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Does self-reference modulate the processing of all emotional words? The distinction between emotion-label and emotion-laden words

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ABSTRACT

There is ample evidence of the influence of both self-reference and the emotional content of words in language processing and memory. This study examines the conjoint influence of both factors in a variant of the affective HisMine-Paradigm. Participants were presented with pairs of words, that comprised emotional (positive and negative) or neutral words, preceded either by the first-person possessive pronoun "my" (self-reference) or by the definite article "the" (no-reference). Emotional words were divided into emotion-label words (e.g., happiness) and emotion-laden words (e.g., party). Participants were asked to perform an affective evaluation task (i.e., to decide if the word pair conveyed a positive, negative or neutral meaning), followed by a valence rating task (i.e., to rate the word pair in terms of their valence) and an unexpected free recall task. The results for positive words, but not negative words, showed that self-reference facilitated the affective evaluation task and led to more extreme valence ratings. These modulatory effects were observed in emotion-laden words, but not in emotion-label words. These findings support a self-positivity bias, and the literature about the modulation of emotional word processing by self-reference, yet point out the relevance of the distinction between emotion-label words and emotion-laden words.

1. Introduction

Cognitive functioning often involves prioritizing some information of the environment over others. In this regard, several properties of the stimuli have been shown to preferentially capture attention. The present study focuses on language processing and memory and examines two properties empirically proven to modulate attention and drive prioritized processing: Emotional content and self-reference.

The emotional content of stimuli, words among them, is commonly defined in terms of continuous variations of two affective dimensions: valence and arousal (Bradley & Lang, 1999). Valence refers to the emotional response evoked by a word, ranging from very negative/unpleasant (e.g. death) to very positive/pleasant (e.g. party). Arousal indicates the degree of activation elicited by a word and ranges from very relaxing (e.g. pillow) to very activating (e.g. war).

Psycholinguistic studies (i.e., studies about language processing) have focused on the comparison between emotional (i.e., positive/pleasant and negative/unpleasant) and neutral words (i.e., words whose valence value is located around the middle point of the scale) (see Ferré, Sánchez-Carmona, et al., 2024, and Hinojosa et al., 2020, for reviews). This comparison involves contrasting words that differ in both valence and arousal (i.e., emotional words tend to be more arousing than neutral ones), although some studies have tried to disentangle the role of each variable. With respect to valence, the most consistent result is a positivity bias, that is, behaviorally faster or more elaborate processing for positive words (e.g., Haro et al., 2024; Herbert et al., 2006, 2008; Kuperman et al., 2014; Rodríguez-Ferreiro & Davies, 2019). In contrast, the results with negative words are mixed, with reports of an advantage over neutral words (e.g., Vinson et al., 2014), a disadvantage (Haro et al., 2024; Kuperman et al., 2014; Yao et al., 2016) or null effects (Kuchinke et al., 2005, see also Ferré, Sánchez-Carmona, et al., 2024, for a recent meta-analysis). These results have been mostly obtained with the lexical decision task (LDT), the most common task to examine word processing, but also during spontaneous and passive viewing of words (e.g., Herbert et al., 2006, 2008). On the other hand, large-scale LDT studies do not report consistent findings regarding arousal, with evidence of facilitative (Estes & Adelman, 2008), inhibitory (Kuperman et al., 2014) and no effects (Rodríguez-Ferreiro & Davies, 2019) of high

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levels of arousal compared to low levels. In addition, interactive effects between valence and arousal have been reported (e.g., Citron et al., 2014; Haro et al., 2024; Hofmann et al., 2009).

The influence of a word's emotional content on memory has also been investigated. The usual finding – as far as long-term memory is concerned - is that emotional words are better remembered than neutral ones (see Talmi, 2013, for a review). Arousal contributes greatly to memory enhancement (Gao et al., 2024). Regarding valence, both positive and negative words are prioritized over neutral ones in memory (e.g., Cortese & Khanna, 2022; see Gao et al., 2024, for a review). In fact, valence extremity seems to be the key variable. That is, the greater the deviation of the words from the midpoint of the valence scale in either direction, the greater the memory advantage. This effect is independent of arousal (Cortese & Khanna, 2022).

The second phenomenon of interest for this study is self-reference. There is abundant evidence that stimuli related to oneself capture attention and are prioritized during processing. This includes a person's own name (Alexopoulos et al., 2012), faces, and objects, among others (see Lee et al., 2023, for a review). Even arbitrary material, such as geometric shapes, influences processing when it is made personally significant (by relating it to the self, Humphreys & Sui, 2016). Memory is also enhanced for self-relevant information (see Gutchess & Kensinger, 2018, for a review). Regarding verbal stimuli, the pioneering work of Rogers et al. (1977) is worth to be mentioned. These authors found that participants performed better in a memory task when they were asked to decide whether a set of trait adjectives were self-descriptive, compared to other encoding conditions (semantic, phonemic and structural). Since then, the self-reference effect, whereby information is more easily encoded when the self is implicated, has been demonstrated using a variety of experimental paradigms and tasks (see Soares et al., 2019, for a review).

As can be seen from the above, self-reference and emotion have a comparable influence in cognitive processing: people respond faster and more accurately to self-relevant (Sui et al., 2012) and emotional information (Brosch et al., 2013, but the effects are modulated by valence and task, with emotional words sometimes causing interference, e.g., Larsen et al., 2006) and both types of information capture attention (Anderson & Yantis, 2013; Bucker & Theeuwes, 2017; Ono & Taniguchi, 2017; Stolte et al., 2017) and enhance episodic memory (Gutchess & Kensinger, 2018). Similar effects have also been reported at a neural level. Indeed, both emotional and self-referential information activate common prefrontal regions during processing (see Gutchess & Kensinger, 2018; Herbert et al., 2011, for a review) and modulate the late positive component (LPC), an event-related potential (ERP) component that is thought to index sustained attention and elaborative processing (e.g., Herbert, Pauli, & Herbert, 2011; see Hinojosa et al., 2020, for a review). These similarities suggest that common information-processing mechanisms may be involved. Indeed, the two phenomena may be connected, given that emotions are typically triggered by situations that are relevant to the self (Gutchess & Kensinger, 2018), and emotional stimuli, including words, are generally perceived as more self-relevant than neutral stimuli (Dimitrova et al., 2022).

