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Normative ratings for perceptual and motor attributes of 750 object concepts in Spanish

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Abstract Subjective ratings of perceptual and motor attributes were obtained for a set of 750 concrete concepts in Spanish by requiring scale-based judgments from a sample of university students (N = 539). Following on the work of Amsel, Urbach, and Kutas (2012), the seven attributes were color, motion, sound, smell, taste, graspability, and pain. Normative data based on the obtained ratings are provided as a tool for future investigations. Additionally, the relationships of these attributes to other lexical dimensions (e.g., familiarity, frequency, concreteness) and the factorial organization of concepts around the main components were analyzed. The pattern of results is consistent with prior findings that highlight the relevance of dimensions related to survival as being crucially involved in conceptual processing.

Keywords Spanish norms · Ratings · Perceptual · Motor · Concepts · Survival

Normative studies of verbal materials are valuable resources in psycholinguistic and cognitive research, as they provide objective and subjective information about lexical and conceptual representations. Besides directly informing theoretical and applied developments in the field, these types of studies are very useful when trying to manipulate and control specific variables in experimental procedures. Numerous normative studies are available for several languages, abundantly for English (see Proctor & Vu, 1999, or Vaughan, 2004, for an overview), but increasingly more common for languages used in countries where substantial linguistic and psychological research is carried out, as is the case of Spanish, the native language of over 470 million people (Instituto Cervantes, 2015). Many normative studies and a large amount of data are available for a wide range of classic psycholinguistic variables (e.g., word frequency, word associations, affective values, orthographic and phonological structure, familiarity, imageability or concreteness) in several languages. And, in the last few years, new norms and rating studies for less common variables have made their appearance, in response to theoretical developments and the specific needs of some new lines of research.

One example of new developments in the publishing of norms is the recent focus on characterizing enactive, sensorial, and motor features of verbal stimuli, with the aim of examining if this type of characteristics play a role in linguistic and conceptual processing, and if so, the extent to which they have unique unmediated effects. Thus, norms have been developed for body–object interaction (BOI), which provide indexes reflecting the extent to which individuals can physically interact with an object using any part of their body (Bennett, Burnett, Siakaluk, & Pexman, 2011; Tillotson, Siakaluk, & Pexman, 2008), with empirical studies indicating that high values of BOI are indicators of facilitation in several word tasks involving both naming and lexical decision (e.g., Yap, Pexman, Wellsby, Hargreaves, & Huff, 2012), starting at early states of linguistic development (Inkster, Wellsby, Lloyd, & Pexman, 2016). Overall perceptual impact has been of interest

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to researchers studying lexical access, and sensory experience ratings (SER), reflecting the extent to which a word evokes a sensory and/or perceptual experience, have been collected for over 5,000 words in English (Juhasz & Yap, 2013) and for over 1,600 words in French (Bonin, Méot, Ferrand, & Bugaïska, 2015). Analyses of the effects of this variable have shown that it is a reliable predictor of lexical decision times (Bonin et al., 2015) and, also, that high SER is associated to words that are high in imageability and to words that are acquired early (Juhasz & Yap, 2013). Focusing on both perceptual and sensorimotor attributes of concepts, McRae, Cree, Seidenberg, and McNorgan (2005) collected semantic feature-production norms for 541 living (e.g., *dog*) and non-living (e.g., *chair*) concepts, which were then grouped into nine knowledge types: three corresponding to visual information (color, parts and surface properties, motion), four related to other sensory modalities (smell, sound, touch, taste), one corresponding to functional/motor information, and one corresponding to all other knowledge types. Medler, Arnoldussen, Binder, and Seidenberg (2005) collected ratings in four sensorimotor domains (sound, color, manipulation, and motion), plus emotion ratings, for 1,402 English words. And Lynott and Connell (2009) provided modality exclusivity norms for 423 object properties, including ratings across five sensory modalities (hearing, taste, touch, smell and vision). Besides providing a rich collection of user-defined conceptual attributes, this featural approach, with some variations and extensions (e.g., Devereux, Tyler, Geertzen, & Randall, 2014), has been very useful in the development and testing of models of semantic representation (e.g., Patterson & Lambon Ralph, 2016) or the study of semantic deterioration patterns associated to different types of brain damage (e.g., Catricalà et al., 2015). Expanding the scope of potentially useful characteristics, Amsel et al. (2012) have more recently provided a set of object-attribute ratings for a set of object concepts. In their study, each noun was rated using an 8-point scale on seven different attributes (color, motion, sound, smell, taste, graspability and pain) in addition to familiarity. Amsel et al. (2012) noted that their aim in extending the normative data available for object attributes with their contribution, was to highlight the correspondence of their selected attributes with the Aristotelian sensory modalities (vision, touch, hearing, smell and taste), as well as including a related sense, namely the likelihood that an object causes pain. Although some previous normative studies have taken account of perceptual attributes, the categories included by Amsel et al. (2012) are not limited to the most common ones, such as color, but encompass other, less studied attributes (e.g., smell or pain), and in that way they enrich the total database of available stimuli. Additionally, as demonstrated in the analyses accompanying their norms, the quantitative descriptions of these dimensions are useful in exploring the internal structure of knowledge representation in single concepts, the ways in which different types of knowledge are involved in lexical and semantic processing (see also Amsel, DeLong, & Kutas, 2015), and the potential relevance of specific conceptual attributes in terms of evolutionary advantages.

New perceptual and sensorimotor descriptions of word attributes and dimensions are potentially useful for having a more comprehensive characterization of concepts, and to foster investigation of their mental representation. One way in which advancement can proceed is by replication and extension studies focused on languages that have not been yet explored, and in this way making it possible for psycholinguistic knowledge to progress by the incorporation of additional researchers, materials, and samples into a developing area of scientific interest. An example of how increasing the range of languages can lead to significant progress in a particular language-related domain can be seen in studies of the effects of the age of word acquisition on linguistic and cognitive processing, with important contributions coming from researchers studying speakers of English (Morrison, Hirsh, & Duggan, 2003), French (Schwitter, Boyer, Méot, Bonin, & Laganaro, 2004), Spanish (Cuetos & Alija, 2003), or Italian (Colombo & Burani, 2002). And progress is also achieved when comparative or cross-linguistic approaches are adopted, with researchers contrasting different languages and providing critical evidence for common and differential mechanisms, often based on the analyses of patterns of congruency and variation. The merits of such a multilingual approach have been recently exemplified by the work of Łuniewska et al. (2016) on language-specific word acquisition ratings across 25 languages, by Rueckl et al. (2015) in their explorations of the neural structures subserving reading and speech perception in Spanish, English, Hebrew, and Chinese, or by Perry, Perlman, and Lupyan (2015) in their study of iconicity of verbs in English and Spanish.

