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## **Content-specific gender differences in emotion ratings from early to late adulthood**

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## **Abstract**

The investigation of gender differences in emotion has attracted much attention given the potential ramifications on our understanding of sexual differences in disorders involving emotion dysregulation. Yet, research on content-specific gender differences across adulthood in emotional responding is lacking.

The aims of the present study were twofold. First, we sought to investigate to what extent gender differences in the self-reported emotional experience are content specific. Second, we sought to determine whether gender differences are stable across the adult lifespan. We assessed valence and arousal ratings of 14 picture series, each of a different content, in 94 men and 118 women aged 20 to 81.

Compared to women, men reacted more positively to erotic images, whereas women rated low-arousing pleasant family scenes and landscapes as particularly positive. Women displayed a disposition to respond with greater defensive activation (i.e., more negative valence and higher arousal), in particular to the most arousing unpleasant contents. Importantly, significant interactions between gender and age were not found for any single content.

This study makes a novel contribution by showing that gender differences in the affective experiences in response to different contents persist across the adult lifespan. These findings support the “stability hypothesis” of gender differences across age.

Keywords: emotional reactivity; affective pictures; gender differences; valence rating; arousal rating

## **Introduction**

In the domain of emotion processing, individual differences are the rule rather than the exception, and the influence of gender in emotion has attracted much attention (Hamann & Canli, 2004). The response to emotional events has been implicated in the vulnerability for numerous disorders with known sexual differences in incidence rate, symptom profile and therapeutic response (e.g., Craske, 2003; Hyde, Mezulis, & Abramson, 2008). A better comprehension of gender differences in emotional processing is important for understanding the mechanisms of gender-specific behaviors in health and disease.

In the present study, we used the picture viewing paradigm as emotion elicitation method and the biphasic theory of emotion as theoretical framework to examine gender differences in the affective experience to different contents from early to late adulthood. The biphasic theory of emotion posits that emotion is fundamentally organized along the affective dimensions of valence and arousal, which combine to describe the basic emotional motivations to approach pleasant stimuli (appetitive/approach activation) and to withdraw from aversive stimuli (defensive/withdrawal activation) (Bradley, Codispoti, Sabatinelli, & Lang, 2001).

### **Affective responses to pictures in young college-aged adults**

The majority of research investigating emotional responses to pictures has been conducted with young adults, mostly college students. Furthermore, the responses have been generally analyzed only in terms of gender-related differences in ratings of valence and arousal of pictures grouped into three broad affective categories, i.e., pleasant, unpleasant and neutral. This research does not provide a totally consistent pattern of gender differences. For instance, whereas in two recent studies women rated their experience to unpleasant pictures as more negative and arousing than men, findings for neutral and pleasant pictures were contradictory (Bianchin & Angrilli, 2012; Gard & Kring, 2007). Moreover, negative findings are not uncommon (Gomez & Danuser, 2010; Kemp et al., 2004). There might be several reasons for

these mixed results. One plausible possibility is that the divergent findings are attributable to the specific contents of the selected stimuli, which often differ in type and variety between studies.

Bradley et al. (2001) investigated the affective response to pictures belonging to 18 different contents in college students. They found that young women showed a stronger disposition to engage the defensive motivational system when exposed to aversive cues, whereas young men displayed increased appetitive activation specifically to erotic stimuli. These findings support the contention that different contents may hold different meanings and significance for men and women (Brody & Hall, 2008).

### **Stability of gender differences in emotional reactivity across adulthood**

To which extent gender differences in emotional reactivity observed among young individuals persist, attenuate, or increase in later life, remains largely unexplored. Few studies of age differences in emotional experiences report testing for gender effects, thus, it is unclear whether gender differences were generally not found or rather that gender effects were not analyzed.

Four main patterns of gender differences in emotional reactivity across adulthood can be hypothesized. The first possibility is that gender differences observed in younger adults persist into late adulthood. We name this the “stability hypothesis”. Findings from studies on the affective response to unpleasant film clips support this hypothesis (Kunzmann & Grühn, 2005; Seider et al., 2011). Also Gavazzeni, Wiens, and Fischer (2008) and Keil and Freund (2009) found that gender differences in affective ratings of pictures were comparable among younger and older adults. Furthermore, gender differences in self-rated distress in interpersonal conflicts, sex-specific use of coping and defense strategies and emotional intensity have been found to persist across different age groups (Birditt & Fingerman, 2003;

Blanchard-Fields, Chen, & Norris, 1997; Diehl, Coyle, & Labouvie-Vief, 1996; Diener, Sandvik, & Larsen, 1985).