Despite the convergence between emotion and self-reference effects, these two phenomena have been traditionally investigated separately. This has started to change in the last years with the use of experimental paradigms that allow the conjoint manipulation of self-reference and emotion. In this regard, several studies have used a priming paradigm which examines the influence of a briefly displayed prime word on the processing of a following target word. For instance, Soares et al. (2019) presented primes related to the self (I am) and to others (She is) immediately before emotional target trait adjectives. Participants were then asked to categorise these adjectives as positive or negative. These authors found that positive words (but not negative ones) were classified faster when they were preceded by self-related primes than by other-related primes. These results provide evidence of a self-positivity bias, i.e. an advantage in processing self-related positive stimuli (Soares et al., 2019), and suggest that self-referential information is quickly activated and modulates emotional word processing. Chen et al. (2014) obtained results in the same direction, using a similar paradigm and recording both behavioral and ERP data. In this study, the fastest responses were observed for self-related positive adjectives and other-related negative adjectives. Consistently, the amplitude of the P300 (an early ERP component) was larger for self-positive and other-negative words than for self-negative and other-positive words, respectively. This indicates that self-related information captured more attentional resources.

Other researchers have also investigated the neural correlates of emotional and self-reference effects. Concretely, Fields and co-workers developed a paradigm in which participants were asked to read two-sentence discourse scenarios containing emotional and neutral words, which referred either to the participants themselves or to a third person while ERP were recorded. Fields and Kuperberg (2012) observed that self-reference, but not emotional content, modulated several early components associated to sensory/perceptual processing (P1, N1, and P2). The authors concluded from this that self-reference affects processing at a very early, pre-semantic stage (see also Fields & Kuperberg, 2016). Using the same paradigm, Fields and Kuperberg (2015) found that positive words elicited a smaller N400 response (an ERP component that indicates semantic integration; Kutas & Federmeier, 2011) when presented in contexts that were self-relevant rather than other-relevant. This suggests that people are more likely to expect positive information when the situation relates to them personally, thus supporting the idea of a self-positivity bias during comprehension. Convergent neuroimaging data showed modulation of medial prefrontal cortex activation by self-reference only when the information was positive (Fields et al., 2019).

Of special interest for this work is the affective HisMine paradigm that allows the simultaneous manipulation of emotional content and self-reference. It was developed by Herbert (Herbert, 2010; for overview see Herbert, 2022) and has been used intensively by several research groups in a series of experimental behavioral and neurophysiological studies (for an overview e.g., see supplement in Herbert, 2022). In the affective HisMine paradigm, nouns that vary in their emotional valence (positive, negative or neutral) can be preceded by either a first-person possessive pronoun (e.g., "my house", self-related condition), a third-person possessive pronoun (e.g., "his house", other-related condition) or a definite article (e.g., "the house", no-reference condition). Some studies include the three conditions (Herbert et al., 2018), while others use only the third-person (Weis & Herbert, 2017) or the no-reference (Herbert et al., 2011), as a comparison to the first-person condition. Participants in these studies are asked to silently read the words (Herbert et al., 2011; Herbert, Pauli, & Herbert, 2011) or to perform an affective evaluation task (i.e., indicate if the word is positive or negative, Herbert et al., 2018; Weis & Herbert, 2017; Meixner & Herbert, 2018; Weis & Herbert, 2022), which can be followed by an unexpected free recall task (Herbert et al., 2018; Herbert et al., 2011; Herbert, Pauli, & Herbert, 2011) and by a valence rating task (Herbert et al., 2011; Herbert, Pauli, & Herbert, 2011; Weis & Herbert, 2017) using the self-assessment manikin (SAM), a pictorial scale that is commonly used to collect normative valence and arousal ratings (Bradley & Lang, 1999). Some of these studies have also examined the neural correlates of self-reference and emotional processing (e.g., Herbert et al., 2011; Herbert, Pauli, & Herbert, 2011; see Herbert, 2022, supplement, for an overview of studies using the affective HisMine paradigm). Regarding the affective evaluation task, Herbert et al. (2018) found that self-related positive words were classified according to their valence more quickly than self-related negative words. Furthermore, participants responded faster to self-related positive words than to other-related positive words. However, the self-reference advantage was not observed for negative or neutral words (Weis & Herbert, 2017). Valence ratings also showed a self-positivity bias in that self-related positive words were considered as more pleasant than other-related positive words (Weis & Herbert, 2017) and non-referenced positive words (Herbert et al., 2011). That is, positive words were considered as more pleasant when they were related to the participant, while this self-reference effect was not observed for negative or neutral words (Herbert et al., 2011). Furthermore, positive words in the self-reference condition were better remembered than in the other conditions (Herbert et al., 2011). ERP data revealed an early modulation of processing by emotional content (valence), in the early posterior negativity (EPN) component, as well as a later effect of self-reference, in the N400 and LPC time windows (Herbert, Pauli, & Herbert, 2011), suggesting that self-relevance effects on processing occur only after emotional content has captured attention and the positive-negative nature of the stimulus has been assessed. In turn, neuroimaging data (Herbert et al., 2011) showed preferential activation of the amygdala and insula in response to positive words, but only when they were self-related. By contrast, processing negative words increased activation of these neural structures regardless of the reference (self, other or no-reference).These data evidence that stimulus reference modulates the amygdala activation in response to emotional stimuli, especially when they have a pleasant nature (Herbert et al., 2011). All these findings are consistent with a self-positive bias which has been explained by mood congruent processing, under the assumption that positive mood is the norm in healthy people (Mezulis et al., 2004; Pahl & Eiser, 2005).

The reviewed literature evidences the interaction between self-reference and emotion, pointing out the differences between positive and negative words. However, apart from having distinct valence values, emotional words may also differ in their relationship with emotional content. Concretely, there is a relevant distinction between Emotion-label words (EM words hereinafter) and Emotion-laden words (EL words hereinafter). EM words directly refer to specific emotions (e.g., "anger"), while EL words may elicit emotions but do not name an emotion (e.g., "party", Pavlenko, 2008). In fact, their affective content is probably a product of their association to an affective state/event (e.g., Betancourt et al., 2023). Therefore, the relationship with emotions is more direct for EM words than for EL words, which are a type of "mediated" emotion concepts (Altarriba & Basnight-Brown, 2011; Wu & Zhang, 2020). The EM-EL differentiation seems to be relevant, as evidenced by several psycholinguistic studies that have reported an earlier emotional activation (Wang et al., 2019; Zhang et al., 2020) and an advantage in processing for EM words when compared to EL words (Altarriba & Basnight-Brown, 2011; Kazanas & Altarriba, 2015).

