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A set of 750 words in Spanish characterized in two survival-related dimensions: avoiding death and locating nourishment

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Abstract

With the aim of finding quantitative indicators of the survival relevance for a set of concrete concepts, a subjective rating task was administered to a large sample of college students ($N = 300$). In the rating task, participants used a five-point scale to rate 750 concepts in one of two survival-relevant dimensions, providing their own judgment about the relevance of each concept in a situation in which either avoiding death (*AD*) or obtaining food (*OF*) was of importance. The subjective ratings showed high stability and reliability and showed varied patterns of association to potentially relevant concept-defining variables, with correlational analyses showing both commonalities and differences between the two rated dimensions. Regression analyses indicated that, while not likely to modulate word accessibility, survival ratings were related to certain conceptual properties that could be especially sensitive for threat detection. The collected data set provides normative information that can be of use in manipulating and controlling verbal stimuli in future research focusing on adaptive properties of episodic memory and other aspects of the human cognitive system. The complete norms are available for downloading at Open Science Framework (https://osf.io/sf9mb/).

Keywords Survival · Adaptive cognition · Spanish word norms · Semantic ratings

Research in psychological science is showing an increasing sensitivity for aspects related to the adaptive function of cognitive mechanisms and operations, expanding both the range of factors that are of relevance in explanations of human behavior and the spectrum of questions that deserve careful investigation by cognitive neuroscientists. As a result, current topics of interest include examination of adaptive features in areas such as perception (Witt, Proffitt, & Epstein, 2004), emotion (Al-Shawaf, Conroy-Beam, Asao, & Buss, 2016), language (Hurford, 2007), or thinking (Haselton et al., 2009). Recent approaches to episodic memory have also adopted an evolutionary perspective (see an early proposal by Glenberg, 1997), with an interesting line focusing on aspects that emphasize the adaptive function of memory in terms of its survival utility (Nairne, Pandeirada, & Fernandes, 2017). The aim of the present study was to contribute to the development of methodological tools that can be of assistance in designing experimental paradigms aimed at further exploring and characterizing survival-related aspects of memory in the domains of episodic and semantic processing.

Seminal work conducted by Nairne and collaborators a decade ago (e.g., Nairne, Pandeirada, & Thompson, 2008; Nairne, Thompson, & Pandeirada, 2007) convincingly demonstrated that processing episodic information with a focus on survival features tends to result in superior memory for that information. Their experimental procedure of choice, since then successfully applied by many other researchers, is known as the survival-processing paradigm. In a typical experiment using this procedure, participants may be asked to rate a series of words in a number of dimensions, the critical one being a survival-relevant dimension (e.g., securing food). The result is that, in a subsequent memory test, words initially rated for survival value are better remembered than words rated with respect to other control dimensions, such as rating the stimuli for pleasantness or personal relevance. Similar results are found when the procedure involves considering the relevance of the words to survival versus non-survival imagined scenarios (e.g., finding shelter from predators versus moving personal belongings to a new home) or, as shown by Fernandes, Pandeirada, Soares, and Nairne (2017), when the words refer to objects that are encoded as potentially dangerous because of contextual interactions with contaminant agents (e.g., being touched by a sick person).

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Table 1 Intraclass correlation coefficients, by booklet, in each of the survival dimensions

Booklet	Avoiding death [95% CI]	Obtaining food [95% CI]
1	0.954 [0.939–0.967]	0.968 [0.958–0.976]
2	0.952 [0.941–0.962]	0.942 [0.929–0.955]
3	0.924 [0.906–0.940]	0.956 [0.945–0.965]
4	0.940 [0.925–0.952]	0.973 [0.966–0.979]

This type of survival-processing paradigm has proven to be powerful in terms of reliable findings, with results widely replicated with varied participants (Aslan & Bäuml, 2012), and diverse materials (Otgaar, Smeets, & van Bergen, 2010), and when comparisons involve a variety of control scenarios (Bell, Röer, & Buchner, 2013). The abundance of empirical findings has been accompanied by a search for explanations and has led to theoretical discussions that, while generally agreeing on the adaptive nature of the effect, tend to disagree on the specific processes involved in its production. Proposals have been advanced that emphasize the role of well-known mechanisms such as attentional bias, deep processing, elaboration, encoding variability, and self-reference (see Nairne & Pandeirada, 2016). However, as pointed in a recent meta-analytic review (Scofield, Buchanan, & Kostic, 2018), research on the topic has not yet provided conclusive evidence that would allow for a consensus in regard to the explanation of the phenomenon.

At this point, advancing the understanding of survival effects on memory might benefit not only from posing new questions and obtaining new data based on the survival-processing paradigm, but also from convergent evidence obtained with alternative empirical procedures and materials. One illustrative case in memory research is how the important issue of memory distortion has been empirically addressed, drawing evidence from a number of paradigms, from the ecologically oriented (e.g., Loftus & Palmer, 1974) to the more controlled laboratory setting (Roediger & McDermott, 1995). Perhaps a more relevant example here is the case of research on the effects of emotion on memory, where research in the human domain has made use of diverse empirical methodologies and stimuli. Using a procedure that is certainly similar to the survival-processing paradigm, researchers have been able to assign emotional value to relatively neutral stimuli by having them processed in the context of an emotionally charged scenario, leading to superior memory for emotionally processed items in standard memory tests (e.g., Cahill & McGaugh, 1995). But valuable information about the mechanisms behind the memory-modulating effects of emotion has also been obtained by making use of materials with intrinsic emotional value, demonstrating that stimuli that are in themselves high in emotional content or tone are better remembered in a variety of experimental situations and episodic memory tasks (e.g., Kensinger & Corkin, 2003).

In exploring the effects of survival on memory, little has attention has been focused on the intrinsic properties of stimuli. In a notable exception, some researchers have recently used a specific type of stimuli, animated concepts, to show that words that represent entities that have the characteristic of being animate, assumedly a survival-related feature, are better remembered, even in the absence of explicit instructions to the participants to engage in survival-centered encoding (Bonin, Gelin, & Bugaiska, 2014; Nairne, VanArsdall, Pandeirada, Cogdill, & LeBreton, 2013). While the animacy status of an entity can rationally be argued to reflect its survival value, an optimal approach for characterizing the survival value of specific stimuli would be to assess the relevance of the property more directly, and by means of empirically validated

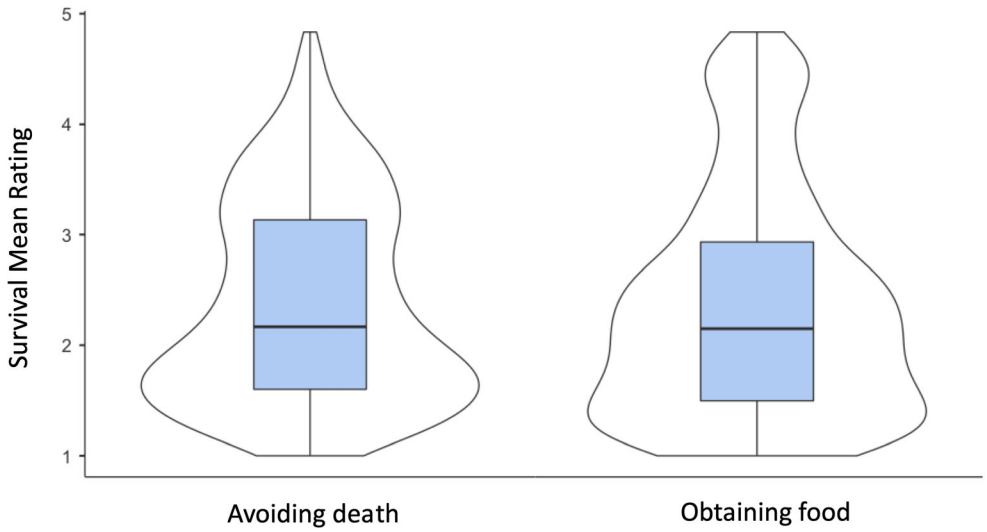

Fig. 1 Violin plots showing the distribution and the probability density of rating scores for the normed set of 750 words in the survival dimensions of avoiding death (*AD*) and obtaining food (*OF*)

