Original article

Valence, arousal, and imagery ratings for 835 French attributes by young, middle-aged, and older adults: The French Emotional Evaluation List (FEEL)

Évaluation de la valence, du niveau d'excitation et de la valeur d'imagerie de 835 adjectifs français par des jeunes adultes, des adultes d'âge moyen et des adultes âgés : The French Emotional Evaluation List (FEEL)

A.-L. Gilet [a,c,*], D. Grühn [b], J. Studer [a], G. Labouvie-Vief [a]

[a] *Faculty of Psychology and Educational Sciences, University of Geneva, 40, boulevard du Pont-d'Arve, 1211 Geneva 4, Switzerland*
[b] *Department of Psychology, North Carolina State University, Campus Box 7650, Raleigh, NC 27695 United States*
[c] *LPPL UPRES EA 4638, faculté de psychologie, université de Nantes, chemin de la Censive-du-Tertre, BP 81227, 44312 Nantes cedex 03, France*

ARTICLE INFO	ABSTRACT
	Introduction and objective. – Attributes are used by young, middle-aged, and older adults to describe persons in everyday life. The current study asks whether attributes are perceived similarly by different age groups: for example, some attributes could be perceived as more positive or more negative in old age than in young adulthood. *Method.* – To address this question, we investigated age-related differences in emotional evaluations of French adjectives. Young, middle-aged, and older adults judged 835 French adjectives on valence, arousal, and imagery. *Results.* – Age groups agreed highly on the relative rank order but showed mean differences for a substantial number of attributes, especially for arousal and imagery ratings. Associations between dimensions differed as well between age groups: valence and arousal were negatively correlated and this correlation was stronger in older than in younger age groups. *Conclusion.* – The present study provided new evidence that the perception of emotionally toned material is affected by age. Several explanations to these age-related differences are discussed. © 2012 Elsevier Masson SAS. All rights reserved.
	RÉSUMÉ Les attributs sont utilisés par les adultes jeunes ou âgés pour décrire les personnes rencontrées dans la vie quotidienne. La question est alors de savoir si ces attributs sont perçus de façon similaire par ces différents groupes d'âge : par exemple, certains attributs peuvent être perçus comme plus positifs ou plus négatifs chez les personnes âgées que chez les jeunes adultes. Pour répondre à cette question, nous avons étudié les différences liées à l'âge dans les évaluations émotionnelles d'adjectifs français. De jeunes adultes, des adultes d'âge moyen et des adultes âgés ont évalué la valence, le niveau d'excitation et la valeur d'imagerie de 835 adjectifs français. Les résultats indiquent que les groupes d'âge s'accordent sur le classement relatif, mais mettent aussi en évidence des différences pour un grand nombre d'attributs, en particulier pour les évaluations du niveau d'excitation et de la valeur d'imagerie. Les associations entre les dimensions diffèrent aussi entre les groupes d'âge : valence et niveau d'excitation sont négativement corrélés et cette corrélation est plus forte chez les âgés que chez les groupes d'âge plus jeunes. Les résultats de cette étude apportent donc de nouvelles preuves empiriques des différences liées à l'âge dans la perception de matériel émotionnel qui sont ensuite discutées. © 2012 Elsevier Masson SAS. Tous droits réservés.

* Corresponding author.
E-mail addresses: anne-laure.gilet@univ-nantes.fr (A.-L. Gilet), dgruehn@ncsu.edu (D. Grühn), joseph.studer@unige.ch (J. Studer), gisela.vief@unige.ch (G. Labouvie-Vief).

Attributes are often used to describe person's current states and long-term traits. For example, a person could be described as 'comical', 'arrogant', 'sad', or 'handsome'. Attributes also carry an emotional connotation: an 'arrogant' person is generally perceived as negative whereas a 'handsome' person is often perceived as positive. An open question is whether such emotional connotations of persons' attributes differ by age. Specifically, do older adults perceive an attribute as similar positive or negative as young adults do? For example, do older adults evaluate 'punctual' persons more positive than young adults? Is a 'comical' person perceived as more negative by older adults than by younger adults? Thus, the question is whether attributes change their emotional meaning across the adult lifespan.

Emotional connotation of words can be assessed according to two main dimensions, valence and arousal. Valence refers to the hedonic tone of a word, that is, to the extent to which a word elicit a pleasant or displeasant feeling. Arousal is defined using the dimension of tension-relaxation or in terms of activation. It refers to the extent to which a word elicits a feeling of excitation or whether it is calming, relaxing (Kensinger and Schacter, 2006; Russell, 1980). The influence of an emotional connotation of the material on cognitive processing was demonstrated in studies involving lexical decision task (Niedenthal and Setterlund, 1994) or memory tasks (Cahill and McGaugh, 1995; Kensinger et al., 2002; Kensinger and Corkin, 2003; Murphy and Isaacowitz, 2008).

The growing literature on social-emotional aging research suggests that older adults process emotional information differently than young adults. Older adults, in contrast to younger adults, tend to report similar or higher levels of positive affect (Lawton et al., 1992; Mroczek and Kolarz, 1998), and better emotion regulation (Gross et al., 1997; Lawton et al., 1992) than do young adults, and use emotions constructively in everyday problem solving (Blanchard-Fields, 1998). At the same time, research findings suggest that regulation capacities may be impaired in later life (Labouvie-Vief, 2008; Labouvie-Vief and Marquez, 2004). For instance, older adults, in contrast to younger adults, have more difficulties processing highly arousing information (Wurm et al., 2004) and coping with high arousing situations (Bäckman and Molander, 1986).

The present study was also influenced by inconsistent findings regarding age-related differences in remembering emotional material. Some studies found age-related differences (Charles et al., 2003; Grühn et al., 2007) and others not (Comblain et al., 2004; Grühn et al., 2005). The lack of consistent results may be partly due to age-related differences in the perception of the valence and the arousal levels of the to-be-remembered material. If age groups differ in how positive/negative or how arousing they evaluate the to-be-remembered material, age differences in remembering this material are likely.

Few studies have addressed age differences in evaluating emotional and non-emotional words with mixed findings. For instance, Grunwald et al. (1999) investigated young, middle-aged and older adults' perception of lexical emotional and non-emotional stimuli (e.g., words or sentences). Older adults perceived emotional material similarly intense as younger adults did. However, older participants evaluated non-emotional stimuli as more intense than young and middle-aged adults. Similarly, Messina et al. (1989) investigated age differences in evaluating 904 non-emotional and easy to imagine French words. Young adults rated words as more positive than middle-aged and older adults did. However, older adults gave slightly more extreme ratings than young and middle-aged adults.