With these ideas in mind, the objective of the present study was to obtain ratings in Spanish for the same attributes studied by Amsel et al. (2012), and to make that information available to researchers in linguistics and cognitive science who make use of verbal materials in Spanish. With increasing frequency, norms for lexical attributes of Spanish words have been assembled and made available to interested researchers, both in Spain and other Spanish-speaking countries. And normative data have been produced on traditionally used variables such as frequency (Cuetos, González-Nosti, Barbón, & Brysbaert, 2011), emotional valence (Guasch, Ferré, & Fraga, 2016), picture names (Manoiloff, Artstein, Canavoso, Fernández, & Segui, 2010), and age of acquisition (Alonso, Díez, & Fernandez, 2016; Alonso, Fernandez, & Díez, 2015). Norms more directly related to semantic aspects of stimuli have also been collected, and at present a sizable number of words are characterized in terms of their status as exemplars in natural categories (Marful, Díez, & Fernandez, 2015), semantic ambiguity (Haro, Ferré, Boada, & Demestre, 2017), or descriptive features (Vivas, Vivas, Comesaña, Coni, & Vorano, 2017). However, norms focusing on the perceptual and motor aspects of concepts are not available, limiting conceptual characterization and the types of research questions that can be pursued using Spanish linguistic materials. With the aim of remediating the situation as much as possible, and acknowledging that norms for more global indexes (i.e., BOI, SER) may also need to be developed, the present study focused on the more specific set of dimensions initially normed in English by Amsel et al. (2012), a set that, as we noted above, has already demonstrated to be a powerful bundle of properties in predicting and explaining semantic processing. With the further goal of facilitating validity checks and assessing the stability of the norms across the English and Spanish languages, the pool of 750 words normed for Spanish in the present study included the terms corresponding to the English words normed by Amsel et al. (2012).

Method

Participants A total of 558 undergraduate students of the Universities of Salamanca and La Laguna, Spain, participated in the study and received course credit for their contribution. The data from 19 participants (3.4%) were discarded: ten were not native speakers of Spanish; two could only complete a few trials (due to equipment malfunction); and, according to a preliminary data screening, seven participants (1.3%) showed inadequate performance on the task, detected according to at least one of three criteria—namely 20 or more trials in a row with the same response (four participants), 50 or more responses made in less than 1 s (no participants), or frequent extreme response latencies (in excess of two standard deviations from the mean times on 50 trials or more; three participants). Thus, the final sample consisted of 539 participants (441 female), self-declared native Spanish speakers, between 18 and 45 years of age ($M = 20.3$, $SD = 2.73$).

Stimuli Spanish nouns denoting 750 object concepts were used as the target set in the study. The 559 words provided by Amsel et al. (2012) were translated into Spanish and included in our study. In some cases, two or more English terms necessarily led to the same translation (e.g., both "squirrel" and "chipmunk" are translated as *ardilla*). As a result, 537 of this initial set of words remained in our study. Additionally, we also included 213 new nouns obtained from a pool of words normed for BOI (Alonso, Díez, Díez, & Fernandez, 2016) that also had available naming (Davies, Barbón, & Cuetos, 2013) and lexical decision times (González-Nosti, Barbón, Rodríguez-Ferreiro, & Cuetos, 2014), for their relevance for planned data analyses. Exemplars from the entire range of BOI values and of varied semantic categories (e.g., animals, vehicles, clothes, musical instruments, places, food) were included. The 750 resulting words were divided in three sets of 250 words, each containing stimuli from all the described sources.

Procedure With the intention of minimizing potential effects of cross-dimension contamination and task order effects on the ratings, participants were randomly assigned to rate words in only one of the seven dimensions (color, motion, sound, smell, taste, graspability and pain) for the 250 words in a given set. The rating instructions used by Amsel et al. (2012) were translated into Spanish (see the exact instructions in the Appendix), and an 8-point rating scale was used for each question. The data were collected using two similar systems: the first set of words were rated using Online Ratings of Visual Stimuli (OR-Vis), an open-source software tool (Hirschfeld, Bien, de Vries, Lüttmann, & Schwall, 2010), and Sets 2 and 3 were implemented using identical applications programmed in jsPsych (de Leeuw, 2015), a JavaScript library for creating behavioral experiments in a Web browser. This change was due to the fact that our OR-Vis application depended on a server that became no longer operational as the study progressed. Groups of 15 to 25 participants performed the rating task at a time in a large computer room, using individual computers. After signing an informed consent form, participants provided demographic data, including information about their native language and knowledge of other languages, and then read their task instructions on the computer screen. After practice with a set of filler words, they performed the 250 rating trials, with words randomly presented. In each trial, the target noun was presented in the center of a computer screen and participants had to answer the appropriate question (e.g., *how intense is the color of this object?*). They were instructed to do so by selecting a single numeric character on a rating scale displayed on the computer screen, directly below the word to be rated, via mouse click. Verbal labels at both extremes reminded participants of the scale values. As in Amsel et al. (2012), an ordinal rating scale between 1 and 8 was used, to maximize reliability with a sufficient number of options, and to minimize the tendency toward neutral judgments likely in scales with an odd number of options. The stimuli were presented automatically and remained on the screen until a response was entered, with participants advised to answer quickly, but as accurately as possible. The duration of the experimental sessions was between 25 and 40 min.

Results and discussion

Each noun in the stimulus set was assigned an average rating for each of the selected attributes. These values were computed from the ratings provided in the seven tasks performed by the participants in the present study, with an average of 26 and a minimum of 23 valid observations for each word in each task. To keep the parallelism with the analyses reported by Amsel et al. (2012), familiarity values ranging from 1 to 7, extracted from the EsPal database (Duchon, Perea, Sebastián-Gallés, Martí, & Carreiras, 2013), were included in the data analyses reported below.

The stimuli were well distributed along the rating scales (see Table 1), and the average scores showed variability, with some items clearly representing extreme examples in each judged dimension (see Table 2). As is shown in Fig. 1, the distribution of the ratings in each attribute was positively skewed, except in the cases of *graspability* and *familiarity*, which were negatively skewed. These distributions are quite similar to those reported by Amsel et al. (2012), with the exception of the distribution of graspability scores, which in the present study shows a particularly high frequency for the maximum rating. It is reasonable to assume that this specific finding is related to the fact that the stimulus set included many nouns corresponding to objects with which we interact physically, in many cases with our hands.

The complete set of attribute ratings for the 750 stimuli is available for downloading from the journal website as supplementary materials (ConceptAttributesSpanish.xlsx). The file includes a column listing the 750 Spanish nouns corresponding to the concepts, with a twin column listing the English translation of those nouns. In adjacent columns, and for each concept, the mean rating (e.g., *color_m*) and the corresponding standard deviation (e.g., *color_sd*) for each attribute are provided. In addition, BOI scores (from Alonso, Díez, Díez, & Fernandez, 2016), concreteness and imageability indexes from the EsPal database (Duchon et al., 2013), as well as categorical information[1] (from Marful et al., 2015), are provided. Finally, the principal component scores for the two extracted components (see below) are provided for each concept.