procedures; for example, characterizing concepts in terms of concrete survival dimensions. Having this type of descriptive information about words or images, for instance, would undoubtedly open the way for new manipulations and potentially contribute to further understanding survival effects on memory and cognition. For example, Howe and Derbish (2010) used associative word lists likely to be high in survival value to show how words scoring high were more susceptible to distortion in an experimental false-memory paradigm (the DRM procedure, Roediger & McDermott, 1995). While informative when used to test an adaptive property of survival-related information, the set of stimuli was small and limited in that it originated in a very reduced associative word pool, and in that the words were first selected as low or high in survival relevance on the basis of the researchers' intuition (although, later, participants' judgments largely agreed with the a priori established dichotomy). Similarly, a pilot study on a reduced set of 45 words was used by Butler, Kang, and Roediger (2009) to assess their survival value in a study showing that congruence between materials and processing task could strongly modulate the observed advantage of survival processing in episodic memory situations. The words in that set were useful for testing the hypotheses of interest, but they are too specific to the goals of the study and too few in number to constitute a general-use pool of well-characterized verbal stimuli.

Additionally, a focus on the survival-related characteristics of stimuli such as words can also be of value for exploring basic aspects of the representation of the concepts they denote in semantic memory (cf., Binder et al., 2016). Thus, a quantitative description that allows one to place a given concept along particular survival dimensions can contribute to a more

Table 2 Correlations between the AD and OF survival dimensions and relevant variables

Type	Variable	Study	*N*	*Avoid death*		*Obtain food*	
				r	*p*	*r*	*p*
Psycholinguistic (objective and subjective)	Number of letters	Duchon et al. (2013)	750	−.10	.01	−.10	.01
	Number of syllables	Duchon et al. (2013)	748	−.08	.04	−.07	.05
	Orthographic neighbors	Duchon et al. (2013)	748	.12	<.01	.08	.04
	Log frequency	Duchon et al. (2013)	748	.03	.39	−.07	.07
	Oral frequency	Alonso et al. (2011)	652	.04	.31	−.07	.09
	Familiarity	Duchon et al. (2013)	482	.12	.01	.13	<.01
	Concreteness	Duchon et al. (2013)	482	.09	.04	.18	<.01
	Imageability	Duchon et al. (2013)	472	.10	.04	.12	.01
	Subjective age of acquisition (AoA)	Alonso et al. (2015, 2016)	616	−.19	<.01	−.22	<.01
Response times	Lexical Decision Times	Aguasvivas et al. (2018)	708	−.10	<.01	−.10	<.01
	Lexical Decision Times	González–Nosti et al. (2014)	405	−.12	.02	−.16	<.01
	Naming	Davies et al. (2013)	405	−.08	.10	−.04	.37
Perception	Color vividness	Díez-Álamo et al. (2018)	750	−.00	1	.16	<.01
	Likelihood of pain		750	.12	<.01	.02	1
	Sound intensity		750	.00	1	−.07	.61
	Taste pleasantness		750	.11	<.05	.42	<.01
	Smell intensity		750	.26	<.01	.52	<.01
	Visual motion		750	−.04	1	.15	<.01
Action	Graspability	Díez-Álamo et al. (2018)	750	.16	<.01	.17	<.01
	Body–object interaction	Alonso, Díez, Díez-Álamo et al. (2018)	342	.26	<.01	.23	<.01
Emotion	Happiness	Ferré et al. (2017); Hinojosa et al. (2016); Stadthagen-González, Ferré et al. (2017)	274	.03	.59	.10	.11
	Disgust		274	.16	<.01	.24	<.01
	Anger		274	−.10	.11	−.14	<.05
	Fear		274	.02	.71	−.10	.13
	Sadness		274	−.13	<.05	−.22	<.01
	Valence	Stadthagen-González, Imbault et al. (2017)	660	−.03	.40	.06	.11
	Arousal		660	−.05	.24	−.08	.05

Table 3 Proportion of variation (adjusted R^2) in AD and OF ratings explained by several predictor variables (hierarchical linear regression analyses)

Predictor variables	Avoid death ($n = 115$)	Obtain food ($n = 115$)
Step 1: Lexical variables		
Adjusted R^2	0.023	0.023
Change in R^2	0.062	0.061
Step 2: Semantic variables		
Adjusted R^2	0.120	0.120
Change in R^2	0.101**	0.10**
Step 3: Perception variables		
Adjusted R^2	0.304	0.590
Change in R^2	0.215***	0.471***
Step 4: Action variables		
Adjusted R^2	0.319	0.611
Change in R^2	0.025	0.027*
Step 5: Emotion variables		
Adjusted R^2	0.381	0.640
Change in R^2	0.092*	0.05*

*$p < .05$, **$p < .01$, ***$p < .001$

Lexical variables: number of syllables, orthographic neighbors, log written frequency, oral frequency. *Semantic variables*: imageability, subjective age of acquisition (AoA). *Perception variables*: color, pain, sound, taste, smell, visual motion. *Action variables*: graspability, body–object interaction. *Emotion variables*: valence, arousal, happiness, disgust, anger, fear, sadness

thorough description of that concept's set of componential features. Also, establishing the degree to which survival dimensions are related to other well-known, sensorimotor, semantic or emotional dimensions can be illuminating and reveal the ways in which interactions between these variables can modulate single-variable effects. Finally, the functional value of information about survival and how it relates to overall conceptual and lexical availability and accessibility could be a factor worth taking into account when addressing issues in lexical and semantic processing. As a matter of fact, dimensions related to survival, such as "danger" or "usefulness", have already been demonstrated to affect performance in standard word recognition tasks such as naming and lexical decision tasks (Wurm, 2007, 2015; Wurm & Seaman, 2008). Expanding this type of study by incorporating a wider range of potentially relevant stimuli could lead to significant advances in the field.

The current study was designed to improve upon this stimulus-scarcity situation by collecting empirically derived normative data on the survival relevance of a relatively large set of concrete concepts, focusing on two specific dimensions. The selection of these two dimensions was based on data reported in two studies, one in English (Amsel, Urbach, & Kutas, 2012) and one in Spanish (Díez-Álamo, Díez, Alonso, Vargas, & Fernandez, 2018), that were aimed at collecting normative ratings for perceptual and motor dimensions of large sets of concrete concepts. In both cases, researchers analyzed the factorial structure of the sensorimotor properties of the rated words by means of a principal component analysis, finding that two factors had relatively high explanatory power in accounting for the variance. Interestingly, despite language and procedural differences, and despite only a partial overlapping between the referents of the two sets of words (approximately two thirds of the words referred to the same conceptual entities), the two factors proved to be identical in the two studies. More relevant for the present study, these factors were interpreted to be relevant to survival, and were labeled "avoiding death" and "locating nourishment" in

Table 4 Proportion of variation (adjusted R^2) in lexical decision and naming response times explained by lexical and semantic variables, with *AD* or *OF* entered in the last step (hierarchical linear regression analyses)

