, angry at self, disgusted with self, dissatisfied with self.

Sadness – sad, blue, downhearted, alone, lonely.