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The adaptation of the Affective Norms for English Words (ANEW) for European Portuguese

Ana Paula Soares · Montserrat Comesaña · Ana P. Pinheiro · Alberto Simões · Carla Sofia Frade

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Abstract This study presents the adaptation of the Affective Norms for English Words (ANEW; Bradley & Lang, 1999a) for European Portuguese (EP). The EP adaptation of the ANEW was based on the affective ratings made by 958 college students who were EP native speakers. Subjects assessed about 60 words by considering the affective dimensions of valence, arousal, and dominance, using the Self-Assessment Manikin (SAM) in either a paper-and-pencil or a Web survey procedure. Results of the adaptation of the ANEW for EP are presented. Furthermore, the differences between EP, American (Bradley & Lang, 1999a), and Spanish (Redondo, Fraga, Padrón, & Comesaña, *Behavior Research Methods*, *39*, 600–605, 2007) standardizations were explored. Results showed that the ANEW words were understood in a similar way by EP, American, and Spanish subjects, although some sex and cross-cultural differences were observed. The EP adaptation of the ANEW is shown to be a valid and useful tool that will allow researchers to control and/or manipulate the affective properties of stimuli, as well as to develop cross-linguistic studies. The normative values of EP adaptation of the ANEW can be downloaded at http://brm.psychonomic-journals.org/content/supplemental.

Keywords ANEW · Affective norms · European Portuguese adaptation

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A. P. Soares · M. Comesaña · C. S. Frade
Human Cognition Lab, CIPsi, University of Minho,
Braga, Portugal

A. P. Pinheiro
Neuropsychophysiology Lab, CIPsi, University of Minho,
Braga, Portugal

A. Simões
Computer Science and Technology Center, University of Minho,
Braga, Portugal

A. P. Soares (✉)
Department of Basic Psychology, School of Psychology,
University of Minho,
Campus de Gualtar,
4710-057 Braga, Portugal
e-mail: asoares@psi.uminho.pt

Introduction

Emotion has a pervasive influence on human cognition. In the last decades, a considerable amount of research has focused on assessing how the processing of emotional evocative stimuli (words, pictures, sounds, odors, and film clips) differs from that of neutral stimuli at the behavioral and brain levels. The increasing interest in this research area has revitalized the emotion–cognition debate in unprecedented ways, allowing this line of research to gain strength and autonomy within the international literature.

However, despite the growing interest in emotion research, the definition and operationalization of *emotion* is still controversial (see, e.g., Mauss & Robinson, 2009, or Scherer, 2005, for a review). In fact, although most researchers agree that emotions are dispositions for action elicited by stimuli perceived as significant by the organism, they disagree about which components are considered intrinsic to emotion (e.g., cognitions, behavioral responses, or neurophysiological processes) and how these different components interact with each other during emotional experience (e.g., do neurophysiological processes precede or follow cognitive processes?; see Moors, 2009, for a review). For example, discrete emotion theories state that emotions are better conceptualized as a set of discrete sensory–motor programs, with each of these programs

consisting of a coherent brain circuit that elicits and links together cognitions and somatic responses into a single neural system (e.g., Ekman, 1992; LeDoux, 1996; Öhman & Wiens, 2004). In turn, dimensional theories argue that, rather than consisting of discrete motor programs, emotions are simply cognitive labels that we apply to physiological activation, characterized by few basic dimensions (e.g., valence and arousal), and suggest that it is the assessment of each of these dimensions that underlies emotional responses (e.g., Bradley & Lang, 2000; Russell, 2003).

This dimensional perspective, dominant in current accounts of emotion, has its historical roots in Wundt's (1896) work. However, it is the work developed by Osgood, Suci, and Tannenbaum (1957) that has consolidated this perspective and allowed its measurement. Using the semantic differential method, Osgood et al. performed factorial analyses over a large number of verbal judgments of a wide variety of stimuli (paintings, words, sounds) and observed that most of the variance of subjects' responses could be explained by two major affective dimensions: *valence*, which represents the way a subject judges a situation, from unpleasant to pleasant, and *arousal*, which expresses the degree of excitement or activation a subject can feel toward a given stimulus, varying from calm to exciting. They have also identified a third dimension, which is called *dominance* and reflects the degree of control a subject feels over a specific stimulus, varying from *in control* to *out of control*.

Following this original work, Bradley and Lang (1994) developed a nonverbal pictographic self-report measure, the Self-Assessment Manikin (SAM; see Fig. 1), to assess the valence, arousal, and dominance dimensions. As was pointed out by Mauss and Robinson (2009), even though not all individuals may be aware of and/or capable of reporting their momentary emotional states, the self-report of emotion seems to be a reliable measure for assessing emotions, correlating strongly with different peripheral physiological measures such as skin conductance responses (e.g., Bradley & Lang, 2000; Codispoti, Ferrari, & Bradley, 2006), startle response (e.g., Bradley, Cuthbert, & Lang, 1999; Bradley, Miccoli, Escrig, & Lang, 2008), and, although less consistently, the heart rate response (e.g., Bradley & Lang, 2000).

On the basis of this pictographic measure, Lang and colleagues developed different sets of emotional stimuli that are internationally available and that provide normative ratings of valence, arousal, and dominance for words (the Affective Norms for English Words [ANEW]; Bradley & Lang, 1999a), pictures (the International Affective Picture System [IAPS]; Lang, Bradley, & Cuthbert, 1999), and sounds (the International Affective Digitized Sounds [IADS]; Bradley & Lang, 1999b). In the present, these data sets represent fundamental tools for research on the neural correlates of emotional processing (e.g., Anders, Eippert, Weiskpf, & Veit, 2008; Junghöfer, Schupp, Stark, & Vaitl, 2005; Kensinger & Schacter, 2006; Lewis, Critchley, Rotshtein, & Dolan, 2007), as well as for the development of studies that aim at exploring the influence of emotion in cognitive processes such as attention (e.g., Fox, Griggs, & Mouchlianitis, 2007; Schimmack, 2005; Schupp et al., 2007), memory (e.g., Bradley, Greenwald, Petry, & Lang, 1992; Mickley & Kensinger, 2008), and language (e.g., Scott, O'Donnell, Leuthold, & Sereno, 2009; Zhang, Lawson, Guo, & Jiang, 2006).

Even though most of the studies on affective processing have used pictures, rather than words and sounds, as

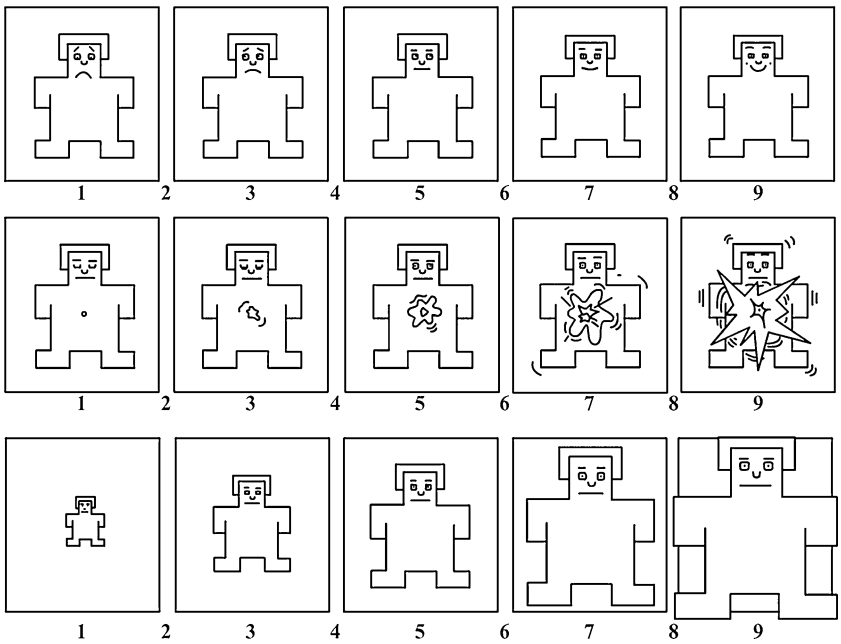

Fig. 1 Self-assessment manikin (SAM)

experimental stimuli, words have been selected as stimuli of choice by an increasing number of researchers. In fact, words provide greater experimental control of stimulus characteristics that may affect cognitive processing, such as frequency, imagery, concreteness, familiarity, and age of acquisition (available in several lexical databases). In addition, the use of words avoids some confounding properties of pictures, such as complexity, brightness, color, and contrast (e.g., Forsythe, Mulhern, & Sawey, 2008). Moreover, using words allows researchers to overcome other constraints, such as the difficulty associated with the graphic representation of some abstract emotional concepts, such as *beauty*, *truth*, *disgust*, or *unhappiness*. Hence, due to these experimental advantages and to their lower visual complexity, words are exceptional stimuli for the investigation of the neural correlates of emotion and the effects of emotion on cognitive functioning.