Predictor variable	Avoid Death		Obtain food	
	Lexical decision RTs ($n = 445$)	Naming RTs ($n = 387$)	Lexical decision RTs ($n = 445$)	Naming RTs ($n = 387$)
Step 1: Lexical variables				
Adjusted R^2	0.260	0.006	0.256	0.006
Change in R^2	0.266***	0.02	0.266***	0.02
Step 2: Semantic variables				
Adjusted R^2	0.375	0.011	0.375	0.011
Change in R^2	0.117***	0.01	0.117***	0.01
Step 3: Survival rating				
Adjusted R^2	0.373	−0.011	0.377	0.009
Change in R^2	0.0002	0.003	0.004†	0.001

***$p < .001$ † $p = 0.08$

Lexical variables: number of syllables, orthographic neighbors, log written frequency, oral frequency. *Semantic variables*: imageability, subjective age of acquisition

the reports of the findings. The fact that two different survival-related factors emerged from the statistical computations suggests the possibility that survival relevance is a general property that can be separated into more concrete dimensions, such as those identified in the two mentioned studies. Therefore, and with the aim of obtaining an empirically based characterization of a set of verbal stimuli in terms of their particular survival value, a subjective rating procedure was implemented to collect independent data on each of the two selected dimensions, which in this study were labeled Avoiding Death (*AD*) and Obtaining Food (*OF*). Details of the design and methodology are described in what follows.

Method

Participants A total of 300 Spanish-speaking undergraduate students pursuing Psychology or Speech Therapy degrees at the University of La Laguna (Spain) participated in the study, in exchange for course credit. Their ages ranged from 18 to 51 years ($M = 20.6$, $SD = 3.23$), and 84% were female.

Stimuli and materials The set of 750 Spanish concrete words previously characterized in terms of perceptual and motor attributes by Díez-Álamo et al. (2018) conformed the pool of words to be normed in the present study (see Appendix 1 for an alphabetical list of the Spanish words and their English translation). The complete pool of words was partitioned into five sets to make the rating task more manageable, and each set was administered to 60 participants (30 per survival dimension). One of the sets consisted of 96 words that were initially rated due to their relevance for an ongoing memory study (not reported here). The 654 remaining words were randomly distributed into two sets of 164 words and two sets of 163 words. For each of these five word sets, three different word orders were randomly prepared and printed on multiple-page booklets. The first page in the booklet contained the rating instructions that asked participants to use a scale, from 1 to 5, to indicate their responses to the words in the following pages. The remaining pages included the list of words, organized into a single column, and each word with a 1-to-5 scale preprinted to its right.

Procedure All the words were rated in two survival dimensions: avoiding death (*AD*) and obtaining food (*OF*), and data were collected in group sessions of between 10 and 20 participants that lasted approximately 20 minutes. Booklets of the two dimensions under study were randomly distributed to participants across sessions, with specific rating instructions printed on the first page of the booklets (the instructions are provided in Appendix 2). For participants in the *AD* condition, the instructions asked them to imagine being abandoned in an unknown place and attempting to survive by finding objects that could be of help in avoiding death by protecting from predators and other kinds of harm. For participants in the *OF* condition, the instructions also asked participants to imagine being abandoned in an unknown place, but this time they were asked to imagine attempting to survive by finding items of nourishment that could be drunk or eaten. All participants were then asked to consider each of the words in the booklet, following the preprinted order, and to use a pen to mark a position in the five-point scale on the right side of the word, indicating its relevance for the particular survival scenario that they were asked to imagine. Following Nairne et al. (2008), a value of 1 corresponded to "irrelevant", and a value of 5 corresponded to "very relevant", in the dimension being rated.

Results and discussion

Survival values for the 750 rated words in the two dimensions (*AD* and *OF*) were obtained by averaging the ratings provided by the participants (between 25 and 30 per word, with 30 independent ratings for 88% of the words). Potentially spurious order effects on the ratings were examined by determining the consistency of ratings to a given word across the three versions of the booklet in which it appeared, and ruled out on the basis of intraclass correlation coefficients [*ICC* (2,k)], which were calculated separately for the two dimensions. The results showed almost identical *ICC*s for all the rated word sets (see Table 1), with values ranging from 0.92 to 0.95 for the five booklets used in the *AD* rating task, and between .94 and .97 for the five booklets in the *OF* rating task. Split-half reliability was very high for both *AD* (Guttman split-half coefficient = .94) and *OF* ratings (Guttman split-half coefficient = .96).

The mean survival value for the words rated in the *AD* dimension was 2.38 ($SD = .91$) in the five-point scale, with values ranging from 1.0 to 4.83. The mean survival value for the words rated in the *OF* dimension was also 2.38 ($SD = 1.04$) in the five-point scale, with values ranging from 1.0 to 4.90. The distribution of scores did not conform to a normal distribution in either of the two rated dimensions (Shapiro–Wilk, $p < .001$), being in both cases moderately positive skewed and, as shown in Fig. 1, with a higher probability density for lower ratings. The variables *AD* and *OF* were found to be positively and strongly correlated ($r = .75$; $p < .001$), reflecting the fact that many words had very similar values in the two dimensions, even though they were rated by different participants. With the data at hand, it is not possible to further investigate the nature or the number of potential relations underlying the correlation. But a reasonable interpretation would be that obtaining food can be taken as a particular case of a more general dimension such as avoiding death.

A spreadsheet document provided with this report as supplementary material (*SurvivalValue750words.xls*) presents

the relevant descriptive data for all the rated stimuli. In that document, words are listed in Spanish in alphabetical order in the first column, and columns to the right of each item present, in this order, the most common English translation of the word, its average rating in the *AD* dimension, the corresponding standard deviation, minimum and maximum average values, and the number of individual valid ratings per word in that dimension. Next, values for average rating, standard deviation, minimum, maximum, and number of contributing valid observations are provided for the *OF* dimension.

The first approach for exploring the nature of the survival ratings was to enter the survival scores in the two normed dimensions into correlational analyses along with a set of indexes of different types, obtained from a variety of recent normative studies in Spanish: psycholinguistic (number of letters, number of syllables, orthographic neighbors, written frequency, oral frequency, lexical decision, naming, familiarity, concreteness, imageability, subjective age of acquisition), perceptual (color vividness, visual motion, sound intensity, smell intensity, taste pleasantness), actional (graspability, body–object interaction), and emotional (valence, arousal, happiness, disgust, anger, fear, sadness). Table 2 shows the correlations with all those potentially relevant variables as well as the sources for the various indexes included in the correlational analyses.

Overall, significant but low correlations were found between survival values and some objective word descriptors, indicating that words that were more related to survival tended to be shorter in length and to have more orthographic neighbors. However, survival values were not significantly related to either the written or the oral frequency of words. Significant correlations emerged when a set of subjectively obtained word ratings were considered, showing that words that were related to survival in the two dimensions tended to be more familiar, more concrete, more imageable, and also more likely to be acquired early in the course of first-language acquisition.

Correlations with perception, action, and emotion variables were also observed. The *AD* dimension showed several significant but small correlations. Concepts that were considered more relevant for avoiding death in the imagined scenario were those that tended to have higher ratings in experiential dimensions, such as the likelihood of producing pain ($r = .12$), smell intensity ($r = .26$), graspability ($r = .16$), probability of body–object interaction ($r = .26$), and disgust ($r = .16$), while being less associated with feelings of sadness ($r = -.13$). The *OF* dimension demonstrated a somewhat different pattern of correlations, showing that concepts that are considered more relevant in the finding nourishment scenario tend to be perceived with more color vividness ($r = .16$), smell intensity ($r = .52$), taste pleasantness ($r = .42$), and visual motion ($r = .15$), and tend to be more graspable ($r = .17$), more likely to interact with the body ($r = .23$), and associated with higher disgust ($r = .24$) and less anger ($r = -.14$) and sadness ($r = -.22$).