Despite the above, the EM-EL distinction has not been systematically included in research on the interaction between self-reference and emotion, although it may be worth considering. From an embodied perspective (Barsalou et al., 2008), emotional words generally trigger more perceptual and sensory information than neutral words. This provides more cues for word retrieval and contributes to a processing advantage. Furthermore, emotional words may activate self-referential information more strongly than neutral words because they activate not only the concept, but also the bodily reactions, feelings, and personal experiences associated with it (Herbert et al., 2006; Lang, 1979; Soares et al., 2019; Weis & Herbert, 2017). This might be the case especially for EM words, as evidenced by recent data revealing that these words are more strongly connected to bodily reactions and feelings than EL words. Concretely, Ferré, Guasch, et al. (2024) collected subjective ratings for a large set of potential EM words in relation to a series of variables associated with the different components of emotion (Sander et al., 2018). These authors asked participants to rate the relationship of each EM word with action, assessment, expression, feeling, and internal bodily sensations. They found that the more prototypical EM words, that is, the best exemplars of the "emotion" category, were those strongly associated with feelings and internal bodily sensations. In a further study, Betancourt et al. (2024) observed that these variables not only defined EM words, but also that they are key to differentiate them from EL words. That is, although EL words are similar to EM words in terms of valence and arousal, they are less closely associated with feelings and bodily sensations.

Considering the above, the aim of the present study was to examine the interaction between self-reference and emotion in language processing and memory, by distinguishing, for the first time, between EM and EL words. To this end, we relied on the affective HisMine paradigm (see Herbert, 2022, and above). The stimuli were Spanish emotional (positive and negative) and neutral words that could be preceded either by the first-person possessive pronoun "my" (self-reference) or by the definite article "the" (no-reference). Emotional words were divided into EM and EL words. Participants were asked to perform an affective evaluation task (i.e., to decide if the word pair conveyed a positive, negative or neutral meaning), followed by a valence rating task and an unexpected free recall task. In line with the reviewed literature, we expected an advantage for emotional words (i.e., faster reaction times in the affective evaluation task and a higher level of recall in the free recall task) compared to neutral words. We also expected to obtain the self-reference effect. That is, an overall advantage of the self-reference condition (compared to the no-reference condition), as indicated by faster reaction times in the affective evaluation task, more extreme valence scores in the valence rating task, and a higher number of correctly remembered words in the free recall task. Importantly, our prediction was that if EM words are more able to activate self-referential information than EL words (because they elicit bodily sensations, feelings and personal experiences to a greater extent), this self-reference advantage would be larger for EM words than for EL words. On the other hand, in line with the extant evidence, we expected the self-reference advantage to be mostly observed with positive words.

2. Method

2.1. Participants

A total of 100 participants took part in the experiment, all of whom were native speakers of Spanish. The data of thirty participants had to be removed after data trimming (see below). Therefore, the final number of participants was 70 (35 on each experimental file, see below). Among these, there were 57 females, 11 males, and 2 participants who chose the "other" option. Their mean age was 20.97 years (SD = 6.07; range: 18–59 years). They were undergraduate students of the Universitat Rovira i Virgili (Tarragona, Spain), who received course credit for their participation. All of them signed an informed consent before starting the experiment. Approval was granted by the Ethics Committee for Research on People, Society and the Environment of the Universitat Rovira i Virgili (CEIPSA-2021-PR-0044).

2.2. Materials

There were 160 Spanish words in total: 40 EM words, 40 EL words and 80 neutral words. All of them were nouns. EM and EL words were divided into positive and negative words (20 EM positive words, 20 EM negative words, 20 EL positive words and 20 EL negative words). To classify the words into positive, negative and neutral, we relied on the valence and arousal ratings obtained from Stadthagen-Gonzalez et al. (2017). In that dataset, both valence and arousal were assessed in a 1-to-9 scale. For valence, 1 meant highly unpleasant and 9 meant highly pleasant. For arousal, 1 meant calming and 9 meant exciting/arousing. Words were considered as negative if they had a valence value below 4, and they were classified as positive if they had a valence value above 6. The arousal values of positive and negative words varied throughout all the range. Neutral words had a valence score between 4 and 6 (included), and an arousal value equal to or less than 5. In addition, to classify words into EM and EL words, we relied on the EmoPro database (Emotional prototypicality; Pérez-Sánchez et al., 2021). This is the most comprehensive dataset of Spanish words denoting emotions, where words are characterized in terms of emotion prototypicality, ranging from 1 (the word does not refer to an emotion) to 5 (the word clearly refers to an emotion). We considered as EM words those with a prototypicality rating higher than 3. We checked that the selected EL and neutral words were not in that database.

Furthermore, half of these words were to be presented in the self-reference condition, preceded by *mi* ("my"), and the other half in the no-reference condition, preceded by *el/la* ("the", masculine and feminine in Spanish, respectively). To be sure that the combination of the words with the "my" possessive pronoun was equally plausible in all the conditions, a plausibility questionnaire was administered to 40 volunteers from the same population as the participants in the experiment, but who did not participate in it. They were asked to rate to what extent the combination of "my" and the noun (e.g., *mi fiesta*, "my party", *mi pena*, "my sadness") sounds good (i.e., it is common in usage). A 1-to-7 scale was used to that end, where 1 meant that the combination is very strange and sounds very rare, and 7 meant that the combination sounds very well. A total of 224 words were assessed (28 for each critical condition and 112 neutral words) in order to have a pool large enough from which to derive the final set of experimental materials. These words and the participants were evenly divided into two online questionnaires created with TestMaker (Haro, 2012). Both questionnaires showed high reliability, assessed with a split-half procedure corrected with the Spearman-Brown formula (i.e., 0.90 and 0.91).

We considered a series of variables to match the experimental conditions: plausibility, length in number of letters, Zipf as a measure of lexical frequency, concreteness, and age of acquisition. Zipf values and concreteness were obtained from EsPal (Duchon et al., 2013), whereas age of acquisition ratings were obtained from Alonso et al. (2015). Due to the characteristics of the experimental materials, it was possible to match the EM and EL words in all the variables, but not positive and negative words.[1] Therefore, we matched separately the three conditions included in the positive set (EM, EL and neutral words) and the three conditions included in the negative set (EM, EL and neutral words). Finally, although the total number of neutral words was the same as the total number of emotional words (to provide a balanced experimental list in terms of emotional content), we selected a subset of 20 neutral words to be compared with the corresponding EM and EL words, to have the same number of items in the analysed experimental conditions. See Table 1 for descriptive characteristics of the experimental materials.

First, we focused on the conditions included in the positive set, by comparing the EM positive words (20), EL positive words (20) and the corresponding subset of neutral words (20). We ran a one-way ANOVA with the factor "type of word" (EM, EL, neutral word). The results revealed that the three conditions were matched in plausibility, length, Zipf, concreteness, and age of acquisition (all $ps > 0.198$). The ANOVA also showed a main effect of type of word in valence, $F(2,57) = 197.72$, $p < .001$, $\eta_p^2 = 0.874$, and arousal, $F(2,57) = 6.58$, $p = .003$, $\eta_p^2 = 0.187$. Post-hoc Bonferroni tests indicated that, while EM and EL positive words were matched in both variables (both $ps > 0.094$), they differed from neutral words in valence (both $ps < 0.001$) and arousal ($p = .003$ in the comparison between EM and neutral words, and $p = .024$ in the comparison between EL and neutral words).