However, other studies point to different patterns of gender differences across age. Findings from Mroczek and Kolarz (1998) and Neiss, Leigland, Carlson, and Janowsky (2009) support a “divergence hypothesis” that assumes that historical and cohort differences could produce larger gender differences in older age groups because adherence to traditional female and male roles in Western countries has become less strict (Schieman & Van Gundy, 2000). In contrast, a “convergence hypothesis” assumes that men and women become more alike in emotion with age. This hypothesis is based on the idea that gender roles become less rigid in later life (Helson, Pals, & Solomon, 1997) and some lines of research support it (Byers et al., 2010; Labouvie-Vief, Lumley, Jain, & Heinze, 2003; Schieman & Van Gundy, 2000). Finally, evidence for a fourth pattern, a reversal of gender differences in emotion, is provided by Birditt and Fingerman (2003), who found that middle-aged men reported more often nonspecific negative emotions than middle-aged women in response to interpersonal problems, whereas men over 80 reported less of these emotions than same-aged women.

### **The current study**

We could locate only three studies using the picture viewing paradigm that reported gender effects in affective ratings among different age groups. Whereas Gavazzeni and colleagues (2008) and Keil and Freund (2009)’s findings suggest that gender differences remain stable across adulthood and, thus, support the “stability hypothesis”, Neiss and coauthors (2009) reported gender x age interactions in affective ratings pointing to gender-specific trajectories in emotion reactivity across age in support of the “divergence hypothesis”. It is worth noting that in these three studies, the specific content of the selected pictures was not taken into account, and with the exception of Keil and Freund (2009), middle-aged adults were not tested.

The goal of the present work was to fill a gap in emotion research by examining gender differences in the experiential response to a broad range of different contents of pictures in a large sample of men and women ranging in age from 20 to 81 years. To the best of our knowledge, no study has done this before. Our research questions were first, to what extent gender differences in self-reports of valence and arousal are content-specific and, second, to what extent age modulates gender differences. Based primarily on Bradley et al. (2001)'s work, we expected (younger) men to show a stronger appetitive motivation in response to erotica than (younger) women, whereas we predicted that women would react more defensively than men to unpleasant contents. Given the inconsistency of findings reviewed above, we treated the question of the modulatory effect of age on gender differences as an exploratory issue.

## Method

### Participants

Participants were 94 men and 118 women ranging in age from 20 to 81 years with a mean of 47.4 years ( $SD = 17.3$ ). They were recruited from the XXX area through advertisements placed in different public places (e.g., university campus, supermarkets), in newspapers and magazines, and on websites. Exclusion criteria were scores above 10 for anxiety or depressive symptoms on the HADS (Zigmond & Snaith, 1983); self-reported “bad” or “very bad” current general health on a scale ranging from “very good” to “very bad”; use of recreational/illicit drugs; strabismus and color blindness. Table 1 reports sociodemographic characteristics, self-rated health, verbal fluency, personality, and state affect of the participants.

Chi-square tests revealed that women were more often single than men (women: 50%, men: 31%,  $\chi^2 = 4.2$ ,  $p < .05$ ). There were no significant differences between men and women in their employment status and educational level ( $\chi^2$  between 0.0 and 2.6,  $ps > .10$ ). Thirteen percent were students, 45% were working, 11% were unemployed and 31% were retired. Only 7% had no vocational training, whereas 43% had completed vocational training equivalent to apprenticeship or a degree judged equivalent, and 50% had a baccalaureate with or without later academic studies.

Participants were well-functioning individuals. Their mean scores for anxiety and depression were 5.1 ( $SD = 2.3$ ) and 2.2 ( $SD = 2.0$ ), respectively. Positive and negative affect (PANAS; Watson, Clark, & Tellegen, 1988) were relatively high ( $M = 35.1$ ,  $SD = 4.8$ ) and low ( $M = 16.6$ ,  $SD = 4.7$ ), respectively. The score for the general health perception (SF-36-GH, Ware & Sherbourne, 1992) was 80 ( $SD = 14$ ), which is above the score for the general local population (Richard et al., 2000). Participants were above average in verbal fluency as assessed with the Animal Naming Task (1 minute, Kertesz, 1982). This test shows a strong association with general intellectual ability. There were no significant effects of gender and

gender x age interactions for any of these variables ( $ps > .05$ ), except for depressive symptoms. Women reported slightly less depressive symptoms than men ( $F(1, 209) = 6.18, p < .05, \eta_p^2 = .029$ ).

With respect to personality, which was measured with the NEO-FFI-R (McCrae & Costa, 2004), women were higher on agreeableness ( $F(1, 208) = 11.32, p < .01, \eta_p^2 = .052$ ). There were no significant gender differences nor gender x age interactions either for neuroticism, extraversion, openness to experience or conscientiousness ( $ps > .06$ ).