To explore the nature of survival ratings in greater depth, two hierarchical regression analyses were conducted, with *AD* and *OF* ratings as the dependent variables, and a set of psycholinguistic, perceptual, action, and emotion variables as predictors, entered in successive steps. Table 3 shows the results of both analyses. The lexical and semantic predictor variables only accounted for 12% of the variance in *AD* and *OF*, with the entering of perception variables in the model producing a greater increment in the explained variance ($\Delta R^2 = .22$ for *AD* and $\Delta R^2 = .47$ for *OF*). Action variables only showed a significant but weak R^2 increment for *OF* ($\Delta R^2 = .03$). Finally, emotion variables produced significant increments for both *AD* ($\Delta R^2 = .09$) and *OF* ($\Delta R^2 = .05$).

Overall, these results point to the importance of factors related to perception (e.g., smell, taste or pain), action (e.g., body–object interaction and graspability), and emotions (e.g., disgust, sadness), to explain the survival relevance ratings in both *AD* and *OF* scenarios. These results are in line with some findings in the field of memory that suggest that the differences in recall found in the survival processing literature may be related to a factor that can be regarded as "perceived threat to survival". As Olds, Lanska, and Westerman (2013) point out, from this view, "survival processing might require participants to consider behaviors associated with avoiding bodily harm or sickness for self-preservation" (p. 34). Our results show that concepts that are considered relevant in the two survival scenarios are also associated with properties that could be related to avoiding both bodily harm (e.g., higher body–object interaction or graspability could be associated with the possibility of taking an object apart) and sickness (e.g., concepts more likely to produce pain, intense smell or taste, or provoking more disgust would be better for survival).

Finally, two three-step hierarchical linear regression analyses were performed to explore the power of survival values in predicting reaction times in lexical decision (Aguasvivas et al., 2018) and naming tasks (Davies et al., 2013). In step 1, several variables related to the lexical–word–form level were entered: number of syllables, orthographic neighborhood size and frequency, both written (Duchon, Perea, Sebastián-Gallés, Martí, & Carreiras, 2013) and oral (Alonso, Fernandez, & Díez, 2011). In step 2, two measures thought to be related to semantic processing were included, namely imageability (from Duchon et al., 2013) and age of acquisition (from Alonso, Díez, & Fernandez, 2016; and from Alonso, Fernandez, & Díez, 2015). Finally, in the last step, the survival ratings obtained in the present study were entered as predictors. As shown in Table 4, the amount of change in the variance predicted by survival ratings was low and nonsignificant both for lexical decision times and for naming times. In the light of these analyses, then, survival-related words do not

have any significant predictive validity for response times reflecting lexical accessibility.

Conclusion

In this study, a relatively large set of words in Spanish were rated on two particular survival dimensions by Spanish-speaking young adults. As a result, quantitative estimations of the extent to which each of those words are related to the dimensions of Avoiding Death (*AD*) and Obtaining Food (*OF*) are now available to the research community. As described above, the procedure led to the collection of normative values that were very consistent across participants and highly reliable estimators for the two dimensions of interest. Although with the limitation of including only concrete nouns, the collected norms are likely to be particularly useful because of the rich characterization of the words in many other features and attributes, as quantitative indicators for their frequency of use, age of acquisition, category membership, affective value, bodily interaction, sensory experience, etc., are currently available. The data set thus has the potential to be a powerful tool for researchers conducting empirical studies with verbal stimuli in Spanish, both when controlling for potential stimulus-driven contaminating effects on their results and when their interest might be a purposeful manipulation of stimuli in investigating survival-relevant issues in cognition and, particularly, in memory.

It is a fact that the most frequently used empirical paradigm, the survival processing scenario (Nairne et al., 2007), has provided a wide range of interesting results. However, it is possible that the type of questions that can be addressed and the type of data that can be gathered can be substantially expanded by establishing research lines focused on the survival attributes inherent in the processed stimuli. As an example, studies analyzing a survival-related attribute such as animacy have contributed to a better understanding of important issues, for example, the status of survival value in relation to other semantic properties such as imagery (Bonin, Gelin, Laroche, Méot, & Bugaiska, 2015) or arousal (Popp & Serra, 2018), the relevance of survival value in processes such as categorization (Radanovic, Westbury, & Milin, 2016), or the neural correlates of the survival advantage in episodic memory (Xiao, Dong, Chen, & Xue, 2016). It is therefore foreseeable that other and more specific characterizations of survival-related properties in stimuli, as in the norms presented here, can lead to progress along similar lines of inquiry and open the way along which new lines can be explored. Explanatory accounts have made progress in the cognitive neuroscience of memory by testing hypotheses with empirical procedures aimed at obtaining convergent evidence, thus broadening the scope of reliable effects that can be brought to shed light on the validity of arguments. One illustrative example of such an approach in recent memory research is the study of the—also adaptation-related—phenomenon of using memory of the past to construct visions of the future (Schacter et al., 2012). Here, data from behavioral experiments (e.g., Ditta & Storm, 2016), neuroimaging techniques (e.g., Gilmore, Nelson, & McDermott, 2014), and neuropsychological samples (e.g., Hassabis, Kumaran, Vann, & Maguire, 2007) have been successfully combined to advance the identification of mechanisms and functions of episodic future thinking (Schacter, Benoit, & Szpunar, 2017). The availability of well-described materials, such as the set characterized for two survival dimensions in the present study, can be reasonably expected to be of value in setting a multi-approach research agenda in the realm of adaptive memory studies.

The database also has the potential for use in research programs focusing on more applied issues. For example, availability of stimuli of the kind presented here could be instrumental in further testing empirical hypotheses related to the general claim that, because our cognitive system is particularly primed to process survival information, the use of survival-relevant content could facilitate the early acquisition of basic concepts and skills in particular domains (e.g., the early learning of vocabulary in a foreign language; see Nairne, 2016; and VanArsdall, Nairne, Pandeirada, & Cogdill, 2015). Another field in which the database could be of relevance is in the scientific study of pathologies such as anxiety disorders, where findings are not totally consistent on whether patients have a tendency to process information about the world with a bias towards threat and danger (Mitte, 2008); here, having stimuli normed for a survival dimension, like death avoidance, could facilitate the development and use of empirical procedures aimed at better identifying risky personal profiles, and also conditions under which the malfunctioning of cognitive processes and representations could lead to pathological manifestations. Finally, and going a step beyond pure psychological interests, knowledge about how well-characterized survival-related information is perceived, acquired, retained, and used in human social environments could be useful in demonstrating the ways in which central aspects of human evolution can inform our understanding of social cognition (Schaller, Park, & Kenrick, 2006).

In conclusion, and from a more general and theoretical perspective, the characterization of the concepts in terms of the two dimensions of survival, avoiding death and obtaining food, can be seen as a step forward in the context of recent attempts to gather behavioral data on which to build empirically and brain-based componential semantic representations of concepts, taking into account relevant constituent features, their weight and combinatorial dynamics within a given concept, and their representational systems at a neural level (e.g., Binder et al., 2016). While most feature-based approaches typically incorporate associative properties, affective states, and sensorimotor attributes (e.g., Barsalou, 2012; Cree & McRae, 2003; Steyvers & Tenenbaum, 2005), the potential contribution of survival relevance as a defining conceptual feature has not been specifically

targeted by semantic models or approaches. Whether it would eventually prove to be a conceptual aspect worth being taken into account can be considered as an issue for future investigation.