We ran the same analyses with negative words. We compared the 20 negative EM words and the 20 negative EL words to the corresponding subset of 20 neutral words. The ANOVA revealed that the three conditions were matched in plausibility, length, Zipf, concreteness, and age of acquisition (all $ps > 0.294$). There was a main effect of type of word in valence, $F(2,57) = 282.79$, $p < .001$, $\eta_p^2 = 0.91$, and arousal, $F(2,57) = 149.53$, $p < .001$, $\eta_p^2 = 0.84$. EM and EL negative words were matched in both variables (both ps = 1.00), but they differed from neutral words in valence and arousal (all ps < 0.001).

Table 1
Descriptive statistics of the experimental materials split by type of word.

Variable	Scale	Positive EM words	Positive EL words	Neutral words (Subset 1)
N	–	20	20	20
Prototypicality	1–5	3.66 (0.49)	–	–
Valence	1–9	7.65 (0.54)	7.35 (0.48)	5.16 (0.20)
Arousal	1–9	5.58 (1.82)	5.30 (1.29)	4.17 (0.31)
Plausibility	1–7	5.53 (0.89)	5.65 (0.99)	5.25 (0.98)
Length	–	8.05 (2.26)	7.65 (2.54)	6.70 (2.41)
Zipf	–	4.43 (0.57)	4.47 (0.62)	4.28 (0.51)
Concreteness	1–7	3.87 (0.55)	4.18 (0.84)	4.21 (0.84)
Age of Acq.	1–11	7.46 (1.79)	6.90 (1.99)	7.28 (2.07)

Variable	Scale	Negative EM words	Negative EL words	Neutral words (Subset 2)
N	–	20	20	20
Prototypicality	1–5	3.84 (0.42)	–	–
Valence	1–9	2.53 (0.50)	2.49 (0.54)	5.56 (0.34)
Arousal	1–9	7.03 (0.74)	7.00 (0.49)	4.41 (0.33)
Plausibility	1–7	4.46 (0.99)	4.48 (1.08)	4.68 (0.77)
Length	–	7.55 (2.52)	7.60 (2.26)	7.65 (1.95)
Zipf	–	4.02 (0.26)	4.02 (0.28)	3.96 (0.27)
Concreteness	1–7	4.15 (0.55)	4.36 (0.56)	4.47 (0.82)
Age of Acq.	1–11	8.20 (1.64)	8.20 (1.59)	8.22 (1.14)

Note. Subset 1 and Subset 2 refer to the subset of the selected neutral words to be compared with positive words and negative words, respectively.

2.3. Procedure

Participants were presented with word pairs including a determiner and a noun. The determiner was a first-person possessive pronoun, indicating self-reference (*mi*, "my"), or a definite article (*el/la*, "the", masculine and feminine, respectively), indicating no self-reference.

There were two experimental files. Half of the nouns in each file were preceded by *mi* and the other half by *el/la*. The word pairs were counterbalanced across the two files, so the same noun was preceded by *mi* in one file and by *el/la* in the other file. Participants were randomly assigned to one of the files.

The experiment was implemented and presented online using the PsyToolkit platform (Stoet, 2010, 2017). Before starting the experiment, participants first agreed to an informed consent form by ticking a checkbox. Then, they were asked for some demographic information (age, gender, and native language(s)). After that, the experiment began, including the below tasks (see Fig. 1).

Affective evaluation task: Participants were presented with 160 word pairs and had to decide, as fast as possible, if the meaning conveyed by the pair was positive (by pressing the right arrow on the keyboard), negative (by pressing the left arrow on the keyboard), or neutral (by pressing the down arrow on the keyboard). The complete instructions can be found in Appendix 1. Before each word pair, a fixation point (+) was presented in the center of the screen for 500 ms. Then, the word pair was displayed for 4 s or until response. Finally, after a delay of 500 ms, the next trial was automatically displayed. The order of presentation of the trials was randomized for each participant. This experimental part was preceded by a practice phase which included 6 trials.

Valence rating task: Immediately after finishing the affective evaluation task, participants were presented again with the same pairs and were asked to rate the valence of each pair using a 9-point Likert scale, where 1 meant completely sad and 9 meant completely happy (see the complete instructions in Appendix 2). Word pairs were randomly presented one at a time in the middle of the screen, with the scale and its anchor points always visible at the top. Participants did the ratings using

[1] Some psycholinguistic variables show specific relationships with affective variables. For example, positive words tend to have a lower age of acquisition than negative words (Hinojosa et al., 2016), and a greater variation in arousal values, making it easier to find low-arousal positive words than low-arousal negative words (Guasch et al., 2016). These interactions with valence make it difficult to find a set of words that are comparable on many variables between the two extremes of valence. And, when achieved, the sets of words are too idiosyncratic to ensure the generalizability of the results.

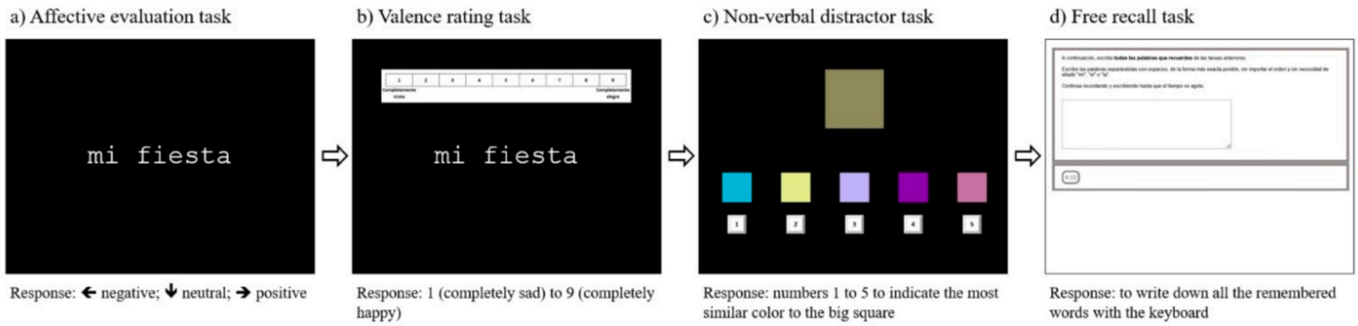

Fig. 1. Layout of the experimental procedure.

the numbers 1 to 9 on the keyboard. They had 15 s to respond before moving on to the next trial.