Prior to the presentation of the pictures, the participants filled in one SAM questionnaire (9-point Self-Assessment Manikin, Lang et al., 2005) and one state scale of Spielberger's State Trait Anxiety Inventory (STAI-S, Spielberger, 1983) to measure their current affective state. On average, men and women felt equally calm and relaxed ( $ps > .36$ ).

(TABLE 1 ABOUT HERE)

## **Stimuli**

The stimuli were 84 pictures chosen from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005). They were arranged in 14 series of six pictures. We showed series of pictures rather than single pictures because we were interested in the more sustained emotional response over an extended period of affective stimulation. The series represented different contents, six expected to be pleasant, six unpleasant, and two neutral. They were (mean normative valence and arousal levels on a 1-9 scale in parentheses, Lang et al., 2005): Pleasant: erotic heterosexual couples (6.9, 6.5); food (7.1, 5.2); pleasant family scenes (7.5, 4.0); pleasant landscapes (7.3, 3.7); romantic heterosexual couples (7.1, 5.2); sport scenes (7.3, 6.7); unpleasant: environmental contamination (3.3, 4.2); human loss (2.8,

4.1); mutilated bodies (1.9, 6.8); physical violence (2.3, 6.7); sick or injured human beings (2.3, 5.3); suffering or dead animals (2.5, 5.4); neutral: household objects (4.9, 2.6); neutral human activities (5.1, 3.1). Categorization was based on previous work (Bradley et al., 2001; Gomez & Danuser, 2010). The series are representative of the typical contents of the IAPS.

## **Measures**

Valence and arousal ratings were registered with the paper-and-pencil version of the 9-point Self-Assessment Manikin (SAM, Lang et al., 2005).

## **Procedure**

Participants were tested individually. They were told that picture series would be displayed, and that the pictures would depict life events, objects, and persons. Next, participants were explained how to use the SAM, and the importance of rating the picture series as they felt while they looked at them was emphasized. Afterwards, the participants filled in the SAM and STAI-S questionnaires to measure their current affect, and an exemplary series showing mushrooms was displayed in order to familiarize the participants with the procedure.

Then, the participants were shown the 14 picture series on a 19'' computer screen. Each picture was presented for 10 s. Series were separated by 75 s during which the participants gave one valence and one arousal rating about the preceding series and then relaxed. The order of the pictures in each series was randomly determined and varied across participants. There were six different orders with each picture being in first, second, third, fourth, fifth, and sixth position, respectively. There were also six different presentation orders of the series. These orders were constructed with the constraint that no more than two series of similar valence (positive, negative, neutral) were presented consecutively. Further, we made sure that over the six presentation orders the same series was presented on average both at the beginning, in the middle, and in the final part of the experiment. These orders were

counterbalanced across gender and six age groups (i.e., 20-29, 30-39, 40-49, 50-59, 60-69, 70-81) to control for possible within-session habituation or fatigue effects.

## **Statistical Analyses**

Analyses of covariance (ANCOVAs) were performed using the General Linear Model (GLM) procedure of IBM SPSS (version 20.0), which allows to model dependent scale variables based on their relationship to categorical and scale predictors. Gender was entered as fixed factor, whereas age (centered) was entered as covariate, and, thus, treated as a continuous variable. In the first step, we tested the full factorial model with the main effects for Gender and Age. In a second step, we added the cross-product Gender x Age to address the question of whether gender differences vary with age. Where appropriate, the multivariate test statistic Wilks' lambda is reported to avoid potential sphericity issues. The significance level was set at 5%. Effect sizes were estimated using partial eta squared ( $\eta_p^2$ ). Mean differences between men and women based on estimated marginal means and regression coefficients for the gender x age interaction together with their confidence intervals are also reported.

Finally, we examined the robustness of our findings when adjusting for other variables that may be related to emotional experience (Carstensen et al., 2011; Hamann & Canli, 2004; Mroczek & Kolarz, 1998): educational level, mood (positive and negative affect, anxiety and depressive symptoms), general health perception, verbal fluency, personality (neuroticism, extraversion, openness to experience, agreeableness, conscientiousness), and state affect (anxiety, valence and arousal prior the picture presentation).

## Results

Table 2 presents mean scores for valence and arousal ratings of the 14 series for men and women as well as the mean differences between men and women based on estimated marginal means and regression coefficients for the gender x age interaction together with their confidence intervals. Main effects of age are not reported here because age differences independent of gender are outside the scope of this article.

A very important finding in relation to our research questions is that no single gender x age interaction was significant ( $F$ -ratios with 1 df between-subjects and 206-208 dfs within-subjects ranged between 0.0 and 2.83 with a mean of 0.62,  $ps > .09$ ). This indicates that age did not significantly moderate gender differences in the affective responses to the picture series.