Studies that focused primarily on emotional material have revealed substantial age differences. Grühn and Smith (2008) asked young and older adults to evaluate 200 German adjectives on six dimensions: valence, arousal, control, imagery, self-relevance, and age-relevance. These authors found for approximately half of the words significant age differences in at least one dimension. In particular, valence (32%) and arousal (21%) ratings revealed a substantial number of words with significant age differences. Grühn and Scheibe (2008) also investigated young and older adults' evaluations of 504 emotional pictures. They found age differences for a large number of pictures, i.e., the valence and arousal ratings for young and older adults differed for 30.0% and 18.7% of 504 pictures, respectively. Older adults rated pictures generally as more extreme than young adults did. Specifically, older adults rated negative pictures as more negative and arousing but they rated positive pictures as more positive and less arousing than young adults did. The association between valence and arousal was strong and linear: As valence went from the negative to the positive end, arousal level decreased. This linear association became stronger with age (young adults: $r = -0.85$, older adults: $r = -0.95$). These findings are consistent with previous results reported by Cuthbert et al. (1994) showing that pleasure and arousal ratings formed a more linear relationship in older women's perception of emotional pictures rather than a curvilinear relation. In sum, studies on emotional material, including attributes, revealed major age differences in the perception of the emotional material. Specifically, age differences seem to be more frequent at the extreme ends, that is, age differences were apparent for very negative or very positive material. These age-differences in the perception of emotional material may in turn influence further processing and remembering of such information. Consequently, making available emotional ratings of words for young and older adults could be of great interest for researchers interesting in age-related differences. For this purpose, we created the French Emotional Evaluation List (FEEL).

The goal of the present study was to investigate age differences in evaluating attributes. Specifically, young, middle-aged, and older adults were asked to evaluate 835 French adjectives. Adjectives were rated on three dimensions: valence (i.e., hedonic value, pleasantness), arousal (i.e., emotional activation), and imagery (i.e., propensity and facility to elicit a visual image). Extending past research on age differences in evaluating word material (Grühn and Smith, 2008), we (a) used a larger set of adjectives, (b) included a group of middle-aged adults, and (c) attempted to generalize the age pattern to a different language, namely French. Rating studies on French words are available for objective and subjective frequence, concreteness, word association, and age of acquisition (Bonin et al., 2003; Ferrand et al., 2008; Robert et al., in press). Likewise, studies have reported imagery ratings for French nouns (Bonin et al., 2003; Desrochers and Bergeron, 2000; Desrochers and Thompson, 2009; Flieller and Tournois, 1996; Gonthier et al., 2009). Regarding valence ratings, Niedenthal et al. (2004) asked 77 participants to rate 237 emotion words and 198 neutral abstract words on several dimensions including valence. Bonin et al. (2003) reported valence ratings for 866 French words given to 97 students. Bertels et al. (2009) asked 166 participants to give valence and arousal ratings for a small sample of 80 mono- or disyllabic positive, negative, neutral, or taboo words uttered in a neutral or an emotionally congruent tone of voice. The authors found an overall strong negative correlation between valence and arousal in the two conditions of voice tone. However, these studies were conducted on young participants. The present study provides French word ratings by three different age groups.

Based on the few past studies, we expected that a substantial portion of the word material would reveal age differences on the emotional dimensions, valence and arousal. We were especially interested in the association between valence and arousal for the different age groups. Consistent with past research (Grühn and Scheibe, 2008), we expected the linear association between valence and arousal to be stronger for older than for younger adults. In addition, in order to facilitate future research, we asked participants to

Table 1
Sample characteristics of young (*n* = 19), middle-aged (*n* = 22), and older adults (*n* = 19).
Caractéristiques des jeunes adultes (n = 19), des adultes d'âge moyen (n = 22) et des adultes âgés (n = 19).

	Young adults		Middle adults		Older adults		Effect size
	M	SD	M	SD	M	SD	
Age (in years)	23.80	2.70	45.00	4.50	64.70	5.30	
Affect	5.42[a]	1.31	5.36[a]	1.33	5.63[a]	1.50	0.01
Life satisfaction	5.84[a]	0.77	4.86[b]	1.21	5.16[a,b]	1.50	0.11[*]
Subjective health	5.37[a]	1.46	5.45[a]	1.22	5.47[a]	1.22	0.00

[*] $p < 0.05$. [**] $p < 0.01$.

[a],[b] Means with different superscripts differed significantly ($p < 0.05$) between age groups. Measures of affect, life satisfaction, and subjective health were assessed on 7-point scales.

provide imagery ratings. Imagery ratings are often used in experimental settings to match or to select words. Imagery, like other words characteristics, has been shown to play a role in word processing including lexical decision tasks, semantic categorization, or memory (Dorot and Mathey, 2010; Gonthier et al., 2009; Robert et al., 2009). The inclusion of imagery ratings will help researchers to select word material for future experiments.

1. Method

1.1. Participants

The sample comprised 19 young (aged 19 to 28 years, *M* = 23.8, SD = 2.7, 52.6% female), 22 middle-aged (aged 36 to 52 years, *M* = 45.0, SD = 4.5, 50.0% female), and 19 older (aged 55 to 72 years, *M* = 64.7, SD = 5.3, 52.6% female) adults. Participants were recruited through newspaper advertisements in the local area of Geneva, Switzerland. Participants were all native French speakers. The sample was stratified by sex. Participants received 40 SFr ($\approx$ 33 $) as compensation.

Participants' subjective well-being was assessed using single item measures of current affect, subjective health, and life satisfaction. All three measures were assessed on 7-point scales. Specifically, current affect ("How do you feel right now?") ranged from very bad (1) to very good (7), subjective health ("How do you judge your physical health?") ranged from very bad (1) to excellent (7), and life satisfaction ("In general, how satisfied are you with your life?") ranged from not satisfied at all (1) to very satisfied (7). Age groups did not differ in current affect, $F(2, 57) = 0.21$, $p = 0.81$, $\eta^2 < 0.01$, or subjective health, $F(2, 57) = 0.04$, $p = 0.96$, $\eta^2 < 0.01$. However, young adults reported higher life satisfaction than middle-aged adults, whereas older adults did not differ significantly from young and middle-aged adults, $F(2, 57) = 3.52$, $p < 0.05$, $\eta^2 = 0.11$. However, young ($M = 16.81$, SD = 2.68) and middle-aged ($M = 14.68$, SD = 3.92) adults reported more years of formal education, $F(2, 57) = 8.65$, $p < 0.01$, $\eta^2 = 0.23$, than older adults did ($M = 12.32$, SD = 3.18). Sample characteristics are provided in Table 1.