To assess interrater reliability (see Table 3), the intraclass correlation (ICC) was calculated for each rated dimension (two-way random consistency model). The ICC value for color was relatively low, which may be related to the fact that particular tokens of object categories are more likely to vary in color than in other dimensions. Otherwise, the mean ICC of .59 (range = .37 to .75) indicated a good overall interrater reliability (Hallgren, 2012). Additionally, Cronbach's alpha was calculated for each rated dimension, with values ranging from .93 to .99, indicating very good internal consistency. An estimation of validity was obtained by selecting the set of stimuli normed by Amsel et al. (2012) and determining the Pearson correlation for each attribute among the 537 shared items. As can be seen in Table 4, the correlations were significant and rather large for all the rated attributes.

The complete set of intercorrelations among the seven rated attributes, plus familiarity, is presented in Table 5. A moderate correlation (r = .54, p < .01) was found between taste pleasantness and smell intensity, reflecting an association between the two conceptual properties, which makes particularly good sense when it comes to foods. Another moderate correlation was observed between pain and sound intensity (r = .56, p < .01). It is interesting that graspability correlates negatively (p < .01) with both pain (r = – .20) and sound intensity (r = – .46), suggesting that, in general, loud objects are likely to produce damage, and therefore are relatively unlikely to be grasped. In addition, the correlation between sound intensity and visual motion (r = .39, p < .01) indicates that loud objects are more likely to be in motion. These patterns of correlation were also present in Amsel et al.'s (2012) data, with similar r values. In general, all moderate and high intercorrelations were the same in both studies, and only a few low correlations were slightly different. The most remarkable case of a difference was color vividness. This dimension correlated significantly with motion in our study (r = .28, p < .01), but not in Amsel et al. (2012). Additionally, it correlated negatively with pain in Amsel et al.'s (2012) norms (r = – .21), but not in the present study (r = – .04, p = .23).

Principal components analysis

The presence of a substantial number of significant intercorrelations in the collected data suggests the existence of latent factors among the attributes and, for this reason, a principal components analysis (PCA) was conducted. A PCA with varimax rotation including only the seven dimensions rated by the participants in this study showed two factors with eigenvalues greater than 1, which explained 31.5% and 26.9% of the variance, respectively. Interestingly, Amsel et al. (2012) also obtained a two-factor solution in their PCA, and both factors involved the same attributes, with similar loadings, in the two studies, even though our study was conducted in a different language, with an extended set of concepts, and with a procedural variation that asked each participant to provide ratings in only one dimension. Amsel et al. (2012) interpreted their two factors as being related to survival. Factor 1, labeled "avoiding death," included, in general, objects that were loud, unlikely to be grasped, and likely to be in motion and cause pain (potentially dangerous or harmful objects; e.g., *tank*, *train*). Factor 2, labeled "locating nourishment," included objects with good taste, vivid colors, and a strong smell (mostly foods; e.g., *strawberry*, *apple*). In this interpretation, both factors reflect aspects that are of a vital importance for the survival of living beings, and therefore of critical importance for both humans and other animals (see Fig. 2). Since the results of our own PCA revealed the existence of two factors

[1] In the case of items pertaining to more than one category, the category reported was the one in which the items had the highest frequency of production and the earliest output position.

Table 1 Mean and range of ratings for each attribute, plus familiarity from the EsPal database for the 482 shared items

	Color	Motion	Graspability	Pain	Sound	Taste	Smell	Familiarity
Mean	4.16	3.81	5.07	3.11	2.95	3.12	3.22	5.63
Min	1.54	1.08	1.00	1.08	1.00	1.06	1.00	2.47
Max	7.71	7.65	7.96	8.00	7.88	7.97	7.36	7.00

involving the same attributes, and with similar loadings (see Fig. 3 for a graphical representation of the loadings of the seven attributes, and Table 6 for the exact values), they can be considered a replication of the factorial organization unveiled by the earlier analyses of Amsel et al. (2012) in a different linguistic context, and can be interpreted in a similar way. Additional comparisons with other psycholinguistic variables, described below, further support the relation of these factors to survival aspects.

Relation to other variables

The ratings in the seven perceptual and motor attributes of the 750 words included in the present study were submitted to correlational analyses with objective and subjective lexical descriptors for the same set of words in other available sources. The correlations between the present ratings and objective variables, such as word frequency (from the EsPal database; Duchon et al., 2013; shared $n = 748$), oral frequency (from Alonso, Fernandez, & Díez, 2011; shared $n = 652$), naming response times (from Davies et al., 2013; shared $n = 405$), orthographic neighbors, number of letters, and number of syllables (extracted from EsPal; Duchon et al., 2013; shared $n = 748$) were low and mostly not significant (see Table 7). It is worth noting, however, that lexical decision times (LDT; from González-Nosti et al., 2014; shared $n = 405$) correlated negatively with color ($r = -.11, p = .02$), motion ($r = -.10, p = .04$), taste pleasantness ($r = -.21, p < .01$), and smell intensity ($r = -.17, p < .01$), revealing that these properties show a tendency toward faster processing, perhaps for adaptive reasons. This might reflect the fact that object concepts with a more pleasant taste, a more intense smell, and more vivid colors—for example, foods—are processed faster than neutral words, because they capture more our attention due to being adaptively important (see Kousta, Vinson, & Vigliocco, 2009). In contrast, the likelihood of pain showed a low positive correlation with LDTs ($r = .10, p = .04$).

To test the unique predictive value of the five dimensions that showed significant correlations with LDTs, a hierarchical regression analysis was conducted (summarized in Table 8). In the first step, three typical control variables were entered as predictors (written frequency, length, and number of orthographic neighbors), and only frequency and length were significant predictors of LDTs, $F(3, 401) = 83.99, p < .001, R^2 = .38$, 95% CI [.31, .46]. The five dimensions were added in successive steps, according to the magnitude of their correlations with LDTs. The only dimensions that showed significant effects were taste pleasantness and smell intensity, which were added in Steps 2 and 3: $F(4, 400) = 73.31, p < .001, \Delta R^2 = .04$, 95% CI [.35, .49], and $F(5, 399) = 61.06, p < .001, \Delta R^2 = .01$, 95% CI [.37, .51], respectively. As is shown in Table 8, analysis of variance comparisons between the models of Steps 1, 2, and 3 also showed significant increases in R^2 for the regression models that included those two dimensions.

Besides the correlations with familiarity reported in Table 5, the perceptual and motor values reported here showed moderate correlations with various other subjective variables in common use in psycholinguistics (see Table 7). For instance, concreteness from the EsPal database (Duchon et al., 2013; shared $n = 482$) correlated with color ($r = .17, p < .01$), motion ($r = .16, p < .01$), graspability ($r = .10, p = .02$), taste pleasantness ($r = .10, p = .03$), and smell intensity ($r = .20, p <$

Table 2 Examples of stimuli at both extremes of the rating scale, for the seven attributes plus familiarity from the EsPal database, for the 482 shared items

Attribute	Lowest Items	Highest Items
Color vividness	survey, list, wind	highlighter, lava, sun
Visual motion	wall, tower, balcony	falcon, horse, dolphin
Graspability	village, horizon, rainbow	glass, comb, coin
Likelihood of pain	rainbow, butterfly, pajamas	missile, machine gun, bomb
Sound intensity	cell, germ, eggplant	cannon, avalanche, bomb
Taste pleasantness	ashtray, drain, toilet	peach, pie, cake
Smell intensity	sign, knot, thread,	pig, skunk, cigarette
Familiarity	saddle, cloak, duke	telephone, elevator, shower