Despite the fact that emotional properties of verbal stimuli (especially arousal) seem to be less pronounced when compared with pictorial stimuli (e.g., Carretié et al., 2008; Gibbons, 2009; Kensinger & Schacter, 2006), there is evidence for emotional effects in word processing as well. Emotional words seem to more readily attract attention and cause more interference during ongoing tasks, as compared with neutral ones (e.g., Anderson, 2005; Dresler, Mériau, Heekeren, & van der Meer, 2009; Pratto & John, 1991). However, they are more easily remembered and recognized in both immediate (e.g., Hadley & MacKay, 2006; Monnier & Syssau, 2008) and delayed (e.g., Doerksen & Shimamura, 2001; Ferré, 2003) memory tests. Moreover, distinct psycholinguistic tasks, such as lexical decision (e.g., Carretié et al., 2008; Hofmann, Kuchinke, Tamm, Võ, & Jacobs, 2009; Wentura, 2000), pronunciation (e.g., de Houwer & Randell, 2004; Spruyt, Hermans, de Houwer, Vandromme, & Eelen, 2007), and evaluative categorization (e.g., de Houwer, Hermans, Rothermund, & Wentura, 2002; Gibbons, 2009; Hermans, de Houwer, & Eelen, 2001; Spruyt et al., 2007; Wentura & Degner, 2010), have shown that positive and negative words elicit lower reaction times and higher accuracy rates than do neutral words. Emotional words have also been shown to induce affective priming in both masked (e.g., Gibbons, 2009; Wentura & Degner, 2010) and unmasked (e.g., Hermans et al., 2001; Spruyt et al., 2007) designs.

In neuropsychological research, event-related potential (ERP) studies have shown distinct patterns of activation for emotional words, relative to neutral ones. As compared with neutral words, emotional words tend to elicit enhanced amplitudes not only in early stages of processing—including the early posterior negativity component (e.g., Herbert, Junghöfer, & Kissler, 2008; Kissler, Herbert, Winkler, & Junghöfer, 2009; Scott et al., 2009) and the P300 component (e.g., Liu, Jin, Wang, & Hu, 2010; Scott et al., 2009) —but also in later potentials, such as the N400 component (e.g., Herbert et al., 2008; Zhang et al., 2006) and the late positive component (LPC; see, e.g., Carretié et al., 2008; Gibbons, 2009; Herbert et al., 2008; Kissler et al., 2009; Liu et al., 2010). Additionally, functional magnetic resonance imaging studies have revealed that emotional words enhance activity in the amygdala (e.g., Kensinger & Schacter, 2006; Lewis et al., 2007) and in the prefrontal cortex (e.g., Kensinger & Schacter, 2006; Lewis et al., 2007; Posner et al., 2009), when compared with neutral words. Therefore, neuroscience studies have contributed to a better understanding of the neural correlates of affect processing, providing evidence that supports the existence of different mechanisms underlying the processing of emotional words.

Considering the increased interest in the study of emotional processing, as well as the advantages associated with the use of words in terms of experimental manipulation/control, this article presents a study aimed at adapting the Affective Norms for English Words (ANEW; Bradley & Lang, 1999a) to European Portuguese (EP). On the basis of a tridimensional perspective on emotions (see, e.g., Bradley & Lang, 2000), this word set, which has been used in several recent studies, provides affective norms for valence (which ranges from *pleasant* to *unpleasant*), arousal (which ranges from *calm* to *excited*), and dominance (ranging from *in control* to *out of control*) for 1,034 words (including verbs, nouns, and adjectives) (see, e.g., Kensinger & Schacter, 2006; Lewis et al., 2007; Mickley & Kensinger, 2008; Scott et al., 2009; Zhang et al., 2006).

The assessment of each word in each of these three affective dimensions by using the SAM scale is particularly relevant since recent studies have suggested that affective representations of words' intensity (arousal) and their affective content (valence) may rely on distinct cognitive, temporal, and spatial neural substrates (e.g., Dresler et al., 2009; Hinojosa, Carretié, Méndez-Bértolo, Míguez, & Pozo, 2009; Kensinger & Schacter, 2006; Lewis et al., 2007; Mickley & Kensinger, 2008). In particular, valence seems to affect early stages of affective processing (e.g., Kissler et al. 2009; Scott et al., 2009; see, however, Hofmann et al., 2009, for early effects of arousal) and to activate neural circuits that are distinct from those associated with arousal: For example, the prefrontal cortex tends to respond to emotional stimuli mainly in a valence-based manner, whereas the amygdala tends to respond in a arousal-based manner (e.g., Kensinger & Schacter, 2006; Lewis et al., 2007; Posner et al., 2009). Therefore, the lack of simultaneous control of these two affective variables can lead to confounding effects in neurocognitive research.

For example, in the emotional Stroop task (in which subjects are asked to name the color of both emotional and control words, while ignoring their semantic meaning), Pratto and John (1991) found that color latencies were

longer for negative than for positive words. This finding has been interpreted as an allocation of additional attentional resources for negative stimuli processing, since they have greater significance for the individual (*negativity bias*). However, as Schimmack (2005) pointed out, it is unclear whether valence or arousal of the emotional stimuli explains that effect, since negative words tend to show higher levels of arousal when compared with positive words. Indeed, a recent study by Dresler et al. (2009), using positive and negative words matched for arousal, showed that, irrespective of valence, emotional words elicited emotional interference (i.e., both highly positive and negative arousing words produced longer response latencies, relative to neutral words).

Moreover, recent studies on affective priming have shown that arousal and valence have differential effects on word processing. Although most studies have focused on valence (showing that there is a facilitated processing when both primes and targets are pleasant or unpleasant—the so called *affective priming effect*), the words' degree of arousal also seems to play an important role. In an ERP study aiming at analyzing the contributions of arousal to affective priming, Hinojosa et al. (2009) found that the processing of positive, high-arousal targets was facilitated by a previous exposure to a congruent prime (i.e., a positive, high-arousal prime), as reflected by a reduction in the amplitude of the LPC. The modulation of the amplitude of the LPC by arousing congruent stimuli was interpreted as an index of a new emotional effect called the *arousal priming effect*.

As was shown earlier, the simultaneous control of valence and arousal seems critical for current research, and the ANEW data set stands out as a valuable resource for that purpose. Another advantage is that it provides words' affective norms for males and females separately. This is particularly important since previous studies have shown that males and females may respond to emotional stimuli in different ways. Relative to males, females have been shown to rate unpleasant stimuli as significantly more arousing and more unpleasant, demonstrating larger changes in the corrugators' electromyographic activity, greater fear bradycardia (sustained cardiac deceleration in the context of aversive stimuli), and larger skin conductance response changes in response to unpleasant than to pleasant and neutral stimuli (Bradley, Codispoti, Sabatinelli, & Lang, 2001a, b). Moreover, imaging studies have provided evidence for increased defensive activation in females, as suggested by greater activation in the right hemisphere in response to unpleasant stimuli, as compared with males (e.g., Lang et al., 1998).