1.2. Word material

Adjectives were drawn from various different sources. These sources included a web-based database of French words (LEXIQUE; New et al., 2001) as well as previous French rating studies (Flieller and Tournois, 1996; Niedenthal et al., 2004) in order to ensure that relevant adjectives were included. The web-based database of French words also provided data about word frequency in films and books. Our initial list of words consisted of 4497 adjectives. In order to reduce the amount of adjectives systematically, we excluded adjectives that (a) were constituted of two or more sub-words (e.g. *afro-américain*/African American), (b) cannot be used to describe a person (e.g. *climatisé*/conditioning), (c) consisted of more

than 12 letters, and (d) had less than two and more than four syllables. However, eight adjectives of less than two syllables appeared particularly relevant for emotion research (*triste*/sad, *calme*/calm, *gai*/cheerful, *fort*/strong, *seul*/alone, *fier*/proud, *lâche*/coward, and *humble*/humble). These eight adjectives were retained in the final list. The final list contained 835 adjectives.

1.3. Procedure

Participants completed a brief questionnaire about demographic characteristics and received three booklets, which they filled out at home. Each booklet presented one rating dimension with corresponding instructions followed by 35 pages of adjectives. Four word orders were created at random for each booklet and distributed to participants at random. Thirty adjectives appeared twice in a booklet for a total of 865 adjectives. This was done to obtain data about the reliability of the ratings. Equal adjectives were separated by at least 100 other adjectives. Given the huge number of adjectives, it was very unlikely that respondents detected those doubles. Participants were asked to complete the booklets in a prescribed order. The order was counterbalanced across participants. Moreover, participants were asked to leave a 24-hour interval between two consecutive booklets.

Valence, arousal, and imagery were rated on 7-point scales. Response scales ranged for valence from *very unpleasant* (1) to *very pleasant* (7), for arousal from *very relaxed* (1) to *very tensed* (7), and for imagery, that is how easily each word elicits a visual image, from *very difficult* (1) to *very easily* (7).[1] The instruction also contained two response examples for adjectives that were not part of the full adjectives list (complete instructions are provided in the Appendix A, B, C (e-only)).

2. Results

The results are arranged in three sections. First, we examined reliability and consistency of our ratings by looking at retest-reliability, consistency to previous ratings studies, and cross-validating a set of words to a new sample. Second, we investigated associations between dimensions for the entire sample as well as separately for each age group. Third, we examined age differences in the overall evaluation of words. Finally, we were interested in the evaluations for individual adjectives. All the correlations reported in this study are Bravais-Pearson correlations. Ratings for individual attributes are provided as the French Emotional Evaluation List (FEEL)[2] (Appendix D (e-only)).

---

[1] Labels of the French scales ranged (a) for valence from *très désagréable* (1) to *très agréable* (7), (b) for arousal from *très apaisant* (1) to *très excitant* (7), and (c) for imagery from *très difficilement* (1) to *très facilement* (7).

[2] The FEEL database is available upon request from the first author and can also be downloaded at http://www.4.ncsu.edu/~dgruehn/.

Table 2
Correlations between young (Y), middle-aged (M), and older (O) adults' ratings for valence, arousal, and imagery.
Corrélations entre les évaluations de valence, de niveau d'excitation et d'imagerie pour les jeunes adultes, les adultes d'âge moyen et les adultes âgés.

Dimension × age group	Valence			Arousal			Imagery		
	Y	M	O	Y	M	O	Y	M	O
Valence									
Young adults									
Middle-aged adults	0.96**								
Old adults	0.92**	0.95**							
Arousal									
Young adults	−0.63**	−0.62**	−0.60**						
Middle-aged adults	−0.78**	−0.78**	−0.75**	0.92**					
Old adults	−0.85**	−0.86**	−0.85**	0.84**	0.92**				
Imagery									
Young adults	−0.08*	−0.09**	−0.09*	0.19**	0.19**	0.11**			
Middle-aged adults	0.19**	0.19**	0.19**	−0.01	−0.05	−0.14**	0.79**		
Old adults	0.17**	0.18**	0.19**	−0.02	−0.05	−0.16**	0.70**	0.78**	

* $p < 0.05$. ** $p < 0.01$.

2.1. Reliability, consistency, and cross-validation

In order to examine the reliability of our ratings, we investigated three aspects. First, we looked at retest-reliability based on 30 words that appeared twice in each booklet. Second, we looked at the consistency between our word ratings to other French word rating studies. Third, we conducted a separate study in which we tried to cross-validate our ratings by selecting a smaller set of words but giving it to a larger sample.

2.1.1. Retest-reliability

We compared each participant's first and second rating for the same 30 words that were distributed twice in each booklet. By computing Bravais-Pearson correlations between the first and second appearance for all adjectives, we estimated high retest-reliabilities for valence, $r = 0.73$, $p < 0.01$, arousal, $r = 0.75$, $p < 0.01$, and imagery, $r = 0.71$, $p < 0.01$, for the total sample. Within age groups, retest stability was also high (valence: $r_{young} = 0.82$, $r_{middle-aged} = 0.73$, $r_{old} = 0.75$; arousal: $r_{young} = 0.68$, $r_{middle-aged} = 0.76$, $r_{old} = 0.79$; imagery: $r_{young} = 0.75$, $r_{middle-aged} = 0.67$, $r_{old} = 0.69$; all $p < 0.01$).

2.1.2. Consistency between present and previous rating studies

To examine the generalizability of the present ratings, we compared them with ratings available from previous French rating studies (Flieller and Tournois, 1996; Niedenthal et al., 2004). This comparison was possible for the dimensions of valence (Niedenthal et al., 2004) and imagery (Flieller and Tournois, 1996). The sets used by Niedenthal et al. (2004) and Flieller and Tournois (1996) overlapped with the present set of words for only 56 and 24 words, respectively. Valence ratings in the present study were highly consistent with previous valence ratings ($r_{overall} = 0.88$, $r_{young} = 0.90$, $r_{middle-aged} = 0.87$, $r_{old} = 0.82$, all $p < 0.01$) suggesting that the participants of this study agreed substantially with those in Niedenthal et al. study on their perception of words' valence. Regarding imagery ratings, the correlations were slightly lower but still high ($r_{overall} = 0.83$, $r_{young} = 0.83$, $r_{middle-aged} = 0.70$, $r_{old} = 0.75$, all $p < 0.01$) also suggesting that our participants agreed considerabely with those in Flieller and Tournois study on which words easily elicits a visual image or not.