Across all series, there was a significant effect of Series x Gender for both, valence ( $F(13, 195) = 2.94, p < .01, \eta_p^2 = .164$ ) and arousal ( $F(13, 196) = 2.30, p < .01, \eta_p^2 = .133$ ), indicating that men and women responded differently to specific contents. There were no main effects of gender ( $F(1, 207) = 0.77$  for valence and  $F(1, 208) = 0.02$  for arousal,  $ps > .38$ ).

**Responses to pleasant contents.** Men and women reacted differently to specific pleasant contents, as evidenced by significant Series x Gender interactions for both, valence ( $F(5, 203) = 4.40, p < .01, \eta_p^2 = .098$ ) and arousal ( $F(5, 204) = 2.83, p < .05, \eta_p^2 = .065$ ) across the six pleasant series. For arousal, there was also a main effect of gender with women reporting on average lower arousal than men ( $F(1, 208) = 4.03, p < .05, \eta_p^2 = .019$ ).

Men rated images of *Erotic heterosexual couples* as more pleasant than did women ( $F(1, 209) = 6.68, p < .05, \eta_p^2 = .031$ ). In contrast, women rated pictures of *Pleasant landscapes* and *Pleasant family scenes* as more positive than men did ( $F(1, 209) = 5.06, p < .05, \eta_p^2 = .024$  and  $F(1, 208) = 10.62, p < .01, \eta_p^2 = .049$ , respectively). The latter series was also rated as

more relaxing by women than men ( $F(1, 209) = 8.16, p < .01, \eta_p^2 = .038$ ). No significant gender effects were obtained for pictures of *Romantic heterosexual couples*, *Sport scenes* and *Food* ( $F$ -ratios with 1 df between-subjects and 208-209 dfs within-subjects ranged between 0.0 and 2.76 with a mean of 0.68,  $ps > .09$ ).

**Responses to unpleasant contents.** Main effects of gender over the six unpleasant series were obtained for both valence and arousal ( $F(1, 208) = 6.79, p < .05, \eta_p^2 = .032$  and  $F(1, 208) = 5.61, p < .05, \eta_p^2 = .026$ , respectively).. This indicates that women evaluated the six unpleasant series overall as more negative and arousing than men did. The Series x Gender interaction was not significant either for valence ( $F(5, 204) = 1.81, p = .11$ ) or arousal ( $F(5, 204) = 1.91, p = .09$ ). Planned comparisons showed that the main gender effects were mainly due to differences for the three more arousing series, i.e., *Mutilated bodies*, *Physical violence* and *Suffering or dead animals*. Compared with men, women rated these three series as more arousing ( $F(1, 209) = 5.88, p < .05, \eta_p^2 = .027$ ,  $F(1, 208) = 4.18, p < .05, \eta_p^2 = .020$  and  $F(1, 209) = 9.61, p < .01, \eta_p^2 = .044$ , respectively). *Physical violence* and *Suffering or dead animals* were also rated as more unpleasant by women than men ( $F(1, 208) = 8.38, p < .01, \eta_p^2 = .039$  and  $F(1, 209) = 13.47, p < .001, \eta_p^2 = .061$ ). No significant gender effects were obtained for pictures of *Sick or injured human beings*, *Human loss* and *Environmental contamination* ( $F$ -ratios with 1 df between-subjects and 209 dfs within-subjects ranged between 0.0 and 3.24 with a mean of 1.27,  $ps > .07$ ).

**Neutral contents.** For both series *Household objects* and *Neutral human activities* there were no significant gender effects ( $F$ -ratios with 1 df between-subjects and 209 dfs within-subjects ranged between 0.0 and 1.22 with a mean of 0.75,  $ps > .27$ ).

All effects reported above did not change after including in the analyses measures of educational level, mood, general health perception, verbal fluency, personality, and state

affect with the exception of the gender effect for arousal across the six pleasant series, which became nonsignificant ( $p > .10$ ).

(TABLE 2 ABOUT HERE)

## Discussion

The present study aimed to complement existing findings regarding gender differences in emotional reactivity across adulthood, focusing on the aspect of self-reported affect when viewing standardized emotional pictures. Previous work has highlighted differences in the experiential response of *young* men and women to specific pictorial contents. The novel question we addressed in the present article was to which extent such gender differences are moderated by age.

Four hypotheses can be distinguished concerning gender differences in emotional reactivity across adulthood; the “stability hypothesis” that assumes that gender differences do not change significantly across the adult lifespan, the “divergence hypothesis” that suggests that differences in emotional reactivity between men and women tend to increase with age, the “convergence hypothesis” according to which gender differences decrease and possibly disappear as we age, and finally, the “reversal hypothesis” that assumes that gender differences in younger age may reverse in older age.