It is also worth noting that in addition to the original American version (Bradley & Lang, 1999a), the ANEW was already adapted to other languages (Spanish: Redondo, Fraga, Padrón, & Comesaña, 2007) and that, beyond this three-dimensional assessment, a categorical assessment of the ANEW words along five discrete categories (happiness, sadness, fear, disgust, and anger) is also available, which corresponds to the basic universal emotions (see Stevenson, Mikels, & James, 2007). Hence, the adaptation of this data set for EP will constitute an important resource for promoting cognitive and psychophysiological research in the domain of emotional processing in Portugal. In particular, it will allow researchers to control and/or manipulate the affective properties of words to be used in different experimental research paradigms and also to develop cross-linguistic studies matching words in the same affective dimensions in the languages for which this data set is already available (American, Spanish, and now EP). Even though high cross-linguistic correlations between words' affective ratings have been found in different languages (see Eilola & Havelka, 2010; Redondo et al., 2007; Whissell, 2008), the geographic and cultural similarities between Portugal and Spain led us to hypothesize a greater similarity in the findings between EP and Spanish than between EP and American English ANEW standardizations.

Method

Subjects

A total of 958 undergraduate and graduate students (325 male and 633 female; M = 22.82 years, SD = 5.41) from different disciplines (humanities, economics, sciences, and technologies) in several public and private universities from the north to the south of Portugal participated in the study.[1] All the subjects were native EP speakers and were selected from all Portugal districts, including Madeira and Azores islands.[2] The majority were right-handed (92.1%) and had normal (54.6%) or corrected-to-normal visual acuity (45.4%).

Materials and procedure

The words included in the data set were based on the EP translation of the 1,034 words used in the original ANEW (Bradley & Lang, 1999a). This translation was done by two professional philologists specialized in English language and with a deep knowledge of the American culture. During

[1] University of Minho, University of Beira Interior, University of Porto, University of Aveiro, University of Coimbra, University of Lisboa, University of Évora, University of Algarve; University of Madeira, University Lusófona, University Fernando Pessoa, University Aberta, University Católica Portuguesa, Porto Polytechnic Institute and Viseu Polytechnic Institute.

[2] Viana do Castelo, Braga, Vila Real, Bragança, Porto, Aveiro, Viseu, Guarda, Coimbra, Leiria, Castelo Branco, Santarém, Portalegre, Lisboa, Setúbal, Évora, Beja e Faro.

translation of the words, an interjudge agreement was obtained for 90% of the words. For the 106 words for which there was not agreement, resolution was obtained through consensus between the two judges and the psycholinguistic researcher responsible for the adaptation of ANEW for EP. It is worth noting that during words' translation, the original English word was considered as well as its translation to Spanish (Redondo et al., 2007). Therefore, when a word was difficult to translate (due to word's polysemy or syntactic ambiguity or to the lack of lexical parallelism between the languages-i.e., when a word in a given language could be translated into several others in the other language or vice versa), we often decided to use a translation of the English word that was similar to the translation of the same word to the Spanish language. For example, the words *assassin* and *murder* are translated into the same word (*assassino*) in EP, as in Spanish. Therefore, since in the Spanish version, the word *murder* was translated into the word *assassino* and the word "assassin" was translated into *assassinar*, this option was kept in EP, to ensure the comparability of ANEW's words across languages. Once the 1,034 words had been translated, two procedures of data collection were developed in order to increase the efficiency of the process: a traditional paper-and-pencil procedure and a Web procedure (online survey).

Web survey procedure: Online or Web surveys have been increasingly used in current psychological research due to their advantages, such as speed, accuracy, and low cost (see Couper, 2000, for a review). Particularly within an HTML format, they allow an easy access to a larger number of subjects. Therefore, acknowledging these advantages, we developed a Web-based application using standard technologies (i.e., a computer gateway interface that used cookies to identify sessions and server-side sessions to store user data), following the recommendations of Burke and James (2006)-namely, (1) making explicit the purposes of the research and emphasizing the importance of users' collaboration; (2) identifying the survey and the research team by providing e-mail contacts so that users could request more details about the research and/or a copy of the findings; (3) including clear filling instructions and an estimate of time to complete the survey; and (4) informing about privacy policy and data confidentiality.

An invitation with a hyperlink to an online questionnaire was sent via e-mail to the addresses of students who were attending different courses at Portuguese universities. It is worth noting that this procedure was previously authorized by the administration of each institution. In addition, in-person contacts were made with teachers of different institutions in order to ask them to encourage the participation of their students in the study. After a first e-mail inviting the students to participate in the research study, two reminders were sent: The first was sent approximately 1 month after the first e-mail, and the other one was sent 6 months after the first notification. Seven hundred sixty students (291 male and 469 female; M = 23.06 years, SD = 5.43) answered the request (8% were excluded because they did not complete the entire survey and/or did not indicate that EP was their native language).

After each user accessed the online survey (via the URL link) and completed the registration data, a set of 60 words was drawn randomly from the full set of words (1,034). Then the user was asked to classify each word (one at a time) in each affective dimension, using the SAM. In the SAM measurement scale (see Fig. 1), each affective dimension is represented by five figures, and subjects have to use a 9-point scale to assess their affective response to an emotion-evocative word.

During the assessment procedure, each word was presented at the center of the screen until the subjects' response. Before words' presentation, subjects were instructed to rate each word in the three affective dimensions, as in Bradley and Lang's (1999a) original procedure. It is worth noting that an additional instruction was added to the original procedure: Subjects were instructed to use a specific response key if they did not know the meaning of a particular word. This aimed at increasing the validity of results, avoiding subjects' random responses. As soon as the subjects rated a given word, the following word was presented on the screen, and the previous rating was automatically stored. All procedures took about 20 min to be completed.

Paper-and-pencil procedure: In addition to the Web survey procedure, a paper-and-pencil procedure was developed. In this case, assessments were done collectively in a classroom in each of the courses that participated in the study. This procedure included 198 graduate and undergraduate students (34 male and 164 female; M = 21.92 years, SD = 5.26) of the total sample (6% were eliminated because they did not complete the entire survey and/or did not specify EP as their native language). Similarly to the online procedure, subjects rated about 60 words in the abovementioned affective dimensions using the SAM system. However, different from the Web procedure, 17 random lists were created from the total 1,034 words (with 60 words each).

In each experimental session and before data collection, the aim of the study was presented to the students, and the volunteer nature of their participation, as well as the results' confidentiality, were emphasized. Subsequently, the affective assessment task was explained, by describing the use of the SAM scale, as in the original study of Bradley and Lang (1999a). Similarly to the Web procedure, we added the instruction that subjects could mark a specific response whenever they did not know the meaning of any of the

presented words. Finally, one of the 17 lists was distributed to each subject. In the booklet, subjects also provided socio-demographic information (e.g., sex, age, course, place of birth) and answered questions about their language history (e.g., native language, second languages learned). No time limit was defined, but the subjects were encouraged to answer as quickly as possible. The entire process took about 20 min. Each word in the data set was rated by at least 25 subjects (M = 50, range = 25–81).

Results and discussion

The affective norms of valence, arousal, and dominance of the 1,034 Portuguese words that constitute the adaptation of the ANEW (Bradley & Lang, 1999a) for EP language can be downloaded as a supplemental archive from http://brm.psychonomic-journals.org/content/supplemental. The supplemental archive shows the mean values (*M*s) and standard deviations (*SD*s) for valence (*Val*), arousal (*Aro*), and dominance (*Dom*) for each of the 1,034 words of the adaptation of the ANEW to EP, considering the total sample (*All*), as well as female (*Fem*) and male (*Mal*) samples separately. Words are organized by considering their original number (*Number*) in the ANEW data set (Bradley & Lang, 1999a). After its number, the original English word is presented (*E-word*), followed by the EP word (*EP-word*). Similarly to the American (Bradley & Lang, 1999a) data set, values of word frequency (*Freq*) are shown after the presentation of means and standard deviations for each word in each affective dimension, both in the total sample and in the subsamples of females and males separately. These values were computed with the P-PAL Web application (Soares et al., 2010) on the basis of the CORLEX EP corpus (Bacelar do Nascimento, Casteleiro, Marques, Barreto, & Amaro, 2000). As in the Spanish adaptation of the ANEW (Redondo et al., 2007), four additional objective psycholinguistic indexes are included: number of letters (*Nlett*); number of orthographic syllables (*Nsyll*), grammatical class (*GClass*: noun [N], adjective [Adj], adverb [Adv], verb [V], or interjection [I]), and number of orthographic neighbors (*Neigh*: defined as the number of words that differ on a single segment by substitution, deletion, or addition) based on the PORLEX database (Gomes & Castro, 2003) and P-PAL Web application (Soares et al., 2010).