2.1.3. Cross-validation

As part of a separate study, we asked 175 adults ranging from 20 to 89 years ($M = 52.66$ years, SD = 19.79, 53.7% female) to rate 192 words of the FEEL set on both the valence and the arousal dimensions. This study involved a fewer and a more restrictive selection of words as they were matched for valence and arousal across age groups. Analyses revealed a strong positive correlation between the two rating studies on both valence, $r = 0.94$, $p < 0.01$, and arousal, $r = 0.92$, $p < 0.01$, suggesting a high consistency of these ratings. In addition, t-tests comparisons conducted on the ratings between the two studies showed no differences either on the valence ratings, $M_{FEEL} = 3.89$, $SD_{FEEL} = 1.26$, $M_{Study\ 2} = 3.94$, SD $_{Study\ 2} = 1.83$, $t(191) = 0.95$, $p = 0.34$, Cohen's $d = −0.031$, or on the arousal ratings, $M_{FEEL} = 4.08$, $SD_{FEEL} = 1.07$, $M_{Study\ 2} = 4.00$, SD $_{Study\ 2} = 1.43$, $t(191) = −1.78$, $p = 0.077$, $d = 0.063$. Taken together, these results validate the FEEL ratings.

2.2. Associations between valence, arousal, and imagery

In a first step, we compared associations between age groups for valence, arousal, and imagery. Table 2 provides these correlations. Consistency between age groups was high for valence ($0.92 \leq r \leq 0.96$), arousal ($0.84 \leq r \leq 0.92$), and imagery ($0.69 \leq r \leq 0.79$). This suggests that age groups agreed considerably on the rank order, especially for the valence dimension. In a second step, we compared associations between dimensions. Valence and arousal showed a strong negative overall correlation ($r = −0.80$, $p < 0.01$). Consistent with our hypothesis, the valence-arousal association increased with participants' age from young ($r = −0.63$, $p < 0.01$) to middle adulthood ($r = −0.78$, $p < 0.01$) and to old age ($r = −0.85$, $p < 0.01$). All pair-wise comparisons between age groups were significant, all $Z > 4.29$, $p < 0.01$. Fig. 1 depicts scatterplots between valence and arousal ratings for young, middle-aged, and older adults. A visual inspection of Fig. 1 suggests that valence and arousal ratings were used more independently in young adults than in older adults. For older adults, valence and arousal ratings formed practically one line.

Imagery was only weakly associated with valence ($r = 0.09$, $p < 05$) and arousal ($r = 0.02$). These associations varied, however, by age group. Imagery was slightly negatively correlated with valence in young adults ($r = −0.09$, $p < 0.05$) but positively in middle−aged ($r = 0.19$, $p < 0.01$) and older adults ($r = 0.18$, $p < 0.01$). The imagery-valence comparison between young and middle-aged adults, $Z = 5.55$, $p < 0.01$, and between young and older adults, $Z = 5.76$, $p < 0.01$, were significant. Thus, young adults more easily imagined negative adjectives whereas middle-aged and older adults more easily imagined positive adjectives. Similarly, young adults more easily imagined high-arousing adjectives ($r = 0.19$, $p < 0.01$) and older adults more easily imagined low-arousing adjectives ($r = −0.15$, $p < 0.01$). This age group comparison was significant, $Z = 7.00$, $p < 0.01$. The association between arousal and imagery
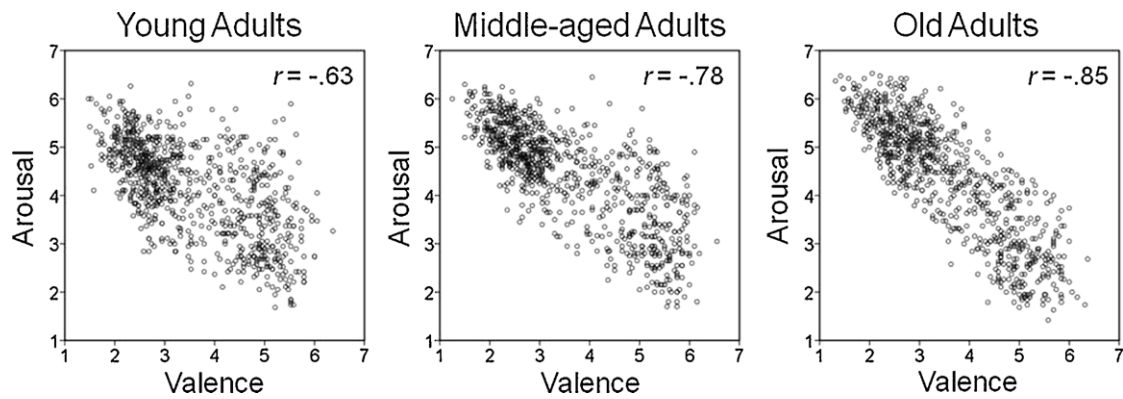
Fig. 1. Scatterplots between valence and arousal for young, middle-aged, and older adults.
Corrélation entre valence et arousal pour les jeunes adultes, les adultes d'âge moyen et les adultes âgés.

Table 3
Correlations between objective and subjective word characteristics.
Corrélations entre les caractéristiques objectives et subjectives des mots.

Dimensions	Valence	Arousal	Imagery
Frequency in films	0.12[**]	−0.14[**]	0.19[**]
Frequency in books	0.09[*]	−0.13[**]	0.20[**]
Length in letters	0.04	0.03	−0.15[**]

[*] $p < 0.05$. [**] $p < 0.01$.

was not significantly different from zero for middle-aged adults ($r = -0.05$).

Regarding objective word characteristics (Table 3), valence was positively correlated with frequency in films ($r = 0.12$, $p < 0.01$) and books ($r = 0.09$, $p < 0.05$) but not with word length in letters ($r = 0.04$). With respect to valence, positive adjectives were used more frequently than negative adjectives. Arousal was negatively associated with frequency in films ($r = -0.14$, $p < 0.001$) and books ($r = -0.13$, $p < 0.01$): high-arousing adjectives were used less frequently than low-arousing adjectives. Arousal was not related to length in letters ($r = 0.03$). As to imagery, ratings were related to frequency in films ($r = 0.19$, $p < 0.01$) and books ($r = 0.20$, $p < 0.01$) and to length in letters ($r = -0.15$, $p < 0.01$). Easily to imagine attributes were more frequent and shorter than difficult to imagine attributes. This pattern of findings was practically the same for all three age groups (all $p > 0.10$).