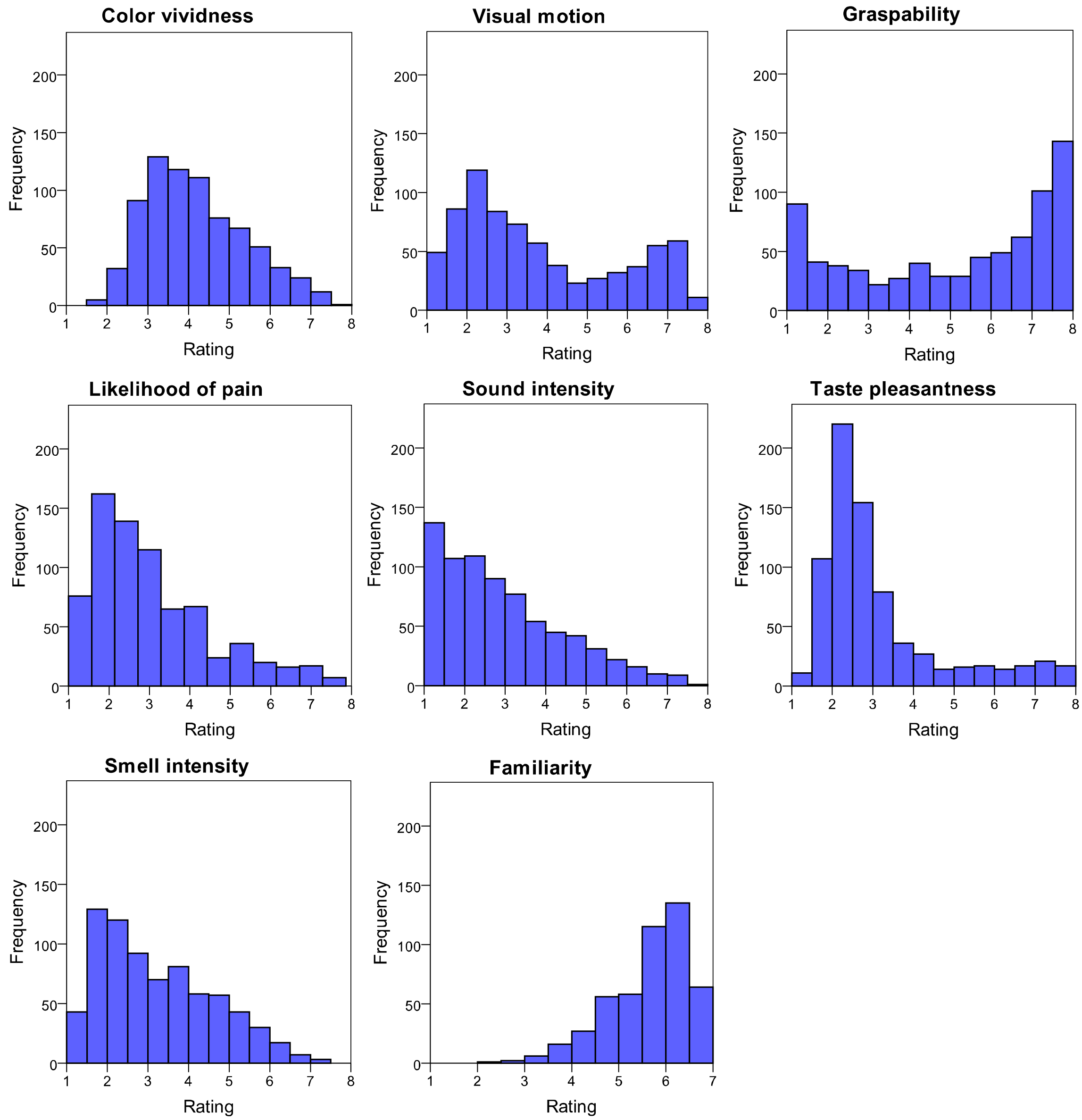

Fig. 1 Distributions of attribute ratings. All scores on a 1–8 scale, except for familiarity (rated on a 1–7 scale in the EsPal database)

.01). Imageability, also from the EsPal database (Duchon et al., 2013; shared $n = 472$), correlated with color vividness ($r = .20$, $p < .01$), motion ($r = .12$, $p = .01$), graspability ($r = .19$, $p < .01$), taste pleasantness ($r = .11$, $p = .02$), and smell intensity ($r = .14$, $p < .01$). And moderate significant correlations were found between subjective age-of-acquisition (AoA) ratings (from Alonso et al., 2015; shared $n = 616$) and color vividness ($r = -.22$, $p < .01$), motion ($r = -.17$, $p < .01$), graspability ($r = -.21$, $p < .01$), pain ($r = .08$, $p = .04$), taste pleasantness ($r = -.21$, $p < .01$), and smell intensity ($r = -.17$, $p < .01$).

More interestingly, the perceptual and motor ratings showed significant correlations with BOI ratings available for the 342 shared items (obtained from Alonso, Díez, Díez, & Fernandez, 2016). For example, a high correlation was found between BOI scores and graspability ($r = .75$, $p <$

Table 3 Interrater reliability (intraclass correlation and Cronbach's alpha) by dimension

	Color	Motion	Grasp	Pain	Sound	Taste	Smell	MEAN
ICC	.37	.67	.75	.57	.62	.62	.49	.59
Cronbach's alpha	.93	.98	.99	.97	.98	.98	.96	.97

Table 4 Correlations between ratings in the study and ratings in Amsel et al. (2012), based on values for the 537 shared items

	Color	Motion	Graspability	Pain	Sound	Taste	Smell
Pearson correlation	.79	.92	.91	.91	.90	.91	.86

All correlations were significant, $p < .01$

.01), since our bodies frequently interact with objects via our hands, and negative correlations between BOI scores and both motion ($r = -.11$, $p = .04$) and sound intensity ($r = -.16$, $p < .01$) were found, suggesting that loud objects, likely to be in motion, are relatively unlikely to be physically interacted with or even avoided as dangerous. It is worth noting, in this regard, that when estimated for a set of 39 items shared (via translation) with a set of norms for subjective danger in nouns (Wurm, 2007), danger correlated significantly with pain ($r = .81$, $p < .01$) and sound intensity ($r = .37$, $p = .02$), and negatively with graspability ($r = -.33$, $p = .04$). Finally, an analysis based on a set of 660 viable items revealed a pattern of correlations in which some attributes were significantly related to emotional aspects of the concepts (estimated from normative data provided by Stadthagen-Gonzalez, Imbault, Pérez Sánchez, & Brysbaert, 2017). Specifically, concepts with higher values in the dimensions of likelihood of pain and sound intensity tended to have a more negative valence (*r*s = –.49 and –.12, respectively) and a higher level of arousal (*r*s = .61 and .37, respectively), all *p*s < .01. Likewise, reflecting another joint trend in the data, some attributes were likely to be possessed by concepts with a positive emotional valence—namely, color vividness ($r = .30$, $p < .01$), taste pleasantness ($r = .38$, $p < .01$), and smell intensity ($r = .18$, $p < .01$).