It is worth noting that, as a preliminary step, before the computation of the normative values of the ANEW data set for EP, we compared the mean values obtained through the online (Web survey) and the paper-and-pencil procedures, in order to estimate whether the ratings of the 1,034 EP words on the three affective dimensions differed by test format. Because of the different sample size for each procedure (paper-and-pencil = 198 vs. online survey = 760), we decided to select a random subsample of subjects from the online procedure's sample with the same size and characteristics of the paper-and-pencil procedure's sample (N = 198: 34 males and 164 females). The independent t-tests conducted showed no statistically significant differences between the paper-and-pencil and online procedures in each of the three affective dimensions [valence, $t(2066) = 1.32$, $p = .187$; arousal, $t(2066) = 1.41$, $p = .159$; and dominance, $t(2066) = -1.22$, $p = .22$]. This finding justified our decision to combine both data sets into one for data analysis.

First, we present and discuss the descriptive results obtained in the adaptation of the ANEW data set for EP, considering the three emotional dimensions (valence, arousal, and dominance) and exploring, as in other studies (e.g., Bradley et al., 2001a, 2001b; Eilola & Havelka, 2010; Redondo et al., 2007; Võ et al. 2009; Whissell, 2008), the relationship between the valence and arousal dimensions in the bidimensional affective space, as well as sex differences in distribution of those results. Second, with the aim of exploring intercultural differences, we present and discuss the results on the basis of a comparison of ratings obtained in the Portuguese adaptation of the ANEW with the ratings obtained in the original American English standardization (Bradley & Lang, 1999a) and in the Spanish adaptation (Redondo et al., 2007). The statistical package IBM SPSS 19 was used for the conduction of these analyses.

The ANEW adaptation for the EP

Figure 2 shows the distribution of the 1,034 EP word ratings (mean values) in the bidimensional affective space of valence×arousal for both males and females.

This distribution fits the typical boomerang shape previously found by Bradley and Lang (1999a) and by Redondo et al. (2007) in the Spanish adaptation of the ANEW. As in the American (Bradley & Lang, 1999a) and in the Spanish (Redondo et al., 2007) standardizations, this boomerang-shaped distribution shows that the words rated as either highly pleasant or highly unpleasant were also rated as more arousing. This is shown by both positive pairwise linear correlations between valence and arousal for pleasant words (i.e., words with valence ratings above 5, the midpoint of the 9 point-scale used; $M = 6.41$, $SD = .90$, range = 5.00–8.46), $r = .27$, $p < .001$ and the distinct negative correlation between valence and arousal for unpleasant words (i.e., words with ratings below 5 points; $M = 3.22$, $SD = .87$, range = 1.34–4.98), $r = -0.58$, $p < .001$. This negativity bias for unpleasant stimuli and positivity offset for pleasant words (Cacioppo, Gardner, & Berntson, 1997) was captured, in the EP adaptation as in the American (Bradley & Lang, 1999a)

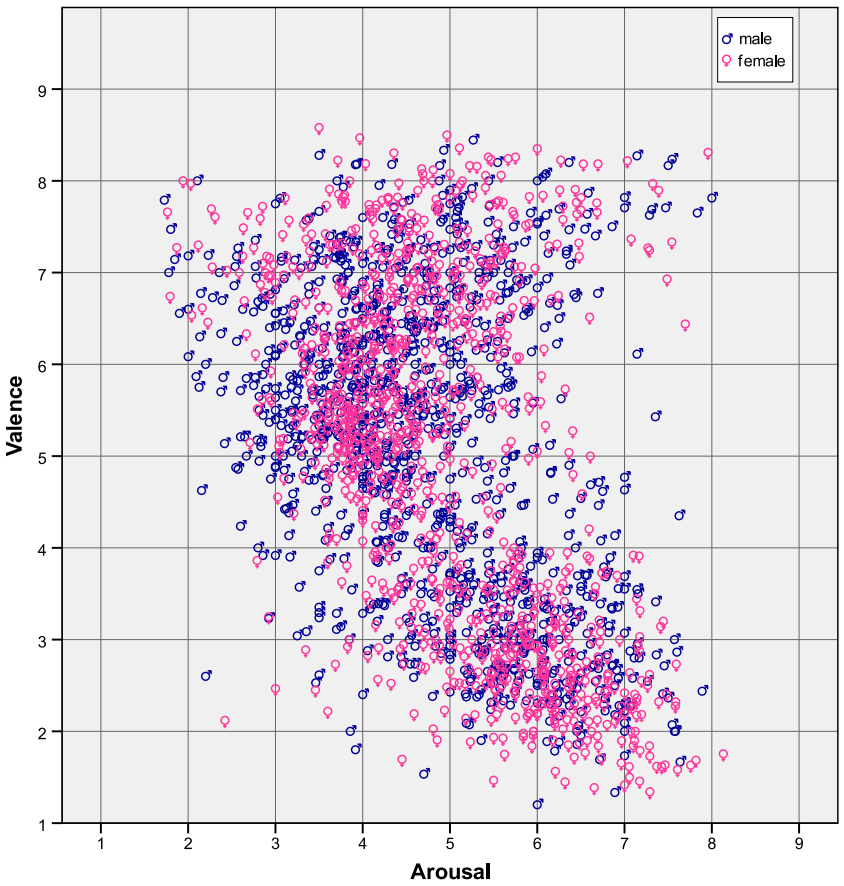

Fig. 2 Distribution of means values (male and female) for the 1,034 words of the European Portuguese adaptation of the ANEW in the valence and arousal affective dimensions

and the Spanish (Redondo et al., 2007) standardizations, by the significant quadratic relationship between valence and arousal, $R = .62$, $p < .001$, that explains 39% of the variance (valence was considered as an independent factor and arousal as a dependent factor in the regression analysis conducted).

Nevertheless, it is important to note that the negative association between valence and arousal for unpleasant words is stronger than the positive association between valence and arousal for pleasant words. Indeed, as can be seen in Fig. 2, most of the pleasant words (which are located in the upper half of the chart) were distributed along the arousal dimension ($M = 4.38$, $SD = .96$, range = 1.79–7.65), which seems to indicate that for this group of words, valence is independent of arousal. However, the ratings for the unpleasant words (which are located in the lower half of the chart) were more concentrated in the right inferior quadrant of the chart ($M = 5.53$; $SD = 1.02$, range = 2.34–7.77). This situation showed that in the ANEW adaptation for EP, it is easier to find pleasant than unpleasant words with lower scores of arousal, $t(1032) = 18.58$, $p < .001$. Indeed, if we assume, as for valence, 5 as the cutoff value in the classification of arousing (above 5) and not arousing (below 5) words, it is possible to observe that in the adaptation of the ANEW for the EP, there is not only a higher number of words classified as pleasant than unpleasant (579 vs. 455, respectively), but also, for the unpleasant ones, a higher number of words classified as high- (319) than low-arousing (136), $\chi^2(1) = 210.88$, $p < .001$. For the pleasant words, we observed the opposite pattern-that is, more words were assessed as low-arousing (435) than as high-arousing (144). This finding, which has been observed in other data sets of affective words (e.g., Võ et al., 2009), may hinder research using pleasant or unpleasant words when the manipulation of level of arousal is intended.

Nonetheless, it is worth noting that besides this asymmetry, the dispersion of results observed for both valence (range = 1.34–8.46) and arousal (range = 1.79–7.77) dimensions will allow EP researchers to control and/or manipulate the affective properties of words that fit their research interests.