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Open Practices Statement The data and materials for the study are available at Open Science Framework (https://osf.io/sf9mb/)

Appendix 1

Table 5. Alphabetical list of Spanish words used in the study and their most common translations in English

Spanish word	English word	Spanish word	English word	Spanish word	English word
abedul	birch	cremallera	zipper	orquesta	orchestra
abeja	bee	cristal	crystal	oruga	caterpillar
abismo	abyss	cuartel	barracks	oso	bear
abrazadera	clamp	cubo	bucket	oveja	sheep
abrigo	coat	cucaracha	cockroach	pájaro	chickadee
academia	academy	cuchara	spoon	pala	shovel
aceituna	olive	cucharón	ladle	palanca	crowbar
acordeón	accordion	cuchilla	razor	palma	palm
aguacate	avocado	cuchillo	knife	palo	stick
aguijón	sting	cuenco	bowl	paloma	dove
águila	eagle	cuerda	rope	pan	bread
aguja	needle	cuervo	crow	pancarta	banner
ajedrez	chess	culebra	snake	pantalla	screen
ajo	garlic	dado	dice	pantalón	trousers
albornoz	robe	daga	dagger	pantera	panther
alce	moose	dálmata	dalmatian	pantuflas	slippers
alfiler	pin	dedal	thimble	pañuelo	tissue
alfombra	carpet	delantal	apron	papel	paper
alfombrilla	mat	delfín	dolphin	paraguas	umbrella
alga	seaweed	desagüe	drain	parche	patch
alicates	pliers	despensa	cupboard	pared	wall
almeja	clam	destornillador	screwdriver	parroquia	parish
almohada	pillow	diablo	devil	pasa	raisin
alubias	beans	dinero	money	pasaporte	passport
ambulancia	ambulance	disco	disc	pasta	pasta
ancla	anchor	discoteca	disco	pastel	cake
ángel	angel	diván	divan	patata	potato
anguila	eel	domicilio	home	patinete	scooter
anillo	ring	dormitorio	bedroom	pato	duck
anorak	parka	dragón	dragon	pavo	turkey
antena	antenna	ducha	shower	pececillo	minnow
antídoto	antidote	duque	duke	peine	comb
antorcha	torch	edificio	building	pelícano	pelican
apartamento	apartment	elefante	elephant	pelota	football
apio	celery	elemento	element	península	peninsula
arándano	blueberry	embarcadero	pier	penique	penny
araña	spider	emú	emu	peña	boulder
árbol	tree	encuesta	survey	pepinillo	pickle
arco	bow	ensalada	salad	pepino	cucumber
arcoíris	rainbow	equipo	team	pera	pear
ardilla	squirrel	ermita	hermitage	perca	perch
arma	weapon	escalera	escalator	percha	peg
armadura	armor	escaparate	storefront	perdiz	partridge
armario	cabinet	escarabajo	beetle	perejil	parsley
armónica	harmonica	escoba	broom	periquito	parakeet
arpa	harp	escopeta	shotgun	perla	pearl
arpón	harpoon	escorpión	scorpion	perro	dog
arrendajo	blue jay	escritorio	desk	persiana	blind
arroz	rice	escudo	shield	petirrojo	robin

Table 5. (continued)

ascensor	elevator	escurridor	colander	pez	goldfish
atún	tuna	esfera	ball	piano	piano
autobús	bus	esmeralda	emerald	picamadero	woodpecker
avalancha	avalanche	esmoquin	tuxedo	pichón	pigeon
avestruz	ostrich	espada	sword	piedra	stone
avión	airplane	espárrago	asparagus	pijama	pajamas
avispa	wasp	espátula	spatula	pimienta	pepper
avispón	hornet	espejo	mirror	pincel	paintbrush
azada	hoe	espina	thorn	pingüino	penguin
azotea	rooftop	espinacas	spinach	pino	pine
babosa	slug	esquís	skis	pintalabios	lipstick
bacalao	cod	estación	station	pinzón	finch
bala	bullet	estantería	bookcase	piña	pineapple
balanza	scale	estéreo	stereo	pirámide	pyramid
balcón	balcony	estómago	stomach	piruleta	lollipop
baldas	shelves	estornino	starling	pistola	handgun
ballena	whale	estructura	structure	pitón	python
ballesta	crossbow	estufa	stove	pizarra	whiteboard
balón	basketball	euro	dime	placa	plate
balsa	raft	faisán	pheasant	plátano	banana
banco	bench	falda	skirt	platillo	saucer
bandeja	tray	ficha	file	plato	dish
banjo	banjo	fiera	beast	polilla	moth
bañador	swimsuit	flamenco	flamingo	pollo	chicken
bañera	bathtub	flauta	flute	polo	popsicle
baño	bathroom	flecha	arrow	pomelo	grapefruit
baraja	deck	flor	dandelion	pomo	doorknob
barca	boat	foca	seal	poni	pony
barco	ship	foco	spotlight	portón	gate
barranco	ravine	folio	sheet	posada	inn
barril	barrel	foto	photo	precipicio	precipice
barro	clay	frambuesa	raspberry	princesa	princess
basílica	basilica	fregadero	sink	príncipe	prince
bastón	cane	fresa	strawberry	proyector	projector
bata	gown	fusil	gun	pruna	prune
batidora	mixer	gaita	bagpipe	pueblo	village
batuta	baton	galápago	tortoise	puente	bridge
baúl	trunk	galleta	biscuit	puercoespín	porcupine
bayoneta	bayonet	gallo	rooster	puerta	door
bazuca	bazooka	gamba	shrimp	puerto	port
berenjena	eggplant	gancho	hook	pulga	flea
biblia	bible	ganso	goose	pulpo	octopus
bicicleta	bike	garaje	garage	pulsera	bracelet
bisonte	bison	gato	cat	puma	cougar
blusa	blouse	gavilán	buzzard	pupila	pupil
bodega	cellar	gaviota	seagull	puro	cigar
boina	beret	germen	germ	queso	cheese
bola	golf ball	gimnasia	gymnastics	rábano	radish
bolígrafo	pen	glaciar	glacier	radio	radio
bolsa	bag	globo	balloon	raíz	root
bomba	bomb	golf	golf	rallador	grater
bombilla	lightbulb	goma	eraser	rama	branch
boniato	yam	gorila	gorilla	ramo	bouquet
borde	edge	gorrión	sparrow	rana	frog
botas	boots	granada	grenade	rapaz	predatory bird
botella	bottle	granero	barn	raqueta	racquet
bóveda	vault	granja	farm	rascacielos	skyscraper
bozal	muzzle	grifo	tap	rastrillo	rake
brócoli	broccoli	guantes	gloves	rata	rat
buey	ox	guardián	guardian	ratón	mouse
búfalo	buffalo	guepardo	cheetah	rayo	lightning
bufanda	scarf	guisantes	peas	red	net
búho	owl	guitarra	guitar	regla	ruler
buitre	vulture	gusano	worm	reja	grille