Conclusion

The present study provides ratings for seven perceptual and motor attributes in a set of 750 Spanish concrete nouns, a dataset with a high level of internal consistency and validity. In addition, and with the aim of further describing the stimuli set, correlations between these attributes and comparisons with other ratings are supplied. We think that the norms presented here may facilitate the manipulation and control of verbal stimuli in Spanish, which can be used in the design of empirical work by researchers interested in the study of concept representation, semantic memory, and other issues regarding human cognition. The set of normed stimuli is relatively large, although somehow restricted in the sense that it only included nouns. Since other types of words such as verbs, adverbs and adjectives have a strong presence in language, and given that they also may imply perceptual and motor information, future studies collecting similar perceptual and motor information for other types of words might be of interest. Still, and given the lack of this type of information in Spanish, the norms as provided are likely to have a positive impact in a number of ways.

First, the availability of perceptual/motor quantitative indexes will permit the design of experiments that were not feasible until now by researchers operating with samples of Spanish-speaking participants. The fact that the set of 750 words normed here for perceptual and motor attributes have been extensively characterized in many other subjective and objective dimensions (frequency, categorical information, BOI, age of acquisition, etc.) increments its value as a research tool.

Second, new opportunities for cross-linguistic research can arise. In this regard, it is not a trivial issue that the present study replicated important results previously found by Amsel et al. (2012) for English in aspects such as the distributions of the attribute ratings, the pattern of correlations among attributes, and the emergence of the two primary dimensions that can be interpreted as relating to survival, despite differences in language, culture and the specific concepts included in the two studies. The close correspondence across the two languages is, above and beyond its importance in terms of

Table 5 Intercorrelations among attributes, as well as correlations with familiarity from the EsPal database for the 482 shared items

	Familiarity	Color	Motion	Grasp	Pain	Sound	Taste
Color	.01						
Motion	– .07	.28**					
Graspability	.20**	.03	– .16**				
Pain	– .15**	– .04	.29**	– .20**			
Sound	– .10*	.02	.39**	– .46**	.56**		
Taste	.12**	.37**	.04	.19**	– .31**	– .27**	
Smell	.06	.27**	.21**	– .09*	– .05	.03	.54**

** $p < .01$, * $p < .05$

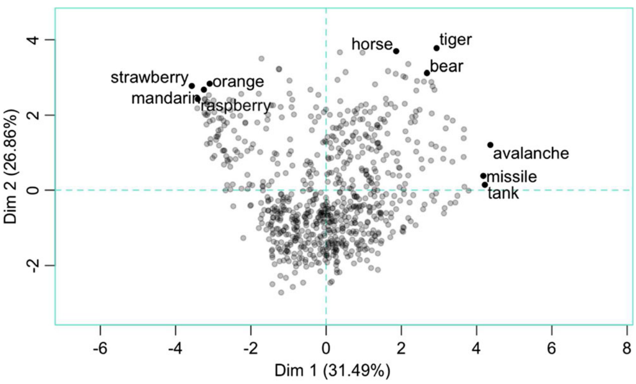

Fig. 2 Distribution of all the words across the two hypothesized dimensions (Dim 1 = avoiding death; Dim 2 = locating nourishment). Labels represent the ten elements (translated into English) with the highest contributions on the two dimensions

Table 6 Rotated component matrix

	Component	
	1	2
Color	.069	**.694**
Motion	**.603**	.417
Graspability	**– .603**	.022
Pain	**.740**	– .158
Sound	**.871**	– .025
Taste	– .362	**.789**
Smell	.053	**.779**

Rotation method: Varimax with Kaiser normalization

external validity, a strong indication of the relevance for survival that certain conceptual properties possess. As we argued in the introduction, extending research efforts to additional languages can contribute to an increment in the amount of knowledge gained through experimentation. Also importantly, it can be of help in the identification of what is shared and what may vary in the representation of concepts and their relations when different linguistic and cultural contexts are examined, and in that way alleviate potential limitations caused by minimal diversity in current psychological science (Medin, Ojalehto, Marin, & Bang, 2017).

Third, the norms for perceptual and motor attributes can be of help in evaluating and in identifying the nature of semantic problems caused by brain damage, pointing to both dimension-specific deficits and deficits arising from a combination of attributes (as proposed by Binder et al., 2016). For example, a recent line of research by a leading

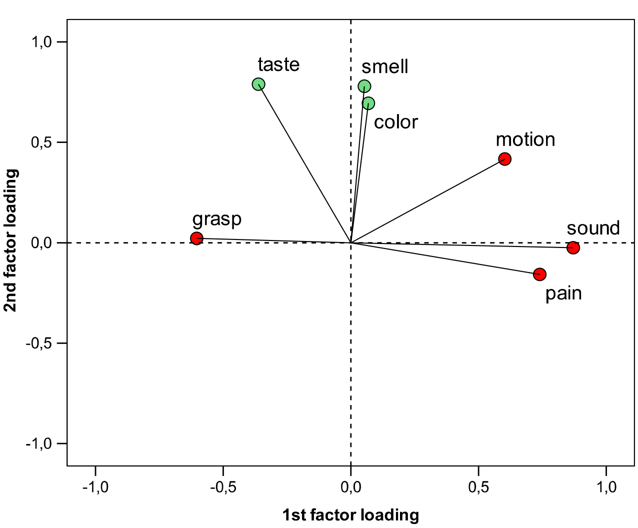

Fig. 3 Principal component analysis. The seven attributes are located at their coordinates on each component. Attributes in red constitute Factor 1, and attributes in green constitute Factor 2

team of Spanish psycholinguists has documented the particular problems of Parkinson´s disease patients in processing verbal material with high motoric content (Herrera, Bermúdez-Margaretto, Ribacoba, & Cuetos, 2015). The specificity of the motoric nature of the deficit has so far been tested with verbs, but it is likely that this line of research could make substantial progress if adequately characterized nouns were used in future developments of the investigation, for instance capitalizing on dimensions such as motion or graspability.