2.3. Age differences in valence, arousal, and imagery

Table 4 provides mean valence, arousal, and imagery ratings across all 835 adjectives by young, middle-aged, and older adults. For each dimension, we conducted ANOVAs with age as a within-subjects factor (young vs. middle-aged vs. old). These analyses used adjectives as the unit of analysis. The analyses revealed main effects of age for valence, $F(2, 833) = 23.87$, $p < 0.01$, $\eta^2 = 0.05$;

arousal, $F(2, 833) = 190.49$, $p < 0.01$, $\eta^2 = 0.31$; and imagery, $F(2, 833) = 1513.15$, $p < 0.01$, $\eta^2 = 0.78$. Follow-up comparisons between age groups showed that middle-aged adults rated adjectives as more positive than young adults, $F(1, 834) = 28.28$, $p < 0.01$, $\eta^2 = 0.03$, and older adults, $F(1, 834) = 29.92$, $p < 0.01$, $\eta^2 = 0.04$. However, effect sizes were quite small. Young and older adults did not differ in their mean valence ratings, $F(1, 834) = 0.26$, $p = 0.61$, $\eta^2 < 0.01$. Words were rated as less arousing by young adults than by middle-aged, $F(1, 834) = 361.75$, $p < 0.01$, $\eta^2 = 0.30$, and older adults, $F(1, 834) = 107.13$, $p < 0.01$, $\eta^2 = 0.11$. Middle-aged and older adults did not differ in their mean arousal ratings, $F(1, 834) = 2.60$, $p = 0.11$, $\eta^2 < 0.01$. Older adults rated attributes as more easily imaginable than young adults, $F(1, 834) = 2266.76$, $p < 0.01$, $\eta^2 = 0.73$, and middle-aged adults, $F(1, 834) = 2388.36$, $p < 0.01$, $\eta^2 = 0.74$; whereas middle-aged adults rated attributes as more easily imaginable than young adults, $F(1, 834) = 141.35$, $p < 0.01$, $\eta^2 = 0.14$. This age-related shift in imagery ratings is depicted in Fig. 2.

In sum, age groups agreed considerably on the overall mean positivity or negativity of the adjectives. However, older and middle-aged adults rated attributes as more arousing than young adults did. Older adults also rated attributes higher on imagery than young and middle-aged adults.

2.4. Age-related differences in evaluating individual adjectives

We conducted univariate analyses of variance for each word and each rating dimension. Age (young vs. middle-aged vs. old) was treated as a within-words factor. This procedure resulted in a large number of analyses and several significant effects by chance (approximately 5% significant results for an alpha level of $\alpha = 0.05$). The goal of these analyses is to highlight words suitable for age-comparative research; therefore, no adjustments on the alpha level

Table 4
Mean valence, arousal, and imagery ratings for 835 French Adjectives by young (Y), middle-aged (M), and older (O) adults.
Évaluations moyennes de valence, de niveau d'excitation et d'imagerie pour 835 adjectifs par les jeunes adultes, les adultes d'âge moyen et les adultes âgés.

	Means			Standard deviations			Effect sizes
	Y	M	O	Y	M	O	
Valence	3.54[a]	3.61[b]	3.53[a]	1.18	1.30	1.19	0.06[**]
Arousal	4.16[a]	4.43[b]	4.40[b]	0.95	1.02	1.21	0.31[**]
Imagery	4.26[a]	4.49[b]	5.31[c]	0.90	0.77	0.61	0.78[**]

[**] $p < 0.01$.
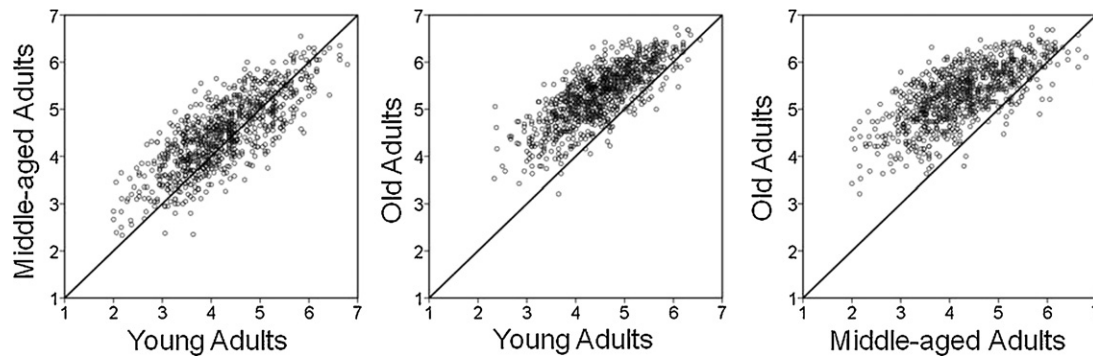[a],[b],[c] Means with different superscripts differed significantly ($p < 0.05$) between age groups.

Fig. 2. Scatterplots for imagery between young, middle-aged, and older adults. The diagonal represents perfect correspondence between age groups (*r* = 1.00).

Corrélations sur les scores d'imagerie entre les jeunes adultes, les adultes d'âge moyen et les adultes âgés. La diagonale indique une correspondance parfaite entre les deux groupes considérés (r = 1,00).

Table 5
Number and percentage of individual words showing significant age differences for valence, arousal, and imagery ratings.
Nombre et pourcentage de mots dont les évaluations de valence, de niveau d'excitation et de valeur d'imagerie diffèrent selon l'âge.

Age comparison	Valence		Arousal		Imagery	
	#	%	#	%	#	%
Overall	61	7.3	187	22.4	280	33.5
Young vs. middle-aged adults	47	5.6	97	11.6	32	3.8
Middle-aged vs. old adults	30	3.6	75	9.0	225	26.9
Young vs. old adults	78	9.3	264	31.6	358	42.9

were done. The FEEL database contains these word-wise analyses as well.[3]

Table 5 presents the number of significant effects between age groups. The word-wise analyses revealed a substantial number of significant age-related differences. Over all three age groups, valence, arousal, and imagery showed age differences for 61 (7.3% of 835 words), 187 (22.4%), and 280 (33.5%) adjectives, respectively. The number of adjectives with significant age differences for valence was only slightly higher than the expected number of effects by chance. Arousal and imagery, in contrast, revealed a substantial number of words with significant age-related differences. This overall pattern was also supported by follow-up comparisons between pairs of age groups. Ratings and pair-wise comparisons for all words and dimensions are available in the online supplement.

3. Discussion

The goal of the present study was to examine age differences in the evaluation of attributes. Specifically, we were interested in whether older adults differed systematically in their evaluations from young adults. To do this, we asked young, middle-aged, and older adults to evaluate 835 adjectives on valence, arousal, and imagery. The corresponding word ratings are provided as the French Emotional Evaluation List (FEEL). The findings suggest that age groups agreed highly on the relative rank order of words but showed significant mean level differences for a substantial number of words, especially for arousal and imagery ratings. In addition, associations between dimensions differed between age groups. Valence and arousal were more highly correlated in older than in younger age groups.