Table 1 presents means, standard deviations and the range values (minimum and maximum) for each of the affective dimensions of valence, arousal, and dominance, for females and males separately.

To investigate sex differences in EP ratings of valence, arousal, and dominance for pleasant and unpleasant words (classified on the basis of the ratings of the global sample), a multivariate analysis of variance (MANOVA) was con-

Table 1 Means (*M*s), standard deviations (*SD*s), and range values (minimum–maximum) of the 1,034 words ratings of the European Portuguese adaptation of the ANEW for females and males in three affective dimensions

Affective Dimensions	Females			Males		
	M	*SD*	Range	*M*	*SD*	Range
Valence	4.98	1.91	1.34–8.58	5.07	1.69	1.20–8.44
Arousal	4.94	1.19	1.76–8.13	4.77	1.24	1.73–8.00
Dominance	4.96	0.95	2.00–7.70	4.97	1.04	1.57–8.17

ducted with sex (females vs. males) and words' valence (unpleasant vs. pleasant) as between-subjects factors and the three affective dimensions of valence, arousal, and dominance as dependent variables. The MANOVA analysis showed a main effect of sex in assessments of arousal, $F(1, 2064) = 11.76$, $p < .001$, and a marginally significant effect in assessments of valence, $F(1, 2064) = 3.50$, $p = .062$. Also, it showed a main effect of words' valence in the affective dimensions of valence, $F(1, 2064) = 6{,}216.03$, $p < .001$, arousal, $F(1, 2064) = 502.99$, $p < .001$, and dominance, $F(1, 2064) = 1{,}542.66$, $p < .001$. A significant sex × words' valence interaction for the valence dimension, $F(1, 2064) = 27.18$, $p < .001$, was also observed.

Therefore, contrary to the original American version (Bradley & Lang, 1999a), in which statistically significant differences were observed only for the dominance dimension,[3] and contrary to the Spanish standardization, in which sex differences did not reach statistical significance (see Redondo et al., 2007), Portuguese females rated words as significantly more arousing than did males ($p < .001$), and Portuguese males tended to rate the words as more positive than did females ($p = .062$). Even though the effect of sex on valence was only marginally significant, the sex × words' valence interaction observed for this affective dimension revealed an interesting pattern of results. On the one hand, Portuguese males rated unpleasant words as significantly more positive than did Portuguese females ($p < .001$), and on the other hand, Portuguese females rated pleasant words as significantly more positive than did Portuguese males ($p < .05$).

Therefore, and consistent with previous studies (e.g., Bradley et al., 2001a, 2001b; Lang et al., 1998), these findings suggest that Portuguese females reveal higher levels of reactivity toward emotional stimuli than do Portuguese males, rating the words of the EP adaptation of the ANEW not only as more arousing, but also with more extreme values of the valence scale-that is, rating unpleasant words as more negative and pleasant words as more positive. For example, females rated the pleasant word *casa* [*house*] ($M_{females} = 3.85$, $SD_{females} = 2.71$; $M_{males} = 1.90$, $SD_{males} = 1.45$) and the unpleasant word *trauma* [*trauma*] ($M_{females} = 7.14$, $SD_{females} = 1.81$; $M_{males} = 5.50$, $SD_{males} = 2.31$) as significantly more arousing than did males, $t(35) = 0.15$, $p < .05$, and $t(41) = 2.54$, $p < .05$, respectively, whereas males rated the unpleasant word *trauma* [*trauma*] as more positive ($M_{females} = 2.18$, $SD_{females} = 1.36$; $M_{males} = 3.12$, $SD_{males} = 1.88$), $t(57) = -2.25$, $p < .05$, and the pleasant word *casa* [*home*] as more negative ($M_{females} = 8.00$, $SD_{females} = 1.12$; $M_{males} = 6.56$, $SD_{males} = 1.65$) than did females, $t(44) = 3.54$, $p < .001$. As a consequence, the sex differences observed for valence and arousal affective dimensions in the adaptation of the ANEW for EP constitute a significant source of between-subjects variation and should be considered during the experimental selection of word stimuli for conducting research on affective processing.

Finally, the main effect of words' valence on the affective dimension of valence showed, as was expected, that pleasant words were assessed more positively than unpleasant words ($p < .001$). Also, in line with the abovementioned findings, unpleasant words were assessed as significantly more arousing than pleasant words ($p < .001$) and, additionally, with significantly lower dominance ratings ($p < .001$). These findings confirm, in the adaptation of the ANEW for EP, the previously reported asymmetry between valence and arousal for pleasant and unpleasant words (i.e., stronger associations for negative stimuli; see Cacioppo et al., 1997; Võ et al., 2009). However, the interpretation of results regarding the affective dimension of dominance should be made with caution. Even though we consider that, in general, negative stimuli may elicit subjective feelings of lower control (see LeDoux, 1996), especially when, as observed in our study, negative stimuli present higher arousal levels, the scarce research on this affective dimension does not allow stronger conclusions. Indeed, dominance is typically considered the least important dimension in terms of the variance explained in emotional ratings (see Bradley & Lang, 2000) and is one of the most neglected topics in contemporary research on emotion. Future research should attend to this variable, in order to clarify the dominance effects on emotional ratings.

[3] Although Bradley and Lang (1999a) did not report these results, we have calculated them from the normative data included in their study. The mean comparisons (independent *t*-tests) for females and males revealed that American males rated the ANEW words with higher levels of dominance, $t(2066) = 4.42$, $p < .001$. American females tended to rate ANEW words as more arousing, $t(2066) = -1.89$, $p = .059$, and American males as more positive, $t(2066) = 1.83$, $p = .068$, although these differences were only marginally significant.

The ANEW standardizations for EP, American, and Spanish languages

In order to explore the intercultural differences observed in the three ANEW standardizations, Fig. 3 presents the distribution of the mean results found in the ratings of the 1,034 words in the American English, Spanish, and EP standardizations in the bidimensional affective space of valence × arousal.

The visual inspection of Fig. 3 indicates a great overlap in distribution of the valence × arousal results in the three languages, with all revealing the expected boomerang shape. Both in the American original version (Bradley & Lang, 1999a) and in the Spanish adaptation (Redondo et al., 2007), it was possible to observe, on the one hand, positive linear correlations between valence and arousal for pleasant words (American, $r = .64$, $p < .001$; Spanish, $r = .45$, $p < .001$) and, on the other hand, negative correlations between valence and arousal for unpleasant words (American, $r = -0.46$, $p < .001$; Spanish, $r = -0.57$, $p < .001$), which were captured by the significant quadratic relationship between valence and arousal in American, $R = .54$, $p < .001$,[4] and Spanish, $R = .54$, $p < .001$, standardizations. Nonetheless, the comparison of the correlations suggests that in the EP standardization, pleasant words were rated as less arousing, $r = .27$, $p < .001$, as indicated by the green dots in the left upper quadrant of the Fig. 3, while unpleasant words were rated as more arousing, $r = -0.58$, $p < .001$, as revealed by the green dots in the right lower quadrant of the Fig. 3.

In spite of these differences, the proximity between ratings in the three languages can be highlighted, as suggested by Table 2, which presents the results for Pearson correlations between the assessments for the EP, American English, and Spanish languages in each of the three affective dimensions.

All correlations were positive and highly significant ($p < .001$ in all comparisons), which seems to suggest that the ANEW words were understood in a similar way by EP, American, and Spanish subjects, eliciting similar emotional reactions (see Table 2). It is important to highlight that, as was expected, this agreement is higher in EP–Spanish comparisons than in EP–American comparisons, which seems to confirm the hypothesis that the geographical proximity and cultural similarities between both countries may promote more similar emotional responses.

[4] Although Bradley and Lang (1999a) did not report correlational and regression analyses in their study, we have calculated these analyses on the basis of the normative data they have published. Also, in the adaptation of the ANEW for Spanish, Redondo et al. (2007) did not present values for the correlational analysis between valence and arousal affective dimensions attending to words' valence (unpleasant vs. pleasant). Thus, in this work, we have additionally computed these analyses on the basis of the normative data they have published.