Finally, further research using the provided data set is likely to facilitate advances in theoretical developments. The aim of understanding semantic representations and the processes by which meaning affects thinking and behaving has guided research for decades in the cognitive sciences, and it continues to be a field with a high level of activity. In progressing toward this goal, tools such as quantitative and well defined descriptions of verbal stimuli have the potential to pave the way for the development and testing of theoretical accounts. From the early times of testing simple, computer-inspired models (e.g., Collins & Loftus, 1975) researchers have made use of databases containing information on category membership, feature production, concept attributes, and the like to develop and test models of various sorts and complexity, such as feature-based models (McRae, de Sa, & Seidenberg, 1997), or connectionist models (McClelland et al., 2010). And additional materials need to be developed in response to research challenges posed by recently developed theoretical proposals, mainly brain-oriented representations of concepts that incorporate emotional, perceptual and motor information, and that understand semantic functioning in terms of grounded perceptual and motor representations (Kiefer & Barsalou, 2013), action-oriented embodied representations (Glenberg, 2015) or combinations of modality-specific and amodal representations (Patterson & Lambon Ralph, 2016). In this context, studies characterizing concepts in regard to general aspects of action (e.g., BOI norms), sensation (e.g., SER norms) or

Table 7 Correlations with other objective and subjective variables

	Color	Motion	Grasp	Pain	Sound	Taste	Smell
Log frequency[1]	– .02	– .09**	– .20**	.01	.11**	– .07*	– .10**
Oral frequency[2]	– .02	– .14**	– .11**	– .07	.05	– .03	– .05
LDTs[3]	– .11*	– .10*	– .09	.10*	– .02	– .21**	– .17**
Naming RTs[4]	– .03	.04	– .08	– .06	.01	.02	.06
Ort. neighbors[1]	– .04	– .05	.07*	.03	– .06	.03	.02
Number of letters[1]	.01	– .03	.02	– .04	.01	– .08*	– .05
Number of syllables[1]	.04	– .03	.01	– .06	– .03	– .04	– .04
Concreteness[1]	.17**	.16**	.10*	.07	.03	.10*	.20**
Imageability[1]	.20**	.12*	.19**	– .02	.06	.11*	.14**
Subjective AoA[5]	– .22**	– .17**	– .21**	.08*	.05	– .21**	– .17**
BOI[6]	.00	– .11*	.75**	– .01	– .16**	.08	.12*
Danger[7]	– .08	.26	– .33*	.81**	.37*	– .43**	– .09
Valence[8]	.30**	.00	.02	– .49**	– .12**	.38**	.18**
Arousal[8]	.04	.26**	– .13**	.61**	.37**	– .25**	– .05

** $p < .01$, * $p < .05$. Sources: (1) Duchon et al. (2013), (2) Alonso et al. (2011), (3) González-Nosti et al. (2014), (4) Davies et al. (2013), (5) Alonso et al. (2015), (6) , Alonso, Díez, Díez, & Fernandez (2016), (7) Wurm (2007), (8) Stadthagen-Gonzalez et al. (2017)

feeling (e.g., arousal norms) and in regard to their specific sensorimotor components (e.g., the norms presented here) have the potential to be very useful, for example, when exploring the effects of semantic richness on early semantic processing (Yap, Tan, Pexman, & Hargreaves, 2011) or the modality-specific aspects of semantic representations and their correspondence with particular brain circuits (Barrós-Loscertales et al., 2012). With the understanding that contributions arising from well formulated problems and well controlled experiments are likely to be of importance regardless the language in which research is conducted, further cross-linguistic research, facilitated by properly defined stimuli, will be of great help to understand crucial aspects of human cognition such as the way in which semantic information is represented and used.

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Table 8 Hierarchical regression analysis assessing the significantly correlated dimensions as predictors of lexical decision times

Predictor	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Written frequency	– .52***	– .54***	– .55***	– .55***	– .55***	– .54***
Length	.35***	.31***	.30***	.30***	.30***	.30***
Orthographic neighbors	– .01	– .01	– .02	– .02	– .02	– .02
Taste pleasantness		– .20***	– .14**	– .13**	– .13**	– .10*
Smell intensity			– .11**	– .11**	– .11*	– .11**
Color				– .05	– .05	– .05
Motion					– .01	– .03
Pain						– .06
R^2	.38	.42	.43	.44	.44	.44
ΔR^2		.04	.01	.01	.00	.00
ΔF		26.21***	7.41**	1.94	.10	2.24

Standardized regression coefficients are shown for each variable in each step. Multiple *R*-squared, increment of *R*-squared and *F* are testing the significance of the differences between successive models. *** $p < .001$, ** $p < .01$, * $p < .05$

Appendix: Rating instructions

¿Cuán intenso es el color de este objeto?

Nada intenso | Extremadamente intenso

1 2 3 4 5 6 7 8

En esta pregunta estamos interesados en la intensidad del color. Por ejemplo, yo evaluaría "patata", cuyo color es apagado, con 1 o 2, y "girasol", que tiene un color intenso con 7 u 8.

Cuando vemos este objeto, ¿cuán probable es que esté en movimiento?

Extremadamente improbable | Extremadamente probable

1 2 3 4 5 6 7 8

En esta pregunta estamos interesados en la percepción de movimiento. Cuando vemos un determinado objeto, ¿cuán probable es que ese objeto se encuentre en movimiento?. Por ejemplo, aunque una "iglesia" podría derrumbarse, no se encuentra habitualmente en movimiento y yo la evaluaría con 1 o 2. Por otra parte, un "colibrí" podría encontrarse quieto en una rama, pero habitualmente se encuentra en movimiento y lo evaluaría con 7 u 8.

¿Cuán probable es que alguien agarre o coja este objeto con una mano?

Extremadamente improbable | Extremadamente probable

1 2 3 4 5 6 7 8

En esta pregunta estamos interesados en la probabilidad de que alguien agarre o coja un objeto con una mano. Por ejemplo, un "asteroide" es demasiado grande para cogerlo y yo lo evaluaría con 1 o 2, mientras que una "rosquilla" está hecha para ser cogida y llevada a la boca y la evaluaría con 7 u 8.

¿Cuán probable es que este objeto cause dolor?

Extremadamente improbable | Extremadamente probable

1 2 3 4 5 6 7 8

En esta pregunta estamos interesados en la probabilidad de que un objeto cause dolor. Por ejemplo, aunque una "pluma" podría causarte dolor si te pincho con ella, es suave y ligera y habitualmente no causa dolor, por lo que yo la evaluaría con 1 o 2. Por el contrario, aunque una "pistola" podría ser utilizada para practicar tiro al blanco, está hecha para causar daño y por ello la evaluaría alto, quizá con 7 u 8. Y yo evaluaría "dedo" entre 3 y 4 porque resulta doloroso que te aprieten con el dedo, pero los dedos también están relacionados con muchas otras cosas que no producen dolor.

¿Cómo de fuerte (intenso) es el sonido producido por este objeto?

Nada intenso Extremadamente intenso

1 2 3 4 5 6 7 8

En esta pregunta estamos interesados en la intensidad del sonido. Por ejemplo, un "palillo" habitualmente no produce ruido y yo lo evaluaría con 1 o 2, mientras que una "avalancha" produce mucho ruido y la evaluaría con 7 u 8.

¿Cómo es probable que sea el sabor de este objeto?

Extremadamente desagradable Extremadamente agradable

1 2 3 4 5 6 7 8

En esta pregunta estamos interesados en el sabor de los objetos. Por ejemplo, aunque nunca he probado una "alcantarilla", supongo que tendrá un sabor muy desagradable y la evaluaría con 1 o 2, mientras que me encanta el sabor del "bizcocho" y lo evaluaría con 7 u 8.

¿Cuán intenso es el olor producido por este objeto?

Nada intenso Extremadamente intenso

1 2 3 4 5 6 7 8

En esta pregunta estamos interesados en la intensidad del olor. Por ejemplo, un "mosquito" común apenas tiene olor y yo lo evaluaría con 1 o 2, mientras que el "estiércol" produce un fuerte hedor y lo evaluaría con 7 u 8.