3.1. Association between valence and arousal

Consistent with past research on age differences in emotional evaluations (Grühn and Scheibe, 2008; Grühn and Smith, 2008), we found strong agreement between age groups on the rank order of words within each dimension, especially for valence and arousal ratings. Thus, age groups agreed considerably whether a word was more or less positive or more or less arousing. We also found a strong linear association between valence and arousal ratings in younger, middle-aged, and older adults: The most positively rated words were the lowest arousing ones; the most negatively rated words were the highest arousing ones. This linear association is consistent with findings from emotional words in Belgium college students (Bertels et al., 2009) as well as for emotional pictures in German (Grühn and Scheibe, 2008; Keil and Freund, 2009) and Brazillian samples (Ribeiro et al., 2005). In contrast, this pattern is inconsistent with the classic U-shaped function reported by U.S. college students where high negative and high positive stimuli are associated to high arousal (Bradley and Lang, 1999; Ito et al., 1998; Lang et al., 1997). The different association pattern between valence and arousal may suggest cross-cultural differences in how emotional details are communicated. Further research would benefit from direct cross-cultural comparisons.

The size of the linear association between valence and arousal differed by age group: older adults' ratings showed a stronger linear association than middle-aged and young adults' ratings. This pattern was consistent with the age pattern reported for emotional pictures (Grühn and Scheibe, 2008; Keil and Freund, 2009). In these studies, valence ratings for emotional pictures had a more linear association with arousal for older adults than for younger adults. Grühn and Scheibe (2008) speculated that this pattern of findings could be due to a dedifferentiation of the emotional space with age (see also Labouvie-Vief et al., 2010).

Processes of dedifferentiation have largely been investigated in the cognitive literature. Lifespan developmental psychologists have argued for a process of differentiation-dedifferentiation in the structure of cognitive abilities over the life span (Schaie, 1962; Werner, 1948). From infancy to early adulthood, undifferentiated

---

[3] The French Emotional Evaluation List (FEEL) contains also separate ratings by women and men. In contrast to age differences, the present study did not reveal a major influence of gender on evaluating adjectives. The number of sex-related differences was in the range of differences to be expected by chance, signifying that for the most part men and women agreed on the emotional meaning of the word material.

structures develop into complex and independent structures. In old age, however, increasing restrictions in the efficiency of these structures lead to a growing dependency among them (Baltes and Lindenberger, 1997; Li et al., 2004). Ghisletta and Lindenberger (2003) also suggested that the dedifferentiation of cognitive functions with increasing age is primarily driven by a loss of fluid abilities. In particular, they showed that a decline in crystallized abilities (e.g., vocabulary) is driven by a decline in fluid abilities (e.g. perceptual speed) and not the other way around. In the emotional realm, Labouvie-Vief et al. (Labouvie-Vief, 2008, 2009; Labouvie-Vief et al., 2010; Labouvie-Vief and Marquez, 2004) have argued for a greater interdependence of the emotional and the cognitive system with advancing age. In particular, declines in the cognitive system are thought to restrict the efficiency of emotion regulation, as with declining cognitive resources the processing and regulation of emotional information gets more difficult. For example, Wurm et al. (2004) showed that highly arousing information is more problematic for older adults than for young adults. In a similar fashion, in stressful situations, older adults are much more easily dysregulated than younger adults (Lupien et al., 2007; Sapolsky et al., 1986; Uchino et al., 2005).

The present pattern of findings of a stronger association between valence and arousal with increasing age speaks for a less differentiated emotional space that might be related to declining cognitive functions. Certainly, more research is needed to examine age-related differences and changes in the perception of emotional material. In particular, future research would benefit from investigating an even older sample that may show stronger cognitive limitations and may show stronger associations between cognitive functions and emotion processing. Thus, it might be that the oldest old show an even stronger linear association between valence and arousal than the young old we investigated.

3.2. Age differences in valence, arousal, and imagery

In contrast to our expectations, age differences in valence ratings – how positive or how negative attributes were perceived – were limited to few attributes. This pattern of findings is consistent with previous research on French words (Messina et al., 1989) but contrasts past research that found major differences between age groups in valence ratings for words (Grühn and Smith, 2008) and pictures (Grühn and Scheibe, 2008) in German samples. For arousal, however, the current French sample showed large age differences as well. Taken together these studies suggest that age differences in the perception of emotional material may differ by cultural background. Whereas German samples showed large age differences in valence ratings, French samples showed large age differences particularly in arousal ratings. Unfortunately, we know rather little about cultural differences in the processing of emotional material. Future research is needed to investigate the impact of culture on age differences in the perception of emotional material and more generally on the development of emotional processing.

Older age groups evaluated attributes as more easily imaginable than younger age groups. The finding that ratings for imagery increased with age was surprising. Older adults rated attributes as more easily imaginable than middle-aged adults, and middle-aged adults evaluated attributes as more easily imaginable than young adults. In fact, from the large number of words that showed significant age differences in imagery, there was no single word that was rated higher on imagery by young or middle-aged adults than by older adults.

There are several possible explanations for this effect of imagery: first, the higher imagery values of older adults could reflect a more developed and rich vocabulary in old age. There is indeed consistent empirical evidence that older adults have often developed a richer vocabulary knowledge than young adults

did (Verhaeghen, 2003). Thus, it is possible that it was easier for older adults to imagine these attributes than for younger adults. In addition, it cannot be ruled out that older adults, in contrast to young adults, had more difficulty understanding the instruction for imagery or to differentiate attributes on this dimension because generally, they gave more extreme ratings. Thus, the higher imagery values of older adults could reflect older adults' difficulties in evaluating attributes. Nevertheless, if this finding is robust, it has major implications for aging-oriented memory research with word material. Imagery is typically related to memorability in young adults, that is, easy-to-imagine words are also easy to recall (Rubin and Friendly, 1986). If older adults perceive all words as easy to imagine, imagery loses its predictive power in older adults' word recall. Future research would benefit from examining this relation more carefully. In particular, it would be helpful to combine a rating study with a word recall study in order to examine the impact of age-related differences in imagery ratings.

Imagery was only weakly associated with valence and arousal ratings. This pattern is consistent with past findings showing no significant correlation between imagery and valence in young adults (Vikis-Freibergs, 1976) but in contrast with Bonin et al. (2003) findings. In the present study, however, the pattern differed by age group. Specifically, positive attributes were more easily imaginable by middle-aged and old adults whereas negative attributes were more easily imaginable by young adults. This is consistent with the idea that positive attributes are more salient in late life (Charles and Carstensen, 2007). The association between arousal and imagery also showed differences between age group: from young to old age, the correlation shifted from positive to negative. Thus, young adults perceived high-arousing words as more easily imaginable than low-arousing words whereas older adults perceived low-arousing words as more easily imaginable than high-arousing words. This pattern may be linked to research on emotional memory showing that older adults remember negative and high-arousing material less well than young adults (Charles et al., 2003; Grühn et al., 2007). In this context, age differences in the perception of the emotional material – as revealed in the present study – might be another factor influencing age differences in remembering emotional material.