The main contribution of this study is that gender differences in valence and arousal ratings of a broad range of different pictorial contents were not significantly influenced by age. Thus, our findings support the “stability hypothesis”. Gender differences in self-reported pleasantness and arousal seem to be rather stable across the adult lifespan. These results are in line with but also extend reports by Gavazzeni and colleagues (2008) and Keil and Freund (2009), who found that gender differences in affective ratings of pictures were comparable among younger and older adults. They are also in concordance with findings from studies on the affective response to unpleasant film clips (Kunzmann & Grühn, 2005; Seider et al., 2011), self-rated distress in interpersonal conflicts, sex-specific use of coping and defense strategies and emotional intensity (Birditt & Fingerman, 2003; Blanchard-Fields, Chen, & Norris, 1997; Diehl, Coyle, & Labouvie-Vief, 1996; Diener, Sandvik, & Larsen, 1985). Thus,

stability of gender differences in emotional reactivity across adulthood is supported by different lines of research.

However, other studies point to different patterns of gender differences across age. Findings from Neiss and coauthors (2009) and Mroczek and Loranz (1998) support the “divergence hypothesis” (Schieman & Van Gundy, 2000). In particular, Neiss et al. (2009) found that the gender difference in valence ratings of pleasant and unpleasant images increased significantly from 20-40 years old adults to 65-85 years old adults: In the older age group, women gave more positive ratings for the pleasant pictures and more negative ratings for the unpleasant pictures than men did. In contrast, some studies have found a decrease in gender differences across age and thus support the “convergence hypothesis” (Byers et al., 2010; Labouvie-Vief, Lumley, Jain, & Heinze, 2003; Schieman & Van Gundy, 2000), whereas Birditt and Fingerman (2003)’s report for nonspecific negative emotions in response to interpersonal problems is in line with the “reversal” hypothesis” of gender differences in emotion.

The most parsimonious explanation for these contrasting findings is that the pattern of gender differences in emotional functioning across the adult lifespan is multi-causal. At the very least, biological, psychological, sociocultural and cohort factors interact with each other in complex ways in determining the pattern of gender differences across age. Importantly, the effect of these factors may vary, depending on several aspects including, but not limited to, the type of emotions, their features (e.g., duration) and components (e.g., physiology, behavior) and the context under which they occur (e.g., interpersonal).

Four gender x age interaction effects were not far from significance ( $p = .094$  to  $.184$ ). Gender differences in valence and arousal ratings of images of erotic heterosexual couples as well as gender differences in valence ratings of pleasant family scenes tended to be larger among the older participants as compared to the younger participants (i.e., tendency to diverge; regression coefficients and 95% CIs of 0.17 (-0.08, 0.41), 0.25 (-0.10, 0.61), and -0.16 (-0.35,

0.03), respectively). Self-rated pleasantness of images of romantic heterosexual couples showed a tendency to be higher for younger men than younger women but to be higher for older women than older men (tendency to reverse; regression coefficient and 95% CI of -0.22 (-0.47, 0.04)). Thus, these admittedly nonsignificant findings would be compatible with true effects of up to 0.41, 0.61, -0.35, and -0.22 per decade, which correspond to changes of 2.05, 3.05, -1.75, and 1.10 from age 20 to age 70, respectively.

### **Gender differences for pleasant contents**

No overall gender effect across the six pleasant series was found. Rather, men and women reacted differently to specific contents (Bradley et al., 2001). Compared with women, men rated the most arousing content, i.e., images of erotic heterosexual couples as more pleasant. In contrast, women rated the least arousing contents, i.e., pictures depicting pleasant family scenes and pleasant landscapes as more positive than men. Psychoneurophysiological research gives evidence that compared to young women, young men engage more intensely their appetitive motivational system in the context of erotic stimuli (Bradley et al., 2001; Hamann, Harman, Nolan, & Wallen, 2004; Murnen & Stockton, 1997; Sabatinelli, Flaisch, Bradley, Fitzsimmons, & Lang, 2004). The outcomes of our study suggest that this gender difference largely persists in middle and old age, at least at the level of self-conscious emotional experience. This gender effect seems to be due to the explicit sexual content or to nudity rather than intimacy per se as evidenced by the lack of gender differences for pictures of romantic heterosexual couples. The origins of the sexually differentiated response to erotic cues are unknown and cannot be established here. Bradley and colleagues (2001) suggested that men may be more responsive to physical properties of potential mates compared with women. From an evolutionary point of view, gender differences in the affective response to sexual contents may reflect differential reproductive goals (see sexual selection theory, Buss & Schmitt, 1993). Both, psychosocial (e.g., a sexual double standard in Western culture and

gender role congruent responding) and biological (e.g., gonadal steroid hormones) factors could contribute to these gender differences (Rupp & Wallen, 2008).