References

Alonso, M. A., Díez, E., Díez, A. M., & Fernandez, A. (2016). Body–object interaction ratings for 750 Spanish words. Poster presented at the 6th International Conference on Memory, Budapest.

Alonso, M. A., Díez, E., & Fernandez, A. (2016). Subjective age-of-acquisition norms for 4,640 verbs in Spanish. *Behavior Research Methods*, *48*, 1337–1342. doi:https://doi.org/10.3758/s13428-015-0675-z

Alonso, M. A., Fernandez, A., & Díez, E. (2011). Oral frequency norms for 67,979 Spanish words. *Behavior Research Methods*, *43*, 449–458. doi:https://doi.org/10.3758/s13428-011-0062-3

Alonso, M. A., Fernandez, A., & Díez, E. (2015). Subjective age-of-acquisition norms for 7,039 Spanish words. *Behavior Research Methods*, *47*, 268–274. doi:https://doi.org/10.3758/s13428-014-0454-2

Amsel, B. D., DeLong, K. A., & Kutas, M. (2015). Close, but no garlic: Perceptuomotor and event knowledge activation during language comprehension. *Journal of Memory and Language*, *82*, 118–132. doi:https://doi.org/10.1016/j.jml.2015.03.009

Amsel, B. D., Urbach, T. P., & Kutas, M. (2012). Perceptual and motor attribute ratings for 559 object concepts. *Behavior Research Methods*, *44*, 1028–1041. doi:https://doi.org/10.3758/s13428-012-0215-z

Barrós-Loscertales, A., González, J., Pulvermüller, F., Ventura-Campos, N., Bustamante, J. C., Costumero, V., … Ávila, C. (2012). Reading salt activates gustatory brain regions: fMRI evidence for semantic grounding in a novel sensory modality. *Cerebral Cortex*, *22*, 2554–2563. doi:https://doi.org/10.1093/cercor/bhr324

Bennett, S. D., Burnett, A. N., Siakaluk, P. D., & Pexman, P. M. (2011). Imageability and body–object interaction ratings for 599 multisyllabic nouns. *Behavior Research Methods*, *43*, 1100–1109. doi:https://doi.org/10.3758/s13428-011-0117-5

Binder, J. R., Conant, L. L., Humphries, C. J., Fernandino, L., Simons, S. B., Aguilar, M., & Desai, R. H. (2016). Toward a brain-based componential semantic representation. *Cognitive Neuropsychology*, *33*, 130–174. doi:https://doi.org/10.1080/02643294.2016.1147426

Bonin, P., Méot, A., Ferrand, L., & Bugaïska, A. (2015). Sensory experience ratings (SERs) for 1,659 French words: Relationships with other psycholinguistic variables and visual word recognition. *Behavior Research Methods*, *47*, 813–825. doi:https://doi.org/10.3758/s13428-014-0503-x

Catricalà, E., Della Rosa, P. A., Plebani, V., Perani, D., Garrard, P., & Cappa, S. F. (2015). Semantic feature degradation and naming performance. Evidence from neurodegenerative disorders. *Brain and Language*, *147*, 58–65. doi:https://doi.org/10.1016/j.bandl.2015.05.007

Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review*, *82*, 407–428. doi:https://doi.org/10.1037/0033-295X.82.6.407

Colombo, L., & Burani, C. (2002). The influence of age of acquisition, root frequency, and context availability in processing nouns and verbs. *Brain and Language*, *81*, 398–411. doi:https://doi.org/10.1006/brln.2001.2533

Cuetos, F., & Alija, M. (2003). Normative data and naming times for action pictures. *Behavior Research Methods, Instruments, & Computers*, *35*, 168–177. doi:https://doi.org/10.3758/BF03195508

Cuetos, F., González-Nosti, M., Barbón, A., & Brysbaert, M. (2011). SUBTLEX-ESP: Spanish word frequencies based on film subtitles. *Psicológica*, *32*, 133–143.

Davies, R., Barbón, A., & Cuetos, F. (2013). Lexical and semantic age-of-acquisition effects on word naming in Spanish. *Memory & Cognition*, *41*, 297–311. doi:https://doi.org/10.3758/s13421-012-0263-8

de Leeuw, J. R. (2015). jsPsych: A JavaScript library for creating behavioral experiments in a web browser. *Behavior Research Methods*, *47*, 1–12. doi:https://doi.org/10.3758/s13428-014-0458-y

Devereux, B. J., Tyler, L. K., Geertzen, J., & Randall, B. (2014). The Centre for Speech, Language and the Brain (CSLB) concept property norms. *Behavior Research Methods*, *46*, 1119–1127. doi:https://doi.org/10.3758/s13428-013-0420-4

Duchon, A., Perea, M., Sebastián-Gallés, N., Martí, A., & Carreiras, M. (2013). EsPal: One-stop shopping for Spanish word properties. *Behavior Research Methods*, *45*, 1246–1258. doi:https://doi.org/10.3758/s13428-013-0326-1

Glenberg, A. M. (2015). Few believe the world is flat: How embodiment is changing the scientific understanding of cognition. *Canadian Journal of Experimental Psychology*, *69*, 165–171. doi:https://doi.org/10.1037/cep0000056

González-Nosti, M., Barbón, A., Rodríguez-Ferreiro, J., & Cuetos, F. (2014). Effects of the psycholinguistic variables on the lexical decision task in Spanish: A study with 2,765 words. *Behavior Research Methods*, *46*, 517–525. doi:https://doi.org/10.3758/s13428-013-0383-5

Guasch, M., Ferré, P., & Fraga, I. (2016). Spanish norms for affective and lexico-semantic variables for 1,400 words. *Behavior Research Methods*, *48*, 1358–1369. doi:https://doi.org/10.3758/s13428-015-0684-y

Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in Quantitative Methods for Psychology*, *8*, 23–34. doi:10.20982/tqmp.08.1.p023

Haro, J., Ferré, P., Boada, R., & Demestre, J. (2017). Semantic ambiguity norms for 530 Spanish words. *Applied Psycholinguistics*, *38*, 457–475. doi:https://doi.org/10.1017/S0142716416000266

Herrera, E., Bermúdez-Margaretto, B., Ribacoba, R., & Cuetos, F. (2015). The motor-semantic meanings of verbs generated by Parkinson's disease patients on/off dopamine medication in a verbal fluency task. *Journal of Neurolinguistics*, *36*, 72–78. doi:https://doi.org/10.1016/j.jneuroling.2015.06.001

Hirschfeld, G., Bien, H., de Vries, M., Lüttmann, H., & Schwall, J. (2010). Open-source software to conduct online rating studies. *Behavior Research Methods*, *42*, 542–546. doi:https://doi.org/10.3758/BRM.42.2.542

Inkster, M., Wellsby, M., Lloyd, E., & Pexman, P. M. (2016). Development of embodied word meanings: Sensorimotor effects in children's lexical processing. *Frontiers in Psychology*, *7*, 317. doi:https://doi.org/10.3389/fpsyg.2016.00317