Non-verbal distractor task: Immediately after the valence rating task, participants performed a color matching task designed to act as a non-verbal distraction. The aim of this task was to minimise verbal rehearsal and reduce the effects of recency of the previously presented verbal material, thereby preventing potential carryover effects into the subsequent task. It was non-verbal to avoid retroactive interference with the verbal information encoded during the valence rating task.

In each trial, participants were presented with one colored square as a sample, along with five smaller squares of different colors. They had to indicate the small square which had the most similar color to the sample figure. Each small square was assigned a number from 1 to 5, so participants did the task by using the numbers on the keyboard. Once a selection was made, the next trial immediately appeared. After 2 min had elapsed, the distractor task was finished, and the instructions of the following task were presented.

Free recall task: Participants were instructed to write down with the keyboard all the words they remembered from the previous tasks, regardless of the order and regardless of the determiner with which they appeared. They were given 5 min to complete the task. The entire experiment lasted about 25 min.

3. Results

The design of the study involves 2 factors: type of word (EM vs. EL vs. neutral words) and self-reference (my vs. the), which were treated as a repeated measures in the analysis of variance (ANOVA). Valence (positive vs. negative words) was not included as a factor because positive and negative words were not matched in all the conditions (see Section 2.2). Therefore, we conducted separate analyses for positive and negative sets. In each analysis, we compared EM, EL, and neutral words (i.e., the subset of neutral words selected and matched to EM and EL words, see Table 1). The dependent variables were the reaction times (RT) in the affective evaluation task, the valence scores in the valence rating task, and the number of words correctly remembered in the free recall task.

3.1. Affective evaluation task

Thirty participants with 30 % or more of their responses deviating from the normative classification of the experimental items were excluded. Note that this task does not involve objectively correct or incorrect responses. However, for consistency, a response was considered an error when it did not match the normative valence assigned to a given word (e.g., classifying as a neutral a word that is positive in a normative database). These discrepancies are subjective in nature and do not reflect systematic differences attributable to specific word types.

The data from those participants were not included in any of the other tasks. Apart from that, RT below 200 ms and time out responses (>4 s) were eliminated. RT that fell 2SD above or below the participants' mean were also removed. RT were only included in the analyses when they corresponded to a correct response. In sum, data from 70 participants (35 in each experimental file) were analysed (see Table 2).

The analysis involving positive words revealed a significant effect of type of word, $F(2,138) = 37.44, p < .001, \eta_p^2 = 0.35$. Bonferroni post-hoc tests showed that participants responded faster to EM words (M = 1068) than to EL words (M = 1194) and neutral words (M = 1270). The difference between the last two types of words was also significant. The effect of self-reference did not reach statistical significance, $F(1,69) = 3.79$, $p = .056$, $\eta_p^2 = 0.05$. In contrast, the interaction between both factors was significant, $F(2,138) = 4.07, p = .019, \eta_p^2 = 0.06$, indicating that the direction of the self-reference effect was modulated by the type of word. Therefore, in EL words, participants responded faster in the "my" condition (M = 1158) than in the "the" condition (M = 1231). The difference between the "my" and the "the" condition was not significant in either EM words (M = 1056 and M = 1080 for the "my" and the "the" conditions, respectively) or neutral words (M = 1281 and M = 1259 for the "my" and the "the" conditions, respectively). On the other hand, while in the "my" condition, there were differences between the three types of words, with faster responses to EM words, followed by EL words and then neutral words, in the "the" condition, the difference between EL and neutral words was not significant.

The analysis on negative words showed a significant effect of type of word, $F(2,138) = 28.13, p < .001, \eta_p^2 = 0.29$. Bonferroni post-hoc tests revealed that participants responded faster to EM words (M = 1177) than to EL words (M = 1246) and neutral words (M = 1363). The difference between the last two types of words was also significant. The effect of self-reference was significant too, $F(1,69) = 12.81, p = .001, \eta_p^2 = 0.16$, because participants were faster in the "the" condition (M = 1233) than in the "my" condition (M = 1291). In contrast, the interaction between both factors failed to reach significance, $F(2,138) = 1.73, p = .181, \eta_p^2 = 0.02$.

3.2. Valence rating task

The dependent variable was the valence score given by the participants to each word (see Table 3).

The analysis involving positive words revealed a significant effect of type of word, $F(2,138) = 585.56, p < .001, \eta_p^2 = 0.90$. Bonferroni post-hoc tests showed that valence ratings were higher for EM words (M = 7.70) than for EL words (M = 6.99) and neutral words (M = 5.53). The

Table 2
RTs (mean and standard deviation in ms) by condition in the affective evaluation task.

	Positive words		Negative words	
Word type	MI (*my*)	EL/LA (*the*)	MI (*my*)	EL/LA (*the*)
EM	1056 (210)	1080 (211)	1190 (251)	1163 (247)
EL	1158 (261)	1231 (284)	1273 (270)	1220 (274)
Neutral	1281 (346)	1259 (319)	1409 (376)	1317 (342)

Table 3
Valence ratings (mean and standard deviation) by condition in the valence rating task.

	Positive words		Negative words	
Word type	MI (*my*)	EL/LA (*the*)	MI (*my*)	EL/LA (*the*)
EM	7.73 (0.73)	7.67 (0.66)	2.18 (0.73)	2.16 (0.73)
EL	7.11 (0.77)	6.87 (0.75)	2.85 (0.80)	2.64 (0.83)
Neutral	5.81 (0.59)	5.25 (0.36)	5.56 (0.59)	5.23 (0.42)

difference between the last two types of words was significant too. The effect of self-reference was also significant, $F(1,69) = 38.48$, $p < .001$, $\eta_p^2 = 0.36$, where words preceded by "my" were rated higher (M = 6.88) than those preceded by "the" (M = 6.60). These main effects were qualified by an interaction, $F(2,138) = 11.89$, $p < .001$, $\eta_p^2 = 0.15$, indicating that the difference between the "my" and "the" conditions was significant for EL and neutral words ($p = .006$ and $p < .001$, respectively), but not for EM words.

The analysis of negative words showed a significant effect of type of word, $F(2,138) = 631.25$, $p < .001$, $\eta_p^2 = 0.90$, indicating that EM words (M = 2.17) were rated as more negative than EL words (M = 2.75). Neutral words (M = 5.39), in turn, differed from both EM words and EL words. The effect of self-reference was significant too, $F(1,69) = 15.00$, $p < .001$, $\eta_p^2 = 0.18$, where words preceded by "the" (M = 3.35) were rated as more negative than words preceded by "my" (M = 3.53). The interaction also reached statistical significance, $F(2,138) = 4.25$, $p = .016$, $\eta_p^2 = 0.06$, indicating that the difference between the "my" and the "the" condition was significant for EL and neutral words ($p = .022$ and $p < .001$, respectively) but not for EM words.