It is also worth noting that, in spite of the high correlations found for all affective dimensions in the three ANEW standardizations, the valence dimension is the one that showed lower cross-language variability. Therefore, and consistent with the findings reported by Redondo et al. (2007) with American English and Spanish speakers and by Whissell (2008) with American English and Canadian English speakers, as well as by Eilola and Havelka (2010) with British English and Finnish speakers, the assessment of a specific word in the pleasant–unpleasant continuum (i.e., valence) seems to be more consensual than its assessment in the control–out-of-control continuum (i.e., dominance) and, especially, than in the calm–excited continuum (i.e., arousal). It is also worth noting that even though this pattern applies to both sexes in the three ANEW standardizations, stronger correlations were observed in females than in males.

To obtain a more detailed appreciation of the intercultural differences observed in each of the three affective dimensions of the ANEW, we conducted a MANOVA with ANEW standardization (EP vs. American vs. Spanish) and sex (females vs. males) as between-subjects factors and the affective dimensions of valence, arousal, and dominance as dependent variables. Table 3 presents means, standard deviations, and range scores for each of the affective dimensions under analysis for the subsamples of females and males separately.

The MANOVA analysis showed a main effect of the ANEW standardization in the three affective dimensions [valence, $F(2, 6198) = 24.12$, $p < .001$; arousal, $F(2, 6198) = 179.10$, $p < .001$; dominance, $F(2, 6198) = 64.83$, $p < .001$]. A main effect of sex was also found in the affective dimensions of arousal, $F(1, 6198) = 13.66$, $p < .001$, and dominance, $F(1, 6198) = 6.76$, $p < .001$, being marginally significant in the valence dimension, $F(1, 6198) = 2.91$, $p = .09$. A significant ANEW standardization × sex interaction was also observed in the affective dimension of dominance, $F(2, 6198) = 6.67$, $p < .001$.

The post hoc Scheffé contrasts for the main effect of the ANEW standardization revealed that, in terms of valence, EP subjects rated the ANEW words using higher scores than did Spanish subjects ($p < .001$) and lower scores than did American subjects, although in this case the difference was only marginally significant ($p = .074$). In the arousal dimension, EP subjects rated the ANEW words as less arousing than did both American ($p < .001$) and Spanish ($p < .001$) subjects. Finally, in the dominance dimension, no differences were observed between EP and American subjects ($p = .216$), even though EP subjects presented higher scores than did Spanish subjects ($p < .001$). The main effect of sex revealed that, irrespective of the ANEW standardization and similar to what was observed in the Portuguese sample, female subjects rated ANEW words as more highly arousing than did males ($p < .001$). In addition,

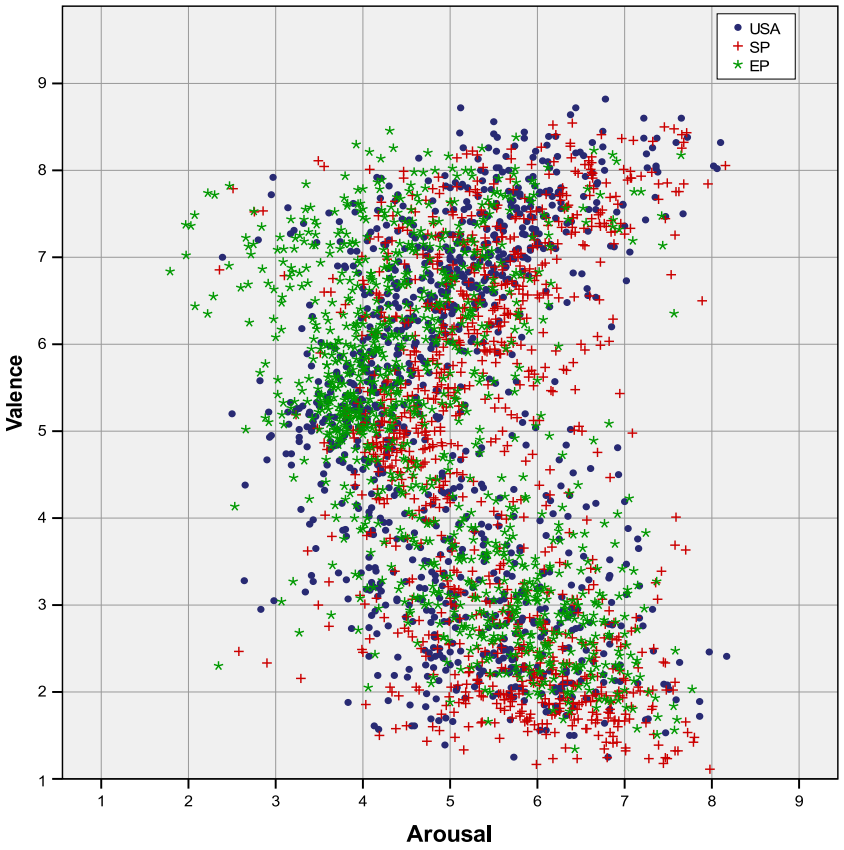

Fig. 3 Distribution of mean values for the 1,034 ANEW words in American (USA), Spanish (SP), and European Portuguese (EP) for valence and arousal affective dimensions

male subjects, as compared with female subjects, scored ANEW words with higher levels of dominance ($p < .010$). Finally, the ANEW standardization × sex interaction for the dominance dimension revealed that even though sex differences did not reach statistical significance in the EP and Spanish ANEW standardizations, in the original American standardization dominance levels were significantly higher for males than for females ($p < .001$).

Overall, these results suggest that Portuguese subjects tend to manifest lower emotional reactivity to ANEW words than do American subjects and that, even though they assessed words as less arousing than did Spanish subjects (with the latter presenting the highest scores in this dimension), they used higher scores for valence and dominance than did the Spanish subjects. Therefore, although the ANEW constitutes a very useful data set composed by words that elicit similar emotional responses in people from different countries and cultures (as evidenced by the high and statistically significant correlations between EP and American and between EP and Spanish; see Table 2), it is important to highlight that these findings point to important sociocultural differences in the way American, Spanish, and Portuguese individuals respond to the words that are part of the ANEW data set. The affective assessment of emotionally evocative words, such as the ANEW words, seems to be language and culture specific. Thus, caution is needed in the development of cross-linguistic studies on affective processing, which should be based on a careful selection of stimuli derived from normative data that fit the sociocultural context of each research.

Finally, future developments of the standardization of the ANEW for EP should consider the possibility of providing reliable discrete emotion norms (namely, in the discrete emotion categories of happiness, anger, fear, disgust, and sadness), following the previous works of Stevenson et al.

Table 2 Linear correlations between European Portuguese (EP), American (USA), and Spanish (SP) ANEW word ratings in the three affective dimensions for all subjects and for females and males separately

Affective Dimensions	All Subjects		Females		Males	
	USA	SP	USA	SP	USA	SP
Valence	.92**	.94**	.92**	.94**	.88**	.90**
Arousal	.65**	.75**	.66**	.72**	.47**	.60**
Dominance	.73**	.78**	.70**	.74**	.51**	.60**

** $p < .001$

Table 3 Means (*M*s), standard deviations (*SD*s), and range for the European Portuguese (EP), American (USA), and Spanish (SP) ANEW word ratings in the three affective dimensions for females and males

Affective Dimensions	Females							Males							
	EP			USA			SP	EP			USA			SP	
	M	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range
Valence	4.98	1.91	7.24	5.08	2.18	7.85	4.74	2.16	7.51	5.07	1.69	7.24	5.24	1.79	7.40	4.74	2.10	7.65
Arousal	4.94	1.19	6.37	5.16	1.17	6.63	5.54	1.02	5.87	4.77	1.24	6.27	5.07	1.08	6.11	5.49	1.05	5.70
Dominance	4.96	0.95	5.70	4.92	1.16	6.43	4.68	1.09	5.79	4.96	1.04	6.60	5.12	.95	5.23	4.67	1.07	6.10

(2007) with the original version of the ANEW and of Briesemeister, Kuchinke, and Jacobs (2011) with the Berlin Affective Word List Reloaded (BAWL–R; Võ et al., 2009). Combining the norms presented in this article (based on a dimensional perspective of emotions) with the discrete or categorical perspective of emotions that has been acknowledged by those studies may contribute significantly to the development of research on affective processing in Portugal. In particular, the combination of these two approaches may help the development of studies that aim to compare the affective processing from both perspectives and to explore sex and cross-cultural differences in that processing. A single data set would also benefit the development of studies focused on the effects of discrete emotions in word recognition, a promising line of research in contemporary affective research (see Briesemeister et al., 2011; Hofmann et al., 2009; Stevenson et al., 2007).