Table 5. (continued)

bungaló	bungalow	hacha	axe	reloj	clock
buque	vessel	hada	fairy	remolacha	beets
burro	donkey	halcón	falcon	repisa	shelf
buzón	mailbox	hamaca	hammock	repollo	cabbage
caballa	mackerel	hámster	hamster	revista	magazine
caballo	horse	hebilla	buckle	revólver	revolver
cabaña	cabin	hélice	propeller	rifle	rifle
cable	cable	helicóptero	helicopter	roble	oak
cabra	goat	héroe	hero	robot	robot
cachorro	cub	herramienta	wrench	roca	rock
cactus	cactus	hiena	hyena	rosa	rose
cadena	chain	hierba	grass	rosario	rosary
caimán	alligator	hierro	iron	rotulador	crayon
caja	box	hilo	thread	rueda	wheel
calabacín	zucchini	hoja	leaf	ruibarbo	rhubarb
calabaza	pumpkin	horizonte	horizon	sábana	bed sheet
calamar	squid	hormiga	ant	sable	sabre
calcetines	socks	horno	oven	sacacorchos	corkscrew
calculadora	calculator	hueso	bone	saco	sack
calendario	calendar	huevo	egg	sala	room
calzoncillos	pants	humo	smoke	salamandra	salamander
cama	bed	husky	husky	salmón	salmon
camello	camel	iglesia	church	saltamontes	grasshopper
camión	truck	iguana	iguana	sandalias	sandals
camioneta	van	instituto	institute	santuario	sanctuary
camisa	shirt	jabalí	wild boar	sapo	toad
camiseta	camisole	jabón	soap	sardina	sardine
camisón	nightgown	jamón	ham	sartén	skillet
campana	bell	jardín	garden	sauce	willow
canario	canary	jarra	jar	saxofón	saxophone
candado	padlock	jarrón	vase	selva	jungle
candelabro	chandelier	jaula	cage	semilla	seed
cangrejo	crab	jeep	jeep	señal	signal
canica	marble	jet	jet	serpiente	rattlesnake
canoa	canoe	jirafa	giraffe	servilleta	napkin
cañón	cannon	joya	jewel	seta	mushroom
capa	cape	juez	judge	sierra	saw
capellán	chaplain	juguete	toy	signo	sign
capilla	chapel	Júpiter	Jupiter	silbato	whistle
caracol	snail	ladera	hillside	silla	chair
caramelo	candy cane	ladrillo	brick	sirena	siren
caribú	caribou	lagarto	lizard	sobre	envelope
carne	meat	lámpara	lamp	sofá	sofa
carpeta	folder	langosta	lobster	sol	sun
carreta	wagon	lanza	spear	sonajero	rattle
carretilla	wheelbarrow	lápiz	pencil	sotana	cassock
carrito	trolley	látigo	whip	sótano	basement
carro	cart	lava	lava	submarino	submarine
carruaje	carriage	lavabo	sink	subrayador	highlighter
carta	letter	lavavajillas	dishwasher	suéter	sweater
cartel	poster	lazo	ribbon	sujetador	bra
casa	house	lechuga	lettuce	surco	furrow
casco	helmet	león	lion	tabique	partition
castor	beaver	leopardo	leopard	tabla	surfboard
catapulta	catapult	leotardos	leotards	tablero	board
catedral	cathedral	libro	book	taburete	stool
cazo	pan	licuadora	blender	taladro	drill
cebolla	onion	liebre	hare	tambor	drum
cebra	zebra	lienzo	canvas	tanque	tank
cedro	cedar	lija	sandpaper	tapiz	tapestry
celda	cell	lima	lime	tapón	cap
célula	cell	limón	lemon	tarro	jar
cenicero	ashtray	limusina	limousine	tarta	pie
céntimo	nickel	línea	line	taxi	taxi

Table 5. (continued)

cepillo	brush	linterna	lantern	taza	cup
cera	wax	lista	list	tazón	mug
cerdo	pig	llave	key	techo	ceiling
cereza	cherry	loro	parrot	teclado	typewriter
cernícalo	hawk	luna	moon	tele	TV
cerrojo	bolts	maceta	pot	teléfono	telephone
certificado	certificate	machete	machete	telón	drapes
cervatillo	fawn	maíz	corn	tenazas	tongs
cesta	basket	mandarina	mandarin	tenedor	fork
chabola	shack	manga	sleeve	tenis	tennis
chal	shawl	manoplas	mittens	termómetro	thermometer
chaleco	vest	mantel	tablecloth	ternero	calf
chalet	cottage	manto	cloak	tetera	kettle
chaqueta	jacket	manzana	apple	tienda	tent
charco	puddle	mapa	map	tigre	tiger
cheque	check	mapache	raccoon	tijeras	scissors
chicle	gum	marco	framework	timbre	doorbell
chimenea	chimney	mariposa	butterfly	tirachinas	slingshot
chimpancé	chimp	mariquita	ladybug	tiza	chalk
chincheta	tack	marmota	groundhog	toalla	towel
chocolate	chocolate	martillo	hammer	tomate	tomato
choza	hut	mazo	sledgehammer	tomo	volume
cicatriz	scar	mecedora	rocker	tornillos	screws
cielo	sky	mechero	lighter	toro	bull
ciervo	deer	medalla	medal	torre	tower
cigarrillo	cigarette	médula	marrow	torreta	pylon
cigarro	cigarette	melocotón	peach	tortuga	turtle
cigüeña	stork	melón	cantaloupe	tostadora	toaster
cima	summit	menú	menu	tractor	tractor
cincel	chisel	merienda	snack	tráiler	trailer
cine	cinema	merluza	hake	transistor	transistor
cinturón	belt	mermelada	marmalade	trapo	cloth
circo	circus	mesa	table	tren	train
circuito	circuit	metralleta	machine gun	trenza	braid
ciruela	plum	metro	subway	triciclo	tricycle
cisne	swan	mezquita	mosque	trigo	wheat
clarinete	clarinet	microondas	microwave	trineo	sleigh
clavicordio	harpsichord	microscopio	microscope	trípode	tripod
clementina	tangerine	mirlo	blackbird	trombón	trombone
clip	paperclip	misil	missile	trompeta	trumpet
club	club	mofeta	skunk	trucha	trout
cobertizo	shed	monasterio	monastery	tuba	tuba
coche	car	moneda	coin	tubo	tube
cochecito	buggy	monociclo	unicycle	urna	urn
cocina	kitchen	monopatín	skateboard	uva	grape
coco	coconut	montura	saddle	vaca	cow
cocodrilo	crocodile	mora	blackberry	valla	fence
cohete	rocket	morsa	walrus	vaqueros	jeans
cojín	cushion	mosca	housefly	varita	wand
colador	strainer	motocicleta	motorcycle	vaso	glass
coliflor	cauliflower	mula	mule	váter	toilet
collar	necklace	muñeca	doll	vela	candle
colmena	beehive	mural	mural	velero	sailboat
comercio	shop	muro	wall	velo	veil
cometa	kite	musgo	moss	vena	vein
cómoda	dresser	nabo	turnip	veneno	poison
concha	shell	naranja	orange	ventana	window
conejo	rabbit	nectarina	nectarine	verja	railings
congelador	freezer	nevera	fridge	vestíbulo	lobby
convento	convent	nido	nest	vestido	dress
copa	drinking glass	niebla	fog	vestidor	closet
corbata	tie	nivel	level	vía	track
corcho	cork	novela	novel	vid	vine
cordero	lamb	nube	cloud	vidriera	stained glass

Table 5. (continued)

cordón	cord	nudo	knot	viento	wind
corneja	raven	nuez	walnut	violín	violin
corona	crown	nutria	otter	violonchelo	cello
corteza	bark	olla	pot	yate	yacht
cortinas	curtains	óptica	optics	yegua	mare
corzo	elk	orejeras	earmuffs	zanahoria	carrot
cotorra	budgie	órgano	organ	zapato	shoe
coyote	coyote	ornitorrinco	platypus	zapatos	shoes
crema	cream	oropéndola	oriole	zorro	fox

Appendix 2

Instructions for the avoiding death (AD) rating task

Spanish En esta tarea nos gustaría que te imaginaras que estás abandonado en un lugar desconocido, como un bosque en un país extranjero, sin ningún tipo de material para poder sobrevivir. En los próximos meses, tendrás que encontrar objetos que puedan protegerte de los depredadores o evitarte daños, para poder sobrevivir. Ahora vas a ver unas palabras y tu tarea consiste en calificar la relevancia/importancia que cada palabra tiene para esa situación se supervivencia que acabas de imaginar. Para dicha evaluación contarás con una escala, que aparecerá al lado de cada palabra. La escala va del 1 al 5 donde 1 significa "irrelevante para la supervivencia" y 5 significa "muy relevante para la supervivencia". Si a una palabra le asignas la puntuación de 1, significa que dicha palabra no te serviría para protegerte y sobrevivir y si le asignas la puntuación de 5 significa que dicha palabra sí es muy importante como protección para tu supervivencia. Alguna palabra puede parecerte más relevante que otra. Realiza tu evaluación señalando el número del 1 a 5 que mejor refleje tu respuesta. Siéntete libre para utilizar el rango completo de números, selecciona aquel que consideres que se adecua mejor a cada palabra para sobrevivir en la situación anteriormente descrita.