3.3. Free recall task

The dependent variable was the number of correctly remembered words. Of note, when the error was a clear typo (e.g., the transposition of two letters, or the lack of an accent mark), that word was considered as correct. If participants put the determiner before the noun, the determiner was ignored but the noun was computed as correct (see Table 4).

The analysis of positive words showed a significant effect of type of word, $F(2,138) = 8.64$, $p < .001$, $\eta_p^2 = 0.11$. Bonferroni post-hoc tests showed that EM words (M = 1.78) were better remembered than neutral words (M = 1.29, $p < .001$). However, the differences between EM words and EL words (M = 1.51) and EL words and neutral words were not significant ($p = .090$ and $p = .157$, respectively). Neither the effect of self-reference, $F(1,69) = 0.01$, $p = .920$, $\eta_p^2 < 0.001$, nor the interaction, $F(2,138) = 1.20$, $p = .305$, $\eta_p^2 = 0.02$, showed statistical significance.

The analysis of negative words revealed a significant effect of type of word, $F(2,138) = 31.97$, $p < .001$, $\eta_p^2 = 0.32$, indicating that EM words (M = 1.62) were better remembered than both EL words (M = 0.77, $p < .001$) and neutral words (M = 0.86, $p < .001$). But the difference between these last two types of words was not significant ($p = 1$). The effect of self-reference was also significant, $F(1,69) = 4.73$, $p = .033$, $\eta_p^2 = 0.06$. Bonferroni post-hoc tests showed that words preceded by "my" (M = 1.17) were better remembered than words preceded by "the" (M = 1.00, $p < .033$). In contrast, the interaction was not significant, $F(2,138) = 1.78$, $p < .172$, $\eta_p^2 = 0.03$.

Table 4
Items correctly recalled (mean and standard deviation) by condition in the free recall task.

	Positive words		Negative words	
Word type	MI (*my*)	EL/LA (*the*)	MI (*my*)	EL/LA (*the*)
EM	1.74 (1.24)	1.81 (1.20)	1.77 (1.12)	1.47 (1.07)
EL	1.41 (1.04)	1.60 (1.12)	0.74 (0.83)	0.80 (1.03)
Neutral	1.40 (1.06)	1.17 (0.92)	1.00 (0.92)	0.71 (0.84)

4. Discussion

Building on previous research outlined in the introduction, this study investigated the interaction between emotion and self-reference in the affective HisMine paradigm (Herbert, 2022 for an overview), by exploring, for the first time, the distinction between EM and EL words. Participants performed an affective evaluation task, a valence rating task and a free recall task. We predicted: 1) An advantage for emotional (positive and negative) words compared to neutral words, 2) an advantage for emotional (mostly positive words) encoded in the self-reference condition compared to the no-reference condition, and a 3) a larger self-reference advantage for EM words compared to EL words. In line with the first prediction, both positive and negative words were responded faster in the affective evaluation task and better remembered in the free recall task (especially in the EM condition) than neutral words. In line with the second prediction, self-reference facilitated the processing of positive words. That is, when the emotional words were positive, self-reference produced an advantage in affective processing, and lead to more extreme (more positive) valence ratings, although it did not affect recall. In contrast, self-reference did not facilitate the processing of negative words, lead to less extreme (less negative) valence ratings and to an increased recall. Finally, contrary to the third prediction, self-reference effects were restricted to EL words (and neutral words in some cases), while EM words were not affected.

The results are consistent with previous findings regarding the effects of emotional content in language processing. Emotional (both positive and negative) words were responded faster than neutral words in the affective evaluation task. This advantage aligns with the model of motivated attention and affective states (Lang et al., 1990), according to which emotional stimuli (both positive and negative) have a strong motivational relevance due to their crucial role in survival. Consequently, they are attended preferentially during processing, leading to faster responses. Alternative proposals predict the same result but suggest a different mechanism for the facilitated processing of positive and negative words. On the one hand, the positive advantage has been attributed to a human bias towards processing positive information (Walker et al., 2003). This bias may reduce the recognition threshold for positive words compared to neutral words, resulting in faster reaction times. On the other, the automatic vigilance hypothesis (Pratto & John, 1991) could explain the negative advantage. This hypothesis proposes that negative stimuli capture attention more easily due to their relevance to survival (i.e. there is an evolutionary tendency to avoid threats and dangers). It takes time for attention to disengage from negative stimuli, which slows down other parallel tasks. This is the cause of the processing disadvantage for negative words observed in tasks like the LDT (e.g., Haro et al., 2024; Kuperman et al., 2014; Yao et al., 2016). In contrast, when the task is focused on emotional content, like in the affective evaluation task used here, an advantage for negative words is expected (because participants' attention has been already captured by the affective content of negative words, Estes & Verges, 2008).

Notably, the emotional facilitation in the affective evaluation task was higher for EM words than for EL words (both positive and negative), suggesting a closer link between EM words and emotions (Altarriba & Basnight-Brown, 2011). This advantage may have been enhanced by the instructions focusing participants on the feelings provoked by words rather than their meanings (see the instructions in Appendix 1 and Ferré et al., 2022, for evidence of the impact of these two types of instruction on affective ratings). This is because EM words appear to be more closely linked to feelings and bodily sensations than EL words (Betancourt et al., 2024). Had the instructions focused on the meaning of the words (i.e., asking participants to decide whether the word was positive or negative, rather than whether it provoked a positive or negative feeling in them), the difference between the words EM and EL could have been reduced.

The advantage for emotional words in the free recall task is also consistent with previous findings. Many studies have demonstrated that both positive and negative words are prioritized in memory over neutral words (see Gao et al., 2024, for a review). This may be a consequence of emotional stimuli capturing attention due to their relevance to survival (Lang et al., 1990). This would lead to both facilitated processing in the affective evaluation task and better memory. This attention-mediated account of the emotional enhancement of memory applies mostly to positive words, while the effect of negative valence on memory is not completely mediated via attention (Talmi et al., 2007). This was confirmed by Kang et al. (2014), who examined the effects of arousal (by comparing negative/positive arousing words to negative/positive non-arousing words) and valence (by comparing negative/positive non-arousing words to neutral words) and tested two different encoding conditions: full-attention and divided-attention. The valence effect disappeared in the divided-attention condition, but the arousal effect was maintained for negative (but not positive) words. These results suggest that the memory advantage produced by arousal, when it is associated to a negative valence, is due to automatic encoding processes. These stimuli would be processed automatically and rapidly through a neural route that involves the amygdala-hippocampus network (Talmi et al., 2007). In contrast, the valence advantage is due to controlled encoding processes, like rehearsal and elaboration of information, mediated by the prefrontal cortex-hippocampus network (Kensinger & Corkin, 2004). The results of the recall task do not allow us to draw any conclusions about the underlying mechanisms because this study was not designed to address this issue. However, a notable finding was that an emotional advantage in memory was observed for EM words, but not EL words. One possible reason for this is that the relationship with emotions, and therefore the impact on memory, is more direct for EM words than for EL words, as above discussed (Altarriba & Basnight-Brown, 2011). Alternatively, EM words may be better remembered due to their semantic relatedness, a factor known to influence memory (see Ferré et al., 2015).