Instituto Cervantes (2015). *El español: una lengua viva: Informe 2015*. Retrieved from http://eldiae.es/wpcontent/uploads/2015/06/espanol_lengua-viva_20151.pdf

Juhasz, B. J., & Yap, M. J. (2013). Sensory experience ratings for over 5,000 mono-and disyllabic words. *Behavior Research Methods*, *45*, 160–168. doi:https://doi.org/10.3758/s13428-012-0242-9

Kiefer, M., & Barsalou, L. W. (2013). Grounding the human conceptual system in perception, action, and internal states. In W. Prinz, M. Beisert, & A. Herwig (Eds.), *Action science: Foundations of an emerging discipline* (pp. 381–407). Cambridge: MIT Press

Kousta, S.-T., Vinson, D. P., & Vigliocco, G. (2009). Emotion words, regardless of polarity, have a processing advantage over neutral words. *Cognition*, *112*, 473–481. doi:https://doi.org/10.1016/j.cognition.2009.06.007

Łuniewska, M., Haman, E., Armon-Lotem, E., Etenkowski, B., Southwood, F., Anđelković, D., … Ünal-Logacev, Ö. (2016). Ratings of age of acquisition of 299 words across 25 languages: Is there a crosslinguistic order of words? *Behavior Research Methods*, *48*, 1154–1177. doi:https://doi.org/10.3758/s13428-015-0636-6

Lynott, D., & Connell, L. (2009). Modality exclusivity norms for 423 object properties. *Behavior Research Methods*, *41*, 558–564. doi:https://doi.org/10.3758/BRM.41.2.558

Manoiloff, L., Artstein, M., Canavoso, M. B., Fernández, L., & Segui, J. (2010). Expanded norms for 400 experimental pictures in an Argentinean Spanish-speaking population. *Behavior Research Methods*, *42*, 452–460. doi:https://doi.org/10.3758/BRM.42.2.452

Marful, A., Díez, E., & Fernandez, A. (2015). Normative data for the 56 categories of Battig & Montague (1969) in Spanish. *Behavior Research Methods*, *47*, 902–910. doi:https://doi.org/10.3758/s13428-014-0513-8

McClelland, J. L., Botvinick, M. M., Noelle, D. C., Plaut, D. C., Rogers, T. T., Seidenberg, M. S., & Smith, L. B. (2010). Letting structure emerge: Connectionist and dynamical systems approaches to cognition. *Trends in Cognitive Sciences*, *14*, 348–356. doi:https://doi.org/10.1016/j.tics.2010.06.002

McRae, K., Cree, G. S., Seidenberg, M. S., & McNorgan, C. (2005). Semantic features production norms for a large set of living and nonliving things. *Behavior Research Methods, Instruments, & Computers*, *37*, 547–559. doi:https://doi.org/10.3758/BF03192726

McRae, K., de Sa, V. R., & Seidenberg, M. S. (1997). On the nature and scope of featural representations of word meaning. *Journal of Experimental Psychology: General*, *126*, 99–130. doi:https://doi.org/10.1037/0096-3445.126.2.99

Medin, D., Ojalehto, B., Marin, A., & Bang, M. (2017). Systems of (non-)diversity. *Nature Human Behavior*, *1*, 0088. doi:https://doi.org/10.1038/s41562-017-0088

Medler, D. A., Arnoldussen, A., Binder, J. R., & Seidenberg, M. S. (2005). *The Wisconsin Perceptual Attribute Ratings Database*. Available at www.neuro.mcw.edu/ratings/

Morrison, C. M., Hirsh, K. W., & Duggan, G. B. (2003). Age of acquisition, ageing, and verb production: Normative and experimental data. *Quarterly Journal of Experimental Psychology*, *56A*, 705–730. doi:https://doi.org/10.1080/02724980244000594

Patterson, K., & Lambon Ralph, M. A. (2016). The hub-and-spoke hypothesis of semantic memory. In G. Hickok, & S. L. Small (Eds.), Neurobiology of language (pp. 675–775). San Diego: Academic Press.

Perry, L. K., Perlman, M., & Lupyan, G. (2015). Iconicity in English and Spanish and its relation to lexical category and age of acquisition. *PLoS ONE*, *10*, e0137147. doi:https://doi.org/10.1371/journal.pone.0137147

Proctor, R. W., & Vu, K.-P. L. (1999). Index of norms and ratings published in the Psychonomic Society journals. *Behavior Research Methods, Instruments, & Computers*, *31*, 659–667. doi:https://doi.org/10.3758/BF03200742

Rueckl, J. G., Paz-Alonso, P. M., Molfese, P. J., Kuo, W-J., Bick, A., Frost, S. J., … Frost, R. (2015). Universal brain signature of proficient reading: Evidence from four contrasting languages. *Proceedings of the National Academy of Sciences*, *112*, 15510–15515. doi:https://doi.org/10.1073/pnas.1509321112

Schwitter, V., Boyer, B., Méot, A., Bonin, P., & Laganaro, M. (2004). French normative data and naming times for action pictures. *Behavior Research Methods, Instruments, & Computers*, *36*, 564–576. doi:https://doi.org/10.3758/BF03195603

Stadthagen-Gonzalez, H., Imbault, C., Pérez Sánchez, M. A., & Brysbaert, M. (2017). Norms of valence and arousal for 14,031 Spanish words. *Behavior Research Methods*, *49*, 111–123. doi:https://doi.org/10.3758/s13428-015-0700-2

Tillotson, S. M., Siakaluk, P. D., & Pexman, P. M. (2008). Body– object interaction ratings for 1,618 monosyllabic nouns. *Behavior Research Methods*, *40*, 1075–1078. doi:https://doi.org/10.3758/BRM.40.4.1075

Vaughan, J. (2004). Editorial: A Web-based archive of norms, stimuli, and data. *Behavior Research Methods, Instruments, & Computers*, *36*, 363–370. doi:https://doi.org/10.3758/BF03195583

Vivas, J., Vivas, L., Comesaña, A., Coni, A. G., & Vorano, A. (2017). Spanish semantic feature production norms for 400 concrete concepts. *Behavior Research Methods*, *49*, 1095–1106. doi:https://doi.org/10.3758/s13428-016-0777-2

Wurm, L. H. (2007). Danger and usefulness: An alternative framework for understanding rapid evaluation effects in perception? *Psychonomic Bulletin & Review*, *14*, 1218–1225. doi:https://doi.org/10.3758/BF03193116

Yap, M. J., Pexman, P. M., Wellsby, M., Hargreaves, I. S., & Huff, M. J. (2012). An abundance of riches: Cross-task comparisons of semantic richness effects in visual word recognition. *Frontiers in Human Neuroscience*, *6*, 72. doi:https://doi.org/10.3389/fnhum.2012.00072

Yap, M. J., Tan, S. E., Pexman, P. M., & Hargreaves, I. S. (2011). Is more always better? Effects of semantic richness on lexical decision, speeded pronunciation, and semantic classification. *Psychonomic Bulletin & Review*, *18*, 742–750. doi:https://doi.org/10.3758/s13423-011-0092-y