English translation In this task, we would like you to imagine that you are stranded in an unknown place, such as a forest in a foreign country, without any kind of survival material. Over the next few months, you'll need to find things that can protect you from predators and avoid damage in order to survive. Now you are going to see a series of words, and your task is to assess the relevance/importance that each word has for the survival scenario that you just imagined. For this assessment, you will have a scale, printed besides each word. The scale goes from 1 to 5, with 1 meaning "irrelevant for survival" and 5 meaning "very relevant for survival". If you assign a score of 1 to a word it means that the word would not protect you or help you to survive; if you assign a score of 5 to the word it means that it is very important for protection and survival. Some words may seem more relevant than others. Do your assessment by picking the number from 1 to 5 that best reflects your response. Feel free to use the complete range of numbers, selecting the one that, in your opinion, best describes the adequacy of each word for survival in the described situation.

Instructions for the finding nourishment (OF) rating task

Spanish En esta tarea nos gustaría que te imaginaras que estás abandonado en un lugar desconocido, como un bosque en un país extranjero, sin ningún tipo de material para poder sobrevivir. En los próximos meses, tendrás que encontrar alimentos y bebidas para poder sobrevivir. Ahora vas a ver unas palabras y tu tarea consiste en calificar la relevancia/importancia que cada palabra tiene para esa situación se supervivencia que acabas de imaginar. Para dicha evaluación contarás con una escala, que aparecerá al lado de cada palabra. La escala va del 1 al 5 donde 1 significa "irrelevante para la supervivencia" y 5 significa "muy relevante para la supervivencia". Si a una palabra le asignas la puntuación de 1, significa que dicha palabra no te serviría como "alimento" para sobrevivir y si le asignas la puntuación de 5 significa que dicha palabra sí es muy importante como alimento para tu supervivencia. Alguna palabra puede parecerte más relevante que otra. Realiza tu evaluación señalando el número del 1 a 5 que mejor refleje tu respuesta. Siéntete libre para utilizar el rango completo de números, selecciona aquel que consideres que se adecua mejor a cada palabra para sobrevivir en la situación anteriormente descrita.

English translation In this task, we would like you to imagine that you are stranded in an unknown place, such as a forest in a foreign country, without any kind of survival material. Over the next few months, you'll need to find food and drink in order to survive. Now you are going to see a series of words, and your task is to assess the relevance/importance that each word has for the survival scenario that you just imagined. For this assessment, you will have a scale, printed besides each word. The scale goes from 1 to 5, with 1 meaning "irrelevant for survival" and 5 meaning "very relevant for survival". If you assign a score of 1 to a word it means that the word would

not be useful as food for survival; if you assign a score of 5 to the word it means that it is very important as food for survival. Some words may seem more relevant than others. Do your assessment by picking the number from 1 to 5 that best reflects your response. Feel free to use the complete range of numbers, selecting the one that, in your opinion, best describes the adequacy of each word for survival in the described situation.

References

Aguasvivas, J. A., Carreiras, M., Brysbaert, M., Mandera, P., Keuleers, E., & Duñabeitia, J. A. (2018). SPALEX: A Spanish lexical decision database from a massive online data collection. *Frontiers in Psychology*, *9*. doi: https://doi.org/10.3389/fpsyg.2018.02156

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

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., Díez, E., Díez-Álamo, A. M., & Fernandez, A. (2018). Body–object interaction ratings for 750 Spanish words. *Applied Psycholinguistics*, *39*, 1239-1252. doi: https://doi.org/10.1017/S0142716418000309

Al-Shawaf, L., Conroy-Beam, D., Asao, K., & Buss, D. M. (2016). Human emotions: An evolutionary psychological perspective. *Emotion Review*, *8*, 173-186. doi: https://doi.org/10.1177/1754073914565518

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

Aslan, A., & Bäuml, K-H. (2012). Adaptive memory: Young children show enhanced retention of fitness-related information. *Cognition*, *122*, 118-122. doi: https://doi.org/10.1016/j.cognition.2011.10.001

Barsalou, L. W. (2012). The human conceptual system. In M. J. Spivey, K. McRae, & M. F. Joanisse (Eds.) *The Cambridge handbook of psycholinguistics* (pp. 239-258). New York: Cambridge University Press. doi: https://doi.org/10.1017/CBO9781139029377.017

Bell, R., Röer, J. P., & Buchner, A. (2013). Adaptive memory: The survival-processing memory advantage is not due to negativity or mortality salience. *Memory & Cognition*, 41, 490-502. doi: https://doi.org/10.3758/s13421-012-0290-5

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., Gelin, M., & Bugaiska, A. (2014). Animates are better remembered than inanimates: Further evidence from word and picture stimuli. *Memory & Cognition*, *42*, 370-382. doi: https://doi.org/10.3758/s13421-013-0368-8

Bonin, P., Gelin, M., Laroche, B., Méot, A., & Bugaiska, A. (2015). The "how" of animacy effects in episodic memory. *Experimental Psychology*, *62*, 371–384. doi: https://doi.org/10.1027/1618-3169/a000308

Butler, A. C., Kang, S. H. K., & Roediger, H. L. (2009). Congruity effects between materials and processing tasks in the survival processing paradigm. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35*, 1477-1486. doi: https://doi.org/10.1037/a0017024

Cahill, L., & McGaugh, J. L. (1995). A novel demonstration of enhanced memory associated with emotional arousal. *Consciousness and Cognition*, *4*, 410-421. doi: https://doi.org/10.1006/ccog.1995.1048

Cree, G. S., & McRae, K. (2003). Analyzing the factors underlying the structure and computation of the meaning of chipmunk, cherry, chisel, cheese, and cello (and many other such concrete nouns). *Journal of Experimental Psychology: General*, *132*, 163-201. doi: https://doi.org/10.1037/0096-3445.132.2.163

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

Díez-Álamo, A. M., Díez, E., Alonso, M. A., Vargas, C. A., & Fernandez, A. (2018). Normative ratings for perceptual and motor attributes of 750 object concepts in Spanish. *Behavior Research Methods*, *50*, 1632-1644. doi: https://doi.org/10.3758/s13428-017-0970-y

Ditta, A. S., & Storm, B. C. (2016). Thinking about the future can cause forgetting of the past. *The Quarterly Journal of Experimental Psychology*, *69*, 339-350. doi: https://doi.org/10.1080/17470218.2015.1026362

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

Fernandes, N. L., Pandeirada, J. N., Soares, S. C., & Nairne, J. S. (2017). Adaptive memory: The mnemonic value of contamination. *Evolution and Human Behavior*, *38*, 451-460. doi: https://doi.org/10.1016/j.evolhumbehav.2017.04.003

Ferré, P., Guasch, M., Martínez-García, N., Fraga, I., & Hinojosa, J. A. (2017). Moved by words: Affective ratings for a set of 2,266 Spanish words in five discrete emotion categories. *Behavior Research Methods*, *49*, 1082-1094. doi: https://doi.org/10.3758/s13428-016-0768-3