The self-reference effect described in the literature was also observed in this study (e.g., Chen et al., 2014; Fields et al., 2019; Herbert et al., 2018; Soares et al., 2019; Weis & Herbert, 2017). Positive words were categorized faster as positive and received higher valence ratings when preceded by “my” than by “the”. These findings are consistent with a self-positivity bias, which may be explained by mood congruent processing, assuming that positive mood is normal for healthy individuals (Mezulis et al., 2004; Pahl & Eiser, 2005). This bias was also evidenced by the faster classification of positive words when they were preceded by briefly presented self-related (compared to other-related) primes (Chen et al., 2014; Soares et al., 2019); by the smaller N400 (indicating a better integration) elicited by positive words when presented in self-relevant contexts compared to other-relevant contexts (Fields & Kuperberg, 2015); and by the self-reference modulation of the amygdala activation elicited by positive words (Herbert et al., 2011). All these findings, together with the present results, suggest that positive information is expected in self-relevant contexts. This leads to a better integration and consequently, to a faster processing. With regard to negative words, self-reference did not facilitate processing in the affective evaluation task. However, it led to more positive ratings in the valence rating task and improved recall. These findings suggest that self-reference affects positive and negative words differently, as previous research has suggested (e.g., Herbert et al., 2018; Soares et al., 2019; Weis & Herbert, 2017). However, the inability to match positive and negative conditions across all relevant variables means we must be cautious about drawing conclusions. Finally, the results of the valence rating task revealed an unexpected finding: neutral words were rated as more positive in the self-reference condition. One possible reason for this is that the determiner “my” has positive connotations because it refers to oneself, and that these connotations extend to the accompanying neutral nouns. This may partly explain the results obtained with positive words: processing positive nouns may be facilitated by the previous presentation of “my”, provided it is also positive, suggesting an affective priming effect [2] (e.g., Spruyt et al., 2002). This possibility should be explored in future studies that collect separate valence ratings of determiners and nouns.

The self-reference effect was modulated by word type. The main novelty of this work was the distinction between EM and EL words. EM words name emotions, and they are more associated with feelings and internal bodily sensations than EL words (Betancourt et al., 2024; Ferré, Guasch, et al., 2024). Hence, EM words might be able to activate self-referential information more strongly than EL words. Considering that, we predicted that self-reference effects would be larger for the former, compared to the latter. However, the results were the opposite. Neither RT in the affective evaluation task, nor valence ratings of EM words were influenced by self-reference. That is, these words exhibited the same performance regardless of whether they were in the self-reference or in the no-reference condition. This applies to both positive and negative words. This pattern contrasts with EL words, the emotional effects of which were modulated by self-reference.

A possible reason of the lack of self-reference effects on EM words (when compared to EL words) is that these words are already prioritized in processing. Differences in processing between EM and EL words have been consistently reported, with EM words showing larger and/or earlier neural responses (ERP) compared to EL words (e.g., Zhang et al., 2017). Furthermore, speakers need less time to make lexical decisions (i.e., to decide whether a stimulus is a real word or not, Kazanas & Altarriba, 2015) or affective evaluations (Zheng et al., 2024) about EM words than EL words. This processing advantage may leave no room for further facilitative effects. This fact might explain the null self-reference effects for EM words in the affective evaluation task, but its role on the valence rating task is less clear. Another possible reason of the null self-reference effects in EM words is that these words are already processed in relation to the self, regardless of the determiner that precedes them. Considering that EM words are strongly linked to bodily reactions and feelings (Ferré, Guasch, et al., 2024), their presentation would rapidly activate emotional reactions and personal experiences (i.e., self-referential information). Therefore, the previous presentation of the first-person possessive pronoun would not add anything, because self-related information is already activated. In contrast, EL words, with less stronger connections to bodily reactions and feelings, would not be able to elicit self-related information to the same extent, unless they are explicitly presented in a self-reference context.

This study has some limitations that need to be discussed. Firstly, it was not possible to match positive and negative words across all the relevant variables. The reason was that, compared to previous studies (e.g., Herbert et al., 2011; Weis & Herbert, 2017), our study included an additional factor: type of word (EM-EL). This had not been assessed in any previous study and was therefore the main novelty and focus of interest in this work. Consequently, we prioritized matching EM and EL (and the corresponding neutral) words over matching positive and negative words, as valence effects were already a well-established issue in the self-reference literature. Consequently, we analysed positive and negative words separately. Other analytic procedures (e.g., linear mixed-effects models) would allow these two types of words to be analysed together. However, our design is not fully factorial, but includes nesting instead. Specifically, we included EM, EL, and neutral word types. EM and EL words were evenly distributed across positive and negative emotional valence levels, but neither EM nor EL words were neutral. This structural constraint prevented full crossing of the word type and valence factors. Specifically, including neutral words as a level of the word type factor requires positive and negative items to be analysed separately. Alternatively, if positive and negative words were analysed together, the dataset would need to be restricted to EM and EL items only. Therefore, we must exercise caution when drawing conclusions about valence effects (i.e., the different pattern of results for positive and negative words) because they may be influenced by characteristics of the words other than emotional content. However, it should be noted that the pattern of findings we observed (i.e. facilitated processing of positive words, but not negative words, in the self-

[2] We thank an anonymous reviewer for suggesting this.

reference condition) is similar to that obtained in studies which matched positive and negative words across all the relevant variables (e.g. Chen et al., 2014; Herbert et al., 2011; Herbert et al., 2018; Soares et al., 2019; Weis & Herbert, 2017).