The gender differences for pleasant landscapes and pleasant family scenes observed here are in line with Bradley and coauthors (2001)'s study. Compared with young men, young women have been found to endorse more often the emotion labels "happy", "loving" and nurturant" when viewing pictures of families (Bradley et al., 2001). The gender effect for the pleasant family scenes may be partly explained by socialization processes during younger years. In comparison to boys, girls are typically socialized to be more nurturing and affiliative (Brody & Hall, 2008).

### **Gender differences for unpleasant contents**

Across the six aversive contents, women reported more unpleasantness and higher arousal than did men. Importantly, as for pleasant contents, there were no significant interactions between gender and age. This finding extends reports of gender effects in defensive activation observed in college students (Bradley et al., 2001) to a sample of people aged 20 to 81 and supports the hypothesis that women of all ages are more defensively reactive than men. These results are also consistent with physiological data showing greater fear bradycardia, potentiation of the defensive startle reflex, and greater facial electromyographic reactions in young women (Bradley et al., 2001), as well as epidemiological and clinical research showing that women manifest more negative affect, anxiety disorders, and depression than men (e.g., Byers, Yaffe, Covinsky, Friedman, & Bruce, 2010; Mroczek & Kolarz, 1998; Nolen-Hoeksema, 2001). Our results further suggest that the gender differences are particularly marked for contents that intensely engage the defensive system, i.e., the most arousing unpleasant contents. The gender difference in defensive activation appears to emerge relatively early in human development (McManis, Bradley, Berg, Cuthbert, & Lang, 2001;

Sharp, van Goozen, & Goodyer, 2006), and our findings suggest that it may persist across adulthood until late age.

## **Conclusion**

The current study adds a unique piece to our knowledge about gender differences in emotion across adulthood by showing that men and women have different affective experiences to specific contents and that these differences are rather stable across the adult lifespan. Importantly, these findings remained robust after accounting for other variables that may be related to emotional experience (personality, verbal fluency, self-reported health, sociodemographic variables, and momentary affect).

Owing to the cross-sectional nature of the data, caution in interpreting results must be exercised regarding age-related vs. cohort effects. Research using sequential designs is needed.

We investigated affective reactivity to a large number of contents. Future studies may increase the variety and specificity of the selected contents. Researchers may also try to determine to which extent gender differences depend on the thematic content, on the arousal/intensity level of the pictures or on a combination of these factors (Bernat, Patrick, Benning, & Tellegen, 2006). Moreover, future studies would benefit from collecting neurophysiological data as well as including a measure of adherence to gender roles.

We showed 1-minute series of six pictures each. It remains to be tested whether results are reproduced when presenting single pictures. Finally, questions remain about gender differences in emotional reactivity beyond the age of 80. We think that research along the line presented in this article is very important to further our understanding of gender, and more generally individual, differences in emotion, health and disease.

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Table 1 Participants' sociodemographic characteristics, self-rated health, verbal fluency, personality and state affect

Variable	Men	Women	Total sample
<b>Sample size (n)</b>			
Younger (20-39 yrs)	37	40	77
Middle-aged (40-59 yrs)	32	35	67
Older (60-81 yrs)	25	43	68
All (20-81 yrs)	94	118	212
<b>Age (years)</b>			
Younger (20-39 yrs)	28.4 (6.0)	28.1 (5.5)	28.2 (5.7)
Middle-aged (40-59 yrs)	49.4 (5.9)	48.2 (5.5)	48.8 (5.7)
Older (60-81 yrs)	68.1 (5.6)	67.5 (5.3)	67.7 (5.4)
All (20-81 yrs)	46.1 (17.1)	48.4 (17.4)	47.4 (17.3)
<b>Marital status (%)</b>			
Single	31	50	42
In a relationship	69	50	58
<b>With children (%)</b>			
	51	58	56
<b>Employment status (%)</b>			
Student	16	11	13
Working	44	47	45
Unemployed	12	10	11
Retired	28	32	31
<b>Educational level (%)<sup>a</sup></b>			
Level I	3	9	7
Level II	42	45	43
Level III	55	46	50
<b>Self-reported health</b>			
Anxiety <sup>b</sup>	4.9 (2.3)	5.2 (2.2)	5.1 (2.3)
Depression <sup>b</sup>	2.6 (2.1)	2.0 (1.9)	2.2 (2.0)
Positive affect <sup>c</sup>	35.1 (4.9)	35.2 (4.7)	35.1 (4.8)
Negative affect <sup>c</sup>	16.8 (4.4)	16.4 (4.9)	16.6 (4.7)
SF-36-GH <sup>d</sup>	79 (14)	81 (15)	80 (14)
<b>Verbal fluency</b>			
Animal naming task <sup>e</sup>	22.3 (6.5)	22.6 (6.1)	22.5 (6.2)
<b>Personality<sup>f</sup></b>			
Neuroticism	1.4 (0.6)	1.5 (0.6)	1.4 (0.6)
Extraversion	2.4 (0.5)	2.5 (0.5)	2.5 (0.5)
Openness to experience	2.7 (0.5)	2.7 (0.5)	2.7 (0.5)
Agreeableness	2.6 (0.5)	2.9 (0.4)	2.8 (0.5)
Conscientiousness	2.9 (0.5)	3.0 (0.4)	3.0 (0.5)
<b>State affect</b>			
Anxiety <sup>g</sup>	26.1 (4.6)	26.1 (5.6)	26.1 (5.2)
Valence <sup>h</sup>	6.8 (1.3)	6.8 (1.5)	6.8 (1.4)
Arousal <sup>h</sup>	3.1 (1.9)	2.9 (2.0)	3.0 (2.0)