Conclusion

The aim of this work was to adapt the ANEW data set (Bradley & Lang, 1999a) to the EP language. The use of standardized emotionally evocative stimuli is a major need to effectively support current cognitive and psychophysiological research. Therefore, given the scarcity of these stimuli in EP, the increasing interest in the study of affective processing that has been observed in the international literature, and the broad utilization of ANEW in studies using emotional words, we have adapted this tool for the EP context.

This study was conducted with a large sample of undergraduate and graduate students (N = 958) and will be a useful tool for the development and internationalization of Portuguese research both on the neurophysiological correlates of emotion and on the influence of emotions in cognitive processing. Similar to the results obtained with the original American version (Bradley & Lang, 1999a) and with the Spanish adaptation (Redondo et al., 2007), the results for the adaptation of the ANEW for EP revealed that the 1,034 words generated emotional responses that were appropriately distributed in the bidimensional affective space of valence × arousal. Therefore, these norms will allow a more appropriate selection of emotional words as a function of the orthogonal manipulation that researchers may want to apply in different paradigms of experimental research on affective processing (although, as was mentioned before, the negative words tended to be rated with higher arousal scores, which can make the conduction of studies aiming at manipulating arousal in that group of words difficult). In this way, the ANEW seems to be a valid and useful measure for the study of emotions in a national context, allowing the comparability of results with those of other international studies that have used the same data set for stimuli selection.

The comparison of results in the three available standardizations (American, Spanish, and now EP) revealed that, although the ANEW words have elicited similar emotional responses in Portuguese, American, and Spanish subjects, cross-cultural differences were identified. Globally, our findings indicate that EP subjects reveal lower emotional reactivity to ANEW words than do American subjects (i.e., EP subjects rated the ANEW words as less arousing and lower in valence and dominance than did American subjects, even though these differences reached statistical significance only for the arousal dimension) and that, when compared with Spanish subjects, they assessed the words as less arousing, even if with higher scores of valence and dominance. Thus, this finding seems to indicate the existence of important sociocultural specificities in the way ANEW words are understood across languages/cultures, which might be acknowledged by future studies.

Finally, it is worth noting that contrary to what was observed in the American original (Bradley & Lang, 1999a) and in the Spanish (Redondo et al., 2007) ANEW standardizations, and consistent with literature on sex differences on affective responses (e.g., Bradley et al., 2001a, 2001b; Lang et al., 1998), the adaptation of the ANEW for EP was characterized by statistically significant sex differences for words' valence and arousal affective dimensions (i.e., higher arousal ratings by EP females than by EP males, higher valence ratings by EP males than by EP females for unpleasant words, and higher valence ratings by EP females than by EP males for pleasant words). As a consequence, during the development of studies on emotional processing, Portuguese researchers should base the selection of word stimuli on the norms that best suit the sex specificities of their samples. Future developments of the adaptation of the ANEW for EP should also consider the possibility of combining these norms with others based on discrete perspective of emotions.

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References

Anders, S., Eippert, F., Weiskpf, N., & Veit, R. (2008). The human amygdala is sensitive to the valence of pictures and sounds irrespective of arousal: An fMRI study. *Social Cognitive and Affective Neuroscience, 3,* 233–243.

Anderson, A. K. (2005). Affective influences on the attentional dynamics supporting awareness. *Journal of Experimental Psychology. General, 134,* 258–281.

Bacelar do Nascimento, M. F., Casteleiro, J., Marques, M., Barreto, F., & Amaro, R. (2000). *Léxico multifuncional computorizado do português contemporâneo* [Multifunctional computational lexicon of contemporary Portuguese] (data file). Available from Centro de Linguística da Universidade de Lisboa.

Bradley, M. M., Codispoti, M., Sabatinelli, D., & Lang, P. J. (2001a). Emotion and motivation: I. *Defensive and appetitive reactions in picture processing. Emotion, 1,* 276–298.

Bradley, M. M., Codispoti, M., Sabatinelli, D., & Lang, P. J. (2001b). Emotion and motivation: II. *Sex differences in picture processing. Emotion, 1,* 300–319.

Bradley, M. M., Cuthbert, B. N., & Lang, P. J. (1999). Affect and the startle reflex. In M. E. Dawson, A. Schell, & A. Boehmelt (Eds.), *Startle modification: Implications for neuroscience, cognitive science and clinical science* (pp. 157–183). Stanford: Cambridge.

Bradley, M. M., Greenwald, M. K., Petry, M. C., & Lang, P. J. (1992). Remembering pictures: Pleasure and arousal in memory. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 18,* 379–390.

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The Self-Assessment Manikin and the semantic differential. *Journal of Behavioral Therapy and Experimental Psychiatry, 25,* 49–59.

Bradley, M. M., & Lang, P. J. (1999a). *Affective Norms for English Words (ANEW): Instruction manual and affective ratings*. Gainesville: University of Florida, Center for Research in Psychophysiology.

Bradley, M. M., & Lang, P. J. (1999b). *International Affective Digitized Sounds (IADS): Stimuli, instruction manual and affective ratings*. Center for Research in Psychophysiology, Gainesville: University of Florida.

Bradley, M. M., & Lang, P. J. (2000). Measuring emotion: Behavior, feeling and physiology. In R. Lane & L. Nadel (Eds.), *Cognitive neuroscience of emotion* (pp. 242–276). New York: Oxford University Press.

Bradley, M. M., Miccoli, L., Escrig, M. A., & Lang, P. J. (2008). The pupil as a measure of emotional arousal and autonomic activation. *Psychophysiology, 45,* 602–607.

Briesemeister, B. B., Kuchinke, L., & Jacobs, A. M. (2011). Discrete emotion norms for nouns–Berlin Affective Word List (DENN–BAWL). *Behavior Research Methods, 43,* 441–448.

Burke, L. A., & James, K. E. (2006). Using on-line surveys for primary research data collection: Lessons from the field. *International Journal of Innovation and Learning, 3,* 16–30.

Cacioppo, J. T., Gardner, W. L., & Berntson, G. G. (1997). Beyond bipolar conceptualizations and measures: The case of attitudes and evaluative space. *Personality and Social Psychology Review, 1,* 3–25.

Carretié, L., Hinojosa, J. A., Albert, J., López-Martín, S., de la Gándara, B. S., Igoa, J. M., et al. (2008). Modulation of ongoing cognitive processes by emotionally intense words. *Psychophysiology, 45,* 188–196.

Codispoti, M., Ferrari, V., & Bradley, M. M. (2006). Repetitive picture processing: Autonomic and cortical correlates. *Brain Research, 1068,* 213–220.

Couper, M. P. (2000). Web surveys: A review of issues and approaches. *Public Opinion Quarterly, 64,* 464–494.

de Houwer, J., Hermans, D., Rothermund, K., & Wentura, D. (2002). Affective priming of semantic categorization responses. *Cognition & Emotion, 16,* 643–666.

de Houwer, J., & Randell, D. (2004). Robust affective priming effects in a conditional pronunciation task: Evidence for the semantic representation of evaluative information. *Cognition & Emotion, 18,* 251–264.

Doerksen, S., & Shimamura, A. P. (2001). Source memory enhancement for emotional words. *Emotion, 1,* 5–11.