4. Summary and conclusion

This study aimed to examine age-related differences in valence, arousal and imagery evaluations of French attributes. The findings of the present study generalized and extended the effects reported by previous studies (Grühn and Scheibe, 2008; Grühn and Smith, 2008), and the study provided new evidence that the perception of emotionally toned material is affected by age. In particular, valence and arousal are more negatively correlated in older adults than in middle-aged or younger adults. A surprising but strong age effect in imagery ratings also occurred: old adults rated all attributes as more easily imaginable than middle-aged or young adults.

The study of age differences in perception and evaluation of attributes is particularly important with respect to the attribution and impression formation literature. There is strong empirical evidence for systematic age differences in attribution processes; for example, older adults tend to make more dispositional trait based attributions than younger adults (Blanchard-Fields et al., 1999; Blanchard-Fields and Horhota, 2005). Age-related differences in attribution processes may thus be mediated by age differences in the perception of the material used. Future research is needed to generalize the pattern of the present findings to other settings or cultures.

Few studies are available investigating discrete emotions in young adults' ratings (Briesemeister et al., 2011). Future research would benefit from investigating age-differences and

cross-cultural differences in the perception of emotional stimuli according to discrete emotions. This would provide interesting and useful information for researchers interested in discrete emotions effects on cognitive activities. Nevertheless, this study provides useful data for researchers wishing to select emotional words for aging-oriented research.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.erap.2012.03.003.

References

Bäckman, L., Molander, B., 1986. Adult age differences in the ability to cope with situations of high arousal in a precision sport. Psychology and Aging 1, 133–139.

Baltes, P.B., Lindenberger, U., 1997. Emergence of a powerful connection between sensory and cognitive functions across the adult life span: a new window to the study of cognitive aging? Psychology and Aging 12, 12–21.

Bertels, J., Kolinsky, R., Morais, J., 2009. Norms of emotional valence, arousal, threat value and shock value for 80 spoken French words: comparison between neutral and emotional tones of voice. Psychologica Belgica 49, 19–40.

Blanchard-Fields, F., 1998. The role of emotion in social cognition across the adult life span. Annual review of gerontology and geriatrics 17, 238–265.

Blanchard-Fields, F., Baldi, R., Stein, R., 1999. Age relevance and context effects on attributions across the adult lifespan. International Journal of Behavioral Development 23, 665–683.

Blanchard-Fields, F., Horhota, M., 2005. Age differences in the correspondence bias: when a plausible explanation matters. Journals of Gerontology: Series B: Psychological Sciences and Social Sciences 60B, P259–P267.

Bonin, P., Méot, A., Aubert, L., Malardier, N., Niedenthal, P., Capelle-Toczek, M.C., 2003. Concreteness, imageability, subjective frequency and emotionality ratings for 866 words. Annee Psychologique 103, 655–694.

Bradley, M.M., Lang, P.J. (1999). Affective norms for English words (ANEW): stimuli, instruction manual and affective ratings. Gainesville, FL: Technical report C-1, The Center for Research in Psychophysiology, University of Florida.

Briesemeister, B., Kuchinke, L., Jacobs, A., 2011. Discrete emotion norms for nouns: Berlin affective word list (DENN–BAWL). Behavior Research Methods 43, 441–448.

Cahill, L., McGaugh, J.L., 1995. A novel demonstration of enhanced memory associated with emotional arousal. Consciousness and Cognition 4, 410–421.

Charles, S.T., Carstensen, L.L., 2007. Emotion regulation and aging. In: Gross, J.J. (Ed.), Handbook of Emotion Regulation. Guilford Press, New York, pp. 207–327.

Charles, S.T., Mather, M., Carstensen, L.L., 2003. Aging and emotional memory: the forgettable nature of negative images for older adults. Journal of Experimental Psychology: General 132, 310–324.

Comblain, C., D'Argembeau, A., van der Linden, M., Aldenhoff, L., 2004. The effect of ageing on the recollection of emotional and neutral pictures. Memory 12, 673–684.

Cuthbert, B.N., Bradley, M.M., Zabaldo, D., Martinez, S., Lang, P.J., 1994. Images for all ages: women and emotional reactions. Psychophysiology 31, S37.

Desrochers, A., Bergeron, M., 2000. Subjective frequences and imagery values of a sample of 1,916 nouns in French. Canadian Journal of Experimental Psychology/Revue canadienne de psychologie expérimentale 54, 274–325.

Desrochers, A., Thompson, G.L., 2009. Subjective frequency and imageability ratings for 3,600 French nouns. Behavior Research Methods 41, 546–557.

Dorot, D., Mathey, S., 2010. Visual word recognition in young and older adults: a study of cohort effects for lexical variables. Revue européenne de psychologie appliquée/European Review of Applied Psychology 60, 163–172.

Ferrand, L., Bonin, P., Meot, A., Augustinova, M., New, B., Pallier, C., et al., 2008. Age-of-acquisition and subjective frequency estimates for all generally known monosyllabic French words and their relation with other psycholinguistic variables. Behavior Research Methods 40, 1049–1054.

Flieller, A., Tournois, J., 1996. Imagery value, subjective and objective frequency, date of entry into the language, and degree of polysemy in a sample of 998 French words. International Journal of Psychology 29, 471–509.

Ghisletta, P., Lindenberger, U., 2003. Age-based structural dynamics between perceptual speed and knowledge in the Berlin aging study: direct evidence for ability dedifferentiation in old age. Psychology and Aging 18, 696–713.

Gonthier, I., Desrochers, A., Thompson, G., Landry, D., 2009. Imagery norms and subjective frequency of 1,760 monosyllabic words in the French language. Canadian

Journal of Experimental Psychology/Revue canadienne de psychologie experimentale 63, 139–149.

Gross, J.J., Carstensen, L.L., Pasupathi, M., Tsai, J., Gotestam Skorpen, C., Hsu, A.Y.C., 1997. Emotion and aging: experience, expression, and control. Psychology and Aging 12, 590–599.

Grühn, D., Scheibe, S., 2008. Age-related differences in valence and arousal ratings of pictures from the International Affective Picture System (IAPS): do ratings become more extreme with age? Behavior Research Methods 40, 512–521.

Grühn, D., Scheibe, S., Baltes, P.B., 2007. Reduced negativity effect in older adults' memory for emotional pictures: the heterogeneity-homogeneity list paradigm. Psychology and Aging 22, 644–649.

Grühn, D., Smith, J., 2008. Characteristics for 200 words rated by young and older adults: age-dependent evaluations of German adjectives (AGE). Behavior Research Methods 40, 1088–1097.

Grühn, D., Smith, J., Baltes, P.B., 2005. No aging bias favoring memory for positive material: evidence from a heterogeneity-homogeneity list paradigm using emotionally toned words. Psychology and Aging 20, 579–588.