A second limitation relates to the affective evaluation task. Some participants had to be excluded due to a high percentage of errors. It is important to note that, in this task, the term 'error' does not have the same meaning as in traditional accuracy-based tasks, where participants can provide incorrect responses. These errors are not objective (as would be the case in a lexical decision task, for example, where a participant incorrectly identifies a non-word as a real word). Instead, these 'errors' reflect subjective interpretations that vary between individuals. In other words, an error indicates that a participant's response does not align with the normative valence classification (positive, negative, or neutral). Reaction times corresponding to these mismatched responses should not be included in the analyses, as this would compromise the validity of category-level comparisons. This is why such responses, and participants with a high proportion of them, were excluded. One possibility for not discarding these data would have been to conduct the analyses for each participant according to their own classification, rather than relying on normative data. However, this would have resulted in a different number of items per condition, which would have complicated the analyses. Therefore, we opted for the standard approach in emotional language research: to define the valence factor (and analyse its effects) according to the normative values of positive, negative and neutral words.

A final limitation relates to the free recall task. Performance was very low. In fact, the quantity of words remembered was similar to that observed in studies using the same paradigm, even when considering that these studies were conducted in other languages (e.g. Herbert et al., 2011). The number of words recalled is also similar to that reported in studies that relied on incidental encoding tasks but not the HisMine paradigm (e.g. Ferré et al., 2015). Notably, however, this did not prevent us from achieving some significant results in our study. For instance, a clear distinction was observed between EM and EL words, with the former demonstrating superior memory performance. To explore the generalisability of these results, we conducted an item analysis which failed to reveal a clear effect of any of the involved factors. This suggests that participants tended to remember the same few words. Of note, this affected all conditions equally. Therefore, the results of the free recall task should be interpreted with caution. To increase performance and examine the replicability of the findings obtained here, future studies should rely on intentional encoding tasks and/or use recognition instead of recall. On the other hand, the HisMine paradigm, as used in this study and in previous research (see Herbert, 2022, for a review), comprises an affective evaluation task and a valence rating task. These tasks constitute the encoding phase of the unexpected recall task. Therefore, attention was focused on the content of emotional words during encoding, which may have boosted the emotional advantage observed in memory. Further research should examine the generalisability of these findings by comparing them with those from encoding tasks not focused on emotion (e.g., driving participants' attention to the formal aspects of words, such as the number of letters, or semantic aspects, like concreteness). It would also be interesting to compare the impact of feeling-focused instructions and meaning-focused instructions (Ferré et al., 2022) on the EM-EL differential effects.

To conclude, both emotional content and self-reference influenced word processing and memory, with different effects observed for EM and EL words. These findings add to the literature about the modulation of emotional word processing by self-reference. They also show the convenience of studying EM and EL words separately, because the distinction between naming and emotion (EM words) and eliciting-but not naming-an emotion (EL words) seems to have consequences for cognitive processing.

CRediT authorship contribution statement

Pilar Ferré: Writing – original draft, Supervision, Project administration, Funding acquisition, Conceptualization. **Marc Guasch:** Writing – review & editing, Visualization, Validation, Software, Project administration, Methodology, Investigation. **Cornelia Herbert:** Writing – review & editing, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix 1. Spanish instructions for the affective evaluation task (above) and their translation in English (below)

A continuación, se te presentarán una serie de palabras. Algunas de estas palabras irán precedidas por "mi" (por ejemplo, "mi perro"), indicando que DICHAS PALABRAS SE REFIEREN A TI MISMO. Otras irán precedidas por "el, la" (por ejemplo, "la casa"), y por tanto NO SE REFIEREN A NADIE EN PARTICULAR. Tu tarea consiste en decir si cada palabra TE PROVOCA UN SENTIMIENTO positivo (agradable), negativo (desagradable) o neutral (ni positivo ni negativo).

Para dar tus respuestas utilizarás las flechas del teclado, de modo que debes apretar la tecla:

▸ *si la palabra te provoca un sentimiento positivo,*

◂ *si te provoca un sentimiento negativo,*

▾ *si no te provoca ni un sentimiento positivo ni negativo, es decir neutral.*

Ten en cuenta que no hay respuestas correctas o incorrectas y que debes dar tus valoraciones DE FORMA ESPONTÁNEA Y LO MÁS RÁPIDO POSIBLE. No te lo pienses demasiado.

You will be presented with a series of words. Some of these words will be preceded by "my" (e.g., "my dog"), indicating that THESE WORDS REFER TO YOURSELF. Others will be preceded by "the" (e.g., "the house"), and therefore DO NOT REFER TO ANYONE IN PARTICULAR. Your task is to say whether each word PROVOKES a positive (pleasant), negative (unpleasant) or neutral (neither positive nor negative) FEELING IN YOU.

Use the arrows on the keyboard to give your answers, so you must press the key:

▸ if the word provokes a positive feeling in you,

◂ if the word provokes a negative feeling in you,

▾ if the word does not provoke in you either a positive or a negative feeling, i.e., neutral.

Keep in mind that there are no right or wrong answers and that you should make your assessments SPONTANEOUSLY AND AS QUICKLY AS POSSIBLE. Do not think too much about it.

Appendix 2. Spanish instructions for the valence rating task (above) and their translation in English (below)

A continuación, tendrás que evaluar las mismas palabras que acabas de ver, mediante los números del teclado del 1 al 9, basándote en la siguiente figura:

1	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
Completamente triste								***Completamente alegre***

Utiliza los valores del 1 al 9 para evaluar cada palabra en la dimensión AGRADO de acuerdo con los siguientes criterios:

Si la palabra te hace sentir ***completamente triste****, la evaluarás con un 1. Si te hace sentir* ***completamente alegre****, la evaluarás con un 9. Si no te hace sentir ni alegre ni triste, sino* ***neutral****, la evaluarás con un 5. Puedes utilizar otros valores si la palabra te hace sentir un poco triste (ej. 3) o un poco alegre (ej. 7). Observa que también puedes evaluar tu nivel de alegría o tristeza utilizando otros valores (2, 4, 6, 8).*

Recuerda que en esta tarea no hay respuestas correctas o incorrectas.

Next, you will have to rate the same words you have just seen, using the numbers on the keyboard from 1 to 9, based on the following figure:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Completely sad								**Completely happy**

Use the values from 1 to 9 to rate each word in the VALENCE dimension according to the following criteria:

If the word makes you feel **completely sad**, you will rate it with a 1. If it makes you feel **completely happy**, you will rate it with a 9. If it makes you feel neither happy nor sad, but **neutral**, you will rate it with a 5. You can use other values if the word makes you feel a little sad (e.g., 3) or a little happy (e.g., 7). Note that you can also rate your level of happiness or sadness using other values (2, 4, 6, 8).

Remember that there are no right or wrong answers in this task.

Data availability

The data that support the findings of this study are openly available in figshare at https://doi.org/10.6084/m9.figshare.28399502.v2.

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