Dresler, T., Mériau, K., Heekeren, H. R., & van der Meer, E. (2009). Emotional Stroop task: Effects of word arousal and subject anxiety on emotional interference. *Psychological Research, 73,* 364–371.

Eilola, T. M., & Havelka, J. (2010). Affective norms for 210 British English and Finnish nouns. *Behavior Research Methods, 42,* 134–140.

Ekman, P. (1992). Are there basic emotions? *Psychological Review, 99,* 550–553.

Ferré, P. (2003). Effects of level of processing on memory for affectively valenced words. *Cognition & Emotion, 17,* 859–880.

Forsythe, A., Mulhern, G., & Sawey, M. (2008). Confounds in pictorial sets: The role of complexity and familiarity in basic-level picture processing. *Behavior Research Methods, 40,* 116–129.

Fox, E., Griggs, L., & Mouchlianitis, E. (2007). The detection of fear-relevant stimuli: Are guns noticed as quickly as snakes? *Emotion, 7,* 691–696.

Gibbons, H. (2009). Evaluative priming from subliminal emotional words: Insights from event-related potentials and individual differences related to anxiety. *Consciousness and Cognition, 18,* 383–400.

Gomes, I., & Castro, S. L. (2003). Porlex: A lexical database in European Portuguese. *Psychologica, 32,* 91–108.

Hadley, B. C., & MacKay, D. G. (2006). Does emotion help or hinder immediate memory? Arousal versus priority-binding mechanisms. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 32,* 79–88.

Herbert, C., Junghöfer, M., & Kissler, J. (2008). Event related potentials to emotional adjectives during reading. *Psychophysiology, 45,* 487–498.

Hermans, D., de Houwer, J., & Eelen, P. (2001). A time course analysis of the affective priming effect. *Cognition & Emotion, 15,* 143–165.

Hinojosa, J. A., Carretié, L., Méndez-Bértolo, C., Míguez, A., & Pozo, M. A. (2009). Arousal contributions to affective priming. *Emotion, 9,* 164–171.

Hofmann, M. J., Kuchinke, L., Tamm, S., Võ, M. L.-H., & Jacobs, A. M. (2009). Affective processing within 1/10th of a second: High arousal is necessary for early facilitative processing of negative but not positive words. *Cognitive, Affective, & Behavioral Neurscience, 9,* 389–397.

Junghöfer, M., Schupp, H., Stark, R., & Vaitl, D. (2005). Neuroimaging of emotion: Empirical effects of proportional global signal scaling in fMRI data analysis. *NeuroImage, 25,* 520–526.

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

Kissler, J., Herbert, C., Winkler, I., & Junghöfer, M. (2009). Emotion and attention in visual word processing: An EEG study. *Biological Psychology, 80,* 75–83.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1999). *International Affective Picture System (IAPS): Technical manual and affective ratings*. Gainesville: University of Florida, Center for Research in Psychophysiology.

Lang, P. J., Bradley, M. M., Fitzsimmons, J. R., Cuthbert, B. N., Scott, J. D., Moulder, B., et al. (1998). Emotional arousal and activation of the visual cortex: An fMRI analysis. *Psychophysiology, 35,* 199–210.

LeDoux, J. (1996). *The emotional brain: The mysterious understanding of emotional life*. New York: Simon & Schuster.

Lewis, P. A., Critchley, H. D., Rotshtein, P., & Dolan, R. J. (2007). Neural correlates of processing valence and arousal in affective words. *Cerebral Cortex, 17,* 742–748.

Liu, B., Jin, Z., Wang, Z., & Hu, Y. (2010). The interaction between pictures and words: Evidence from positivity offset and negativity bias. *Experimental Brain Research, 201,* 141–153.

Mauss, I. B., & Robinson, M. D. (2009). Measures of emotion: A review. *Cognition & Emotion, 23,* 209–237.

Mickley, K. R., & Kensinger, E. A. (2008). Emotional valence influences the neural correlates associated with remembering and knowing. *Cognitive, Affective, & Behavioral Neuroscience, 8,* 143–152.

Monnier, C., & Syssau, A. (2008). Semantic contribution to verbal short-term memory: Are pleasant words easier to remember than neutral words in serial recall and serial recognition? *Memory & Cognition, 36,* 35–42.

Moors, A. (2009). Theories of emotion causation: A review. In J. De Houwer & D. Hermans (Eds.), *Cognition and emotion: Reviews of current research and theories* (pp. 1–37). Ney York: Psychological Press.

Öhman, A., & Wiens, S. (2004). The concept of an evolved fear module and cognitive theories of anxiety. In A. Manstead, A. Fischer, & N. Frijda (Eds.), *Feeling and emotion*. The Amsterdam Symposium. New York: Cambridge University Press.

Osgood, C. E., Suci, G., & Tannenbaum, P. (1957). *The measurement of meaning*. Urbana: University of Illinois Press.

Posner, J., Russell, J. A., Gerber, A., Gorman, D., Colibazzi, T., Yu, S., et al. (2009). The neurophysiological bases of emotion: An fMRI study of the affective circumplex using emotion-denoting words. *Human Brain Mapping, 30,* 883–895.

Pratto, F., & John, O. P. (1991). Automatic vigilance: The attention grabbing power of negative social information. *Journal of Personality and Social Psychology, 61,* 380–391.

Redondo, J., Fraga, I., Padrón, I., & Comesaña, M. (2007). The Spanish adaptation of ANEW (Affective Norms for English Words). *Behavior Research Methods, 39,* 600–605.

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review, 110,* 145–172.

Scherer, K. R. (2005). What are emotions? And how can they be measured? *Social Science Information, 44,* 693–727.

Schimmack, U. (2005). Attentional interference effects of emotional pictures: Threat, negativity, or arousal? *Emotion, 5,* 55–66.

Schupp, H. T., Stockburger, J., Codispoti, M., Junghöfer, M., Weike, A. I., & Hamm, A. O. (2007). Selective visual attention to emotion. *Journal of Neuroscience, 27,* 1082–1089.

Scott, G. G., O'Donnell, P. J., Leuthold, H., & Sereno, S. C. (2009). Early emotion word processing: Evidence from event-related potentials. *Biological Psychology, 80,* 95–104.

Soares, A. P., Comesaña, M., Iriarte, A., Almeida, J. J., Simões, A., Costa, A., et al. (2010). P-PAL: Uma base lexical com índices

psicolinguísticos do Português Europeu [P-PAL: A European Portuguese lexical database]. *Linguamática, 2,* 67–72.

Spruyt, A., Hermans, D., de Houwer, J., Vandromme, H., & Eelen, P. (2007). On the nature of the affective priming effect: Effects of stimulus onset asynchrony and relatedness proportion in naming and evaluative categorization. *Memory & Cognition, 35,* 95–106.

Stevenson, R. A., Mikels, J. A., & James, T. W. (2007). Characterization of Affective Norms for English Words by discrete emotional categories. *Behavior Research Methods, 39,* 1020–1024.

Võ, M. L.-H., Conrad, M., Kuchinke, L., Urton, K., Hofmann, M. J., & Jacobs, A. M. (2009). The Berlin Affective Word List Reloaded (BAWL–R). *Behavior Research Methods, 41,* 534–538.

Wentura, D. (2000). Dissociative affective and associate priming effects in the lexical decision task: Yes versus no responses to word targets reveal evaluative judgment tendencies. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 26,* 456–469.

Wentura, D., & Degner, J. (2010). Automatic evaluation isn't that crude! Moderation of masked affective priming by type of valence. *Cognition & Emotion, 24,* 609–628.

Whissell, C. (2008). A comparison of two lists providing emotional norms for English words (ANEW and the DAL). *Psychological Reports, 102,* 597–600.

Wundt, W. (1896). *Grundriss der Psychologie*. Leipzig: Alfred Kroner.

Zhang, Q., Lawson, A., Guo, C., & Jiang, Y. (2006). Electrophysiological correlates of visual affective priming. *Brain Research Bulletin, 71,* 316–323.