Notes for Table 1: <sup>a</sup> Educational level was divided into three categories: level I = no vocational training with or without practical on-the-job training; education level II: completed vocational training equivalent to apprenticeship or a degree judged equivalent; education level III: baccalaureate with or without later academic studies; values for age, self-reported health, verbal fluency, personality and state affect are means with *SDs* in brackets; <sup>b</sup> HADS (Zigmond & Snaith, 1983), scores between 0 and 21; <sup>c</sup> PANAS (Watson et al., 1988), scores between 10 and 50; <sup>d</sup> (Ware & Sherbourne, 1992), scores between 0 and 100 with higher scores corresponding to better health, GH = general health perception; <sup>e</sup> (Kertesz, 1982), number of animal names in 1 minute; <sup>f</sup> NEO-FFI-R (McCrae & Costa, 2004), scores between 0 and 4; <sup>g</sup> STAI Y-A (Spielberger, 1983), scores between 20 and 80; <sup>h</sup> SAM (Bradley & Lang, 1994), scores between 1 and 9 with higher scores corresponding to more positive valence and higher arousal.

Table 2 Means of valence and arousal ratings (*SEMs* in parentheses) of the fourteen series for men and women and estimates for the gender effect and the gender x age interaction

Series	Men	Women	Mean difference and 95% CI of the main gender effect <sup>1</sup>	Regression coefficient and 95% CI of the gender x age interaction <sup>2</sup>	IAPS nos.
<b>Pleasant series</b>					
Erotic heterosexual couples					
Valence	7.3 (0.2)	6.7 (0.1)	0.56* (0.13, 0.98)	0.17 (-0.08, 0.41)	4659, 4660, 4680
Arousal	5.7 (0.2)	5.0 (0.2)	0.59 (-0.02, 1.20)	0.25 (-0.10, 0.61)	4687, 4690, 4800
Food					
Valence	7.0 (0.1)	7.2 (0.2)	-0.23 (-0.68, 0.21)	-0.07 (-0.33, 0.19)	7200, 7270, 7330
Arousal	4.0 (0.2)	3.4 (0.2)	0.53 (-0.10, 1.17)	-0.05 (-0.42, 0.32)	7470, 7480, 7488
Pleasant family scenes					
Valence	7.7 (0.1)	8.3 (0.1)	-0.54** (-0.87, -0.22)	-0.16 (-0.35, 0.03)	2299, 2311, 2332
Arousal	3.4 (0.2)	2.5 (0.2)	0.87** (0.27, 1.47)	-0.02 (-0.37, 0.33)	2360, 2530, 2598
Pleasant landscapes					
Valence	7.6 (0.2)	8.1 (0.1)	-0.44* (-0.82, -0.05)	-0.10 (-0.32, 0.13)	5200, 5594, 5631
Arousal	2.5 (0.2)	2.2 (0.2)	0.33 (-0.19, 0.86)	0.01 (-0.30, 0.31)	5780, 5781, 5811
Romantic heterosexual couples					
Valence	7.5 (0.2)	7.8 (0.2)	-0.31 (-0.74, 0.13)	-0.22 (-0.47, 0.04)	2550, 4624, 4625
Arousal	3.6 (0.2)	3.2 (0.2)	0.37 (-0.25, 0.99)	0.00 (-0.36, 0.36)	4640, 4641, 4650
Sport scenes					
Valence	6.8 (0.2)	6.8 (0.2)	0.01 (-0.43, 0.44)	-0.04 (-0.29, 0.21)	5621, 8080, 8180
Arousal	4.7 (0.2)	4.9 (0.2)	-0.23 (-0.85, 0.40)	-0.16 (-0.52, 0.20)	8186, 8400, 8490