Grunwald, I.S., Borod, J.C., Obler, L.K., Erhan, H.M., Pick, L.H., Welkowitz, J., et al., 1999. The effects of age and gender on the perception of lexical emotion. Applied Neuropsychology 6, 226–238.

Ito, T., Cacioppo, J.T., Lang, P.J., 1998. Eliciting affect using the international affective picture system: trajectories through evaluative space. Personality and Social Psychology Bulletin 24, 855–879.

Keil, A., Freund, A.M., 2009. Changes in the sensitivity to appetitive and aversive arousal across adulthood. Psychology and Aging 24, 668–680.

Kensinger, E.A., Brierley, B., Medford, N., Growdon, J.H., Corkin, S., 2002. Effects of normal aging and Alzheimer's disease on emotional memory. Emotion 2, 118–134.

Kensinger, E.A., Corkin, S., 2003. Memory enhancement for emotional words: are emotional words more vividly remembered than neutral words? Memory and Cognition 31, 1169–1180.

Kensinger, E.A., Schacter, D.L., 2006. Processing emotional pictures and words: effects of valence and arousal. Cognitive Affective and Behavioral Neuroscience 6, 110–126.

Labouvie-Vief, G., 2008. Dynamic integration theory: emotion, cognition, and equilibrium in later life. In: Bengtson, V., Silverstein, M., Putney, N., Gans, D. (Eds.), Handbook of Theories of Aging. Springer, New York, pp. 277–293.

Labouvie-Vief, G., 2009. Cognition and equilibrium regulation in development and aging. Restorative Neurology and Neuroscience 27, 551–565.

Labouvie-Vief, G., Grühn, D., Studer, J., 2010. Dynamic integration of emotion and cognition: equilibrium regulation in development and aging. In: Lerner, R.M., Lamb, M.E., Freund, A.M. (Eds.), The Handbook of Life-Span Development. Social and Emotional Development, Vol. 2. Wiley, Hoboken, NJ, pp. 79–115.

Labouvie-Vief, G., Marquez, M., 2004. Dynamic integration: affect optimization and differentiation in development. In: Dai, D.Y., Sternberg, R.J. (Eds.), Motivation, Emotion, and Cognition: Integrative Perspectives on Intellectual Functioning and Development. Lawrence Erlbaum Associates Publishers, Mahwah, NJ, pp. 237–272.

Lang, P.J., Bradley, M.M., Cuthbert, B., 1997. International Affective Picture System (IAPS): Technical Manual and Affective Ratings. NIMH Center for the study of emotion and attention, Gainsville, FL.

Lawton, M.P., Kleban, M.H., Rajagopal, D., Dean, J., 1992. Dimensions of affective experience in three age groups. Psychology and Aging 7, 171–184.

Li, S.C., Lindenberger, U., Hommel, B., Aschersleben, G., Prinz, W., Baltes, P.B., 2004. Transformations in the couplings among intellectual abilities and constituent cognitive processes across the life span. Psychological Science 15, 155–163.

Lupien, S.J., Maheu, F., Tu, M., Fiocco, A., Schramek, T.E., 2007. The effects of stress and stress hormones on human cognition: implications for the field of brain and cognition. Brain and cognition 65, 209–237.

Messina, D., Morais, J., Cantraine, F., 1989. Valeur affective de 904 mots de la langue française [Affective connotation of 904 French nouns]. Cahiers de Psychologie Cognitive/European Bulletin of Cognitive Psychology 9 (165), 187.

Mroczek, D.K., Kolarz, C.M., 1998. The effect of age on positive and negative affect: a developmental perspective on happiness. Journal of Personality and Social Psychology 75, 1333–1349.

Murphy, N.A., Isaacowitz, D.M., 2008. Preferences for emotional information in older and younger adults: a meta-analysis of memory and attention tasks. Psychology and Aging 23, 263–286.

New, B., Pallier, C., Ferrand, L., Matos, R., 2001. Une base de données lexicales du français contemporain sur internet : LEXIQUE [A contemporary lexical database for French on the internet: LEXIQUE]. L'année psychologique 101, 447–462.

Niedenthal, P., Auxiette, C., Nugier, A., Dalle, N., Bonin, P., Fayol, M., 2004. A prototype analysis of the French category "emotion". Cognition & Emotion 18, 289–312.

Niedenthal, P., Setterlund, M.B., 1994. Emotion congruence in perception. Personality and Social Psychology Bulletin 20, 401–411.

Ribeiro, R.L., Pompéia, S., Bueno, O.F.A., 2005. Comparison of Brazilian and American norms for the International Affective Picture System (IAPS). Revista Brasileira de Psiquiatria 27, 208–215.

Robert, C., Dorot, D., Mathey, S. (in press). Du Campus au Jardin : estimations de fréquences subjectives auprès d'adultes jeunes et âgés pour 660 mots de la langue française [From Campus to Garden: subjective frequency estimates with young and older adults for 660 French words]. L'année psychologique.

Robert, C., Mathey, S., Postal, V., 2009. Différences liées à l'âge dans la reconnaissance visuelle des mots chez l'adulte. Revue européenne de psychologie appliquée/European Review of Applied Psychology 59, 139–151.

Rubin, D.C., Friendly, M., 1986. Predicting which words get recalled: measures of free recall, availability, goodness, emotionality, and pronunciability for 925 nouns. Memory & Cognition 14, 79–94.

Russell, J.A., 1980. A circumplex model of affect. Journal of Personality and Social Psychology 39, 1161–1178.

Sapolsky, R.M., Krey, L.C., McEwen, B.S., 1986. The neuroendocrinology of stress and aging: the glucocorticoid cascade hypothesis. Endocrine Reviews 7, 284–301.

Schaie, K., 1962. A field-theory approach to age changes in cognitive behavior. Vita Humana Basel 5, 129–141.

Uchino, B.N., Holt-Lunstad, J., Bloor, L.E., Campo, R.A., 2005. Aging and cardiovascular reactivity to stress: longitudinal evidence for changes in stress reactivity. Psychology and Aging 20, 134–143.

Verhaeghen, P., 2003. Aging and vocabulary scores: a meta-analysis. Psychology and Aging 18, 332–339.

Vikis-Freibergs, V., 1976. Abstractness and emotionality values for 398 French words. Canadian Journal of Psychology/Revue canadienne de psychologie 30, 22–30.

Werner, H., 1948. Comparative Psychology of Mental Development. Follett, Oxford, England.

Wurm, L.H., Labouvie-Vief, G., Aycock, J., Rebucal, K.A., Koch, H.E., 2004. Performance in auditory and visual emotional stroop tasks: a comparison of older and younger adults. Psychology and Aging 19, 523–535.