<b>Six pleasant series</b>					
Valence	7.3 (0.1)	7.5 (0.1)	-0.16 (-0.42, 0.09)	-0.07 (-0.22, 0.08)	
Arousal	4.0 (0.2)	3.5 (0.1)	0.42** <sup>a</sup> (0.01, 0.83)	0.01 (-0.23, 0.25)	
<b>Unpleasant series</b>					
Environmental contamination					
Valence	2.9 (0.2)	2.8 (0.1)	0.08 (-0.33, 0.49)	0.01 (-0.23, 0.25)	9090, 9110, 9280
Arousal	4.5 (0.3)	4.6 (0.2)	-0.05 (-0.70, 0.60)	0.23 (-0.15, 0.60)	9290, 9342, 9390
Human loss					
Valence	3.1 (0.2)	2.8 (0.1)	0.29 (-0.16, 0.73)	0.05 (-0.21, 0.31)	2205, 2455, 2490
Arousal	3.5 (0.2)	3.8 (0.2)	-0.19 (-0.73, 0.35)	0.13 (-0.18, 0.45)	2590, 9001, 9220
Mutilated bodies					
Valence	2.1 (0.1)	1.8 (0.1)	0.31 (-0.06, 0.68)	0.09 (-0.13, 0.30)	3010, 3030, 3068
Arousal	5.7 (0.2)	6.6 (0.2)	-0.83* (-1.50, -0.16)	0.16 (-0.23, 0.56)	3071, 3110, 3150
Physical violence					
Valence	2.4 (0.2)	1.9 (0.1)	0.49** (0.16, 0.82)	0.03 (-0.16, 0.23)	2683, 3500, 3530
Arousal	5.7 (0.2)	6.4 (0.2)	-0.68* (-1.33, -0.02)	0.12 (-0.26, 0.50)	6313, 6550, 6821
Sick or injured human beings					
Valence	2.4 (0.1)	2.0 (0.1)	0.33 (-0.03, 0.69)	0.02 (-0.19, 0.23)	2053, 2710, 3181
Arousal	4.9 (0.2)	5.4 (0.2)	-0.43 (-1.00, 0.14)	0.11 (-0.22, 0.45)	3230, 3261, 9415
Suffering or dead animals					
Valence	2.4 (0.1)	1.7 (0.1)	0.62*** (0.29, 0.95)	-0.08 (-0.28, 0.11)	2981, 9180, 9181
Arousal	5.3 (0.2)	6.3 (0.2)	-1.07** (-1.76, -0.39)	0.11 (-0.29, 0.51)	9560, 9561, 9571
<b>Six unpleasant series</b>					
Valence	2.6 (0.1)	2.2 (0.1)	0.36* (0.09, 0.64)	0.03 (-0.13, 0.19)	
Arousal	5.0 (0.2)	5.5 (0.2)	-0.54* (-1.00, -0.09)	0.14 (-0.12, 0.41)	
<b>Neutral series</b>					
Household objects					
Valence	5.4 (0.1)	5.4 (0.1)	-0.01 (-0.24, 0.33)	0.09 (-0.10, 0.28)	7000, 7004, 7035
Arousal	2.3 (0.2)	2.2 (0.1)	0.18 (-0.26, 0.63)	0.01 (-0.25, 0.27)	7090, 7233, 7234
Neutral human activities					
Valence	5.1 (0.1)	5.3 (0.1)	0.19 (-0.55, 0.17)	-0.07 (-0.28, 0.13)	2357, 2393, 2396
Arousal	2.5 (0.2)	2.3 (0.1)	0.24 (-0.19, 0.66)	0.05 (-0.20, 0.29)	2397, 2745.1, 2850
<b>All series</b>					
Valence	5.0 (0.1)	4.9 (0.1)	0.07 (-0.09, 0.23)	-0.02 (-0.11, 0.08)	
Arousal	4.2 (0.1)	4.2 (0.1)	-0.02 (-0.35, 0.30)	0.07 (-0.12, 0.26)	

Notes for Table 2: <sup>1</sup> The mean differences and their 95% CIs are based on estimated marginal means (men minus women); <sup>2</sup> The regression coefficients and their 95% CIs refer to the change in valence and arousal ratings for men for a period of 10 years compared to women; CI = Confidence Interval; IAPS = International Affective Picture System (Lang et al., 2005); \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ; <sup>a</sup> nonsignificant in the analysis with the covariates ( $p > .10$ ).