Gilmore, A. W., Nelson, S. M., & McDermott, K. B. (2014). The contextual association network activates more for remembered than for imagined events. *Cerebral Cortex*, *26*, 611-617. doi: https://doi.org/10.1093/cercor/bhu223

Glenberg, A. M. (1997). What memory is for. *Behavioral and Brain Sciences*, *20*, 1-19. doi: https://doi.org/10.1017/S0140525X97000010

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

Haselton, M. G., Bryant, G. A., Wilke, A., Frederick, D. A., Galperin, A., Frankenhuis, W. E., & Moore, T. (2009). Adaptive rationality: An evolutionary perspective on cognitive bias. *Social Cognition*, *27*, 733–763. doi: https://doi.org/10.1521/soco.2009.27.5.733

Hassabis, D., Kumaran, D., Vann, S. D., & Maguire, E. A. (2007). Patients with hippocampal amnesia cannot imagine new experiences. *Proceedings of the National Academy of Sciences*, *104*, 1726-1731. doi: https://doi.org/10.1073/pnas.0610561104

Hinojosa, J. A., Martínez-García, N., Villalba-García, C., Fernández-Folgueiras, U., Sánchez-Carmona, A., Pozo, M. A., & Montoro, P. R. (2016). Affective norms of 875 Spanish words for five discrete emotional categories and two emotional dimensions. *Behavior Research Methods*, *48*, 272–284. doi:https://doi.org/10.3758/s13428-015-0572-5

Howe, M. L., & Derbish, M. H. (2010). On the susceptibility of adaptive memory to false memory illusions. *Cognition*, *115*, 252-267. doi: https://doi.org/10.1016/j.cognition.2009.12.016

Hurford, J. (2007). *The origins of meaning: Language in the light of evolution*. Oxford, UK: Oxford University Press.

Kensinger, E. A., & Corkin, S. (2003). Memory enhancement for emotional words: Are emotional words more vividly remembered than neutral words? *Memory & Cognition*, 31, 1169-1180. doi: https://doi.org/10.3758/BF03195800

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning and Verbal Behavior*, *13*, 585-589. doi: https://doi.org/10.1016/S0022-5371(74)80011-3

Mitte, K. (2008). Memory bias for threatening information in anxiety and anxiety disorders: A meta-analytic review. *Psychological Bulletin*, *134*, 886–911. doi:https://doi.org/10.1037/a0013343

Nairne, J. S. (2016). Adaptive memory: Fitness-relevant "tunings" help drive learning and remembering. In D. C. Geary & B. D. Berch (Eds.), *Evolutionary perspectives on child development and education*, (pp. 251–269). New York: Springer. doi:https://doi.org/10.1007/978-3-319-29986-0_10

Nairne, J. S., & Pandeirada, J. N. S. (2016). Adaptive memory: The evolutionary significance of survival processing. *Perspectives on Psychological Science*, *11*, 496 –511. doi: https://doi.org/10.1177/1745691616635613

Nairne, J. S., Thompson, S. R., & Pandeirada, J. N. S. (2007). Adaptive memory: Survival processing enhances retention. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, *38*, 495-501. doi: https://doi.org/10.1037/0278-7393.33.2.263

Nairne, J. S., Pandeirada, J. N. S., & Thompson, S. R. (2008). Adaptive memory: The comparative value of survival processing. *Psychological Science*, *19*, 176-180. doi: https://doi.org/10.1111/j.1467-9280.2008.02064.x

Nairne, J. S., VanArsdall, J. E., Pandeirada, J. N., Cogdill, M., & LeBreton, J. M. (2013). Adaptive memory: The mnemonic value of animacy. *Psychological Science*, *24*, 2099-2105. doi: https://doi.org/10.1177/0956797613480803

Nairne, J. S., Pandeirada, J. N., & Fernandes, N. L. (2017). Adaptive memory. In J. H. Byrne & J. Wixted (Eds.) *Learning and memory: A comprehensive reference. 2nd, vol.2* (pp. 279–293). Oxford: Academic Press. doi: https://doi.org/10.1016/B978-0-12-809324-5.21060-2

Olds, J. M., Lanska, M., & Westerman, D. L. (2013). The role of perceived threat in the survival processing memory advantage. *Memory*, *22*, 26-35. doi:https://doi.org/10.1080/09658211.2013.806554

Otgaar, H., Smeets, T., & van Bergen, S. (2010). Picturing survival memories: Enhanced memory after fitness-relevant processing occurs for verbal and visual stimuli. *Memory & Cognition*, *38*, 23–28. doi: https://doi.org/10.3758/MC.38.1.23

Popp, E. Y., & Serra, M. J. (2018). The animacy advantage for free-recall performance is not attributable to greater mental arousal. *Memory*, *26*, 89-95. doi: https://doi.org/10.1080/09658211.2017.1326507

Radanovic, J., Westbury, C., & Milin, P. (2016). Quantifying semantic animacy: How much are words alive? *Applied Psycholinguistics*, *37*, 1477–1499. doi: https://doi.org/10.1017/S0142716416000096

Roediger, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *21*, 803-814. doi: https://doi.org/10.1037/0278-7393.21.4.803

Schacter, D. L., Addis, D. R., Hassabis, D., Martin, V. C., Spreng, R. N., & Szpunar, K. K. (2012). The future of memory: remembering, imagining, and the brain. *Neuron*, *76*, 677-694. doi: https://doi.org/10.1016/j.neuron.2012.11.001

Schacter, D. L., Benoit, R. G., & Szpunar, K. K. (2017). Episodic future thinking: Mechanisms and functions. *Current Opinion in Behavioral Sciences*, *17*, 41–50. doi: https://doi.org/10.1016/j.cobeha.2017.06.002

Schaller, M., Park, J. M., & Kenrick, D. T. (2006). Human evolution and social cognition. In R. I. M. Dunber & L. Barrett (Eds.), *Handbook of evolutionary psychology* (pp. 491-504). Oxford: Oxford University Press.

Scofield, J. E., Buchanan, E. M., & Kostic, B. (2018). A meta-analysis of the survival-processing advantage in memory. *Psychonomic Bulletin & Review*, *25*, 997-1012. doi: https://doi.org/10.3758/s13423-017-1346-0

Stadthagen-González, H., Ferré, P., Pérez-Sánchez, M. A., Imbault, C., & Hinojosa, J. A. (2017). Norms for 10,491 Spanish words for five discrete emotions: Happiness, disgust, anger, fear, and sadness. *Behavior Research Methods*, *50*, 1943–1952. doi: https://doi.org/10.3758/s13428-017-0962-y

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

Steyvers, M., & Tenenbaum, J. B. (2005). The large-scale structure of semantic networks: Statistical analyses and a model of semantic growth. *Cognitive Science*, *29*, 41-78. doi: https://doi.org/10.1207/s15516709cog2901_3

VanArsdall, J. E., Nairne, J. S., Pandeirada, J. N. S., & Cogdill, M. (2015). Adaptive memory: Animacy effects persist in paired-associate learning. *Memory*, *23*, 657–663. doi:https://doi.org/10.1080/09658211.2014.916304

Witt, J. K., Proffitt, D. R., & Epstein, W. (2004). Perceiving distance: A role of effort and intent. *Perception*, *33*, 577-590. doi: https://doi.org/10.1068/p5090

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

Wurm, L. H. (2015). Auditory and visual processing of novel stimuli are affected by subjective connotations of danger and usefulness. *The Mental Lexicon*, *10*, 1-31. doi: https://doi.org/10.1075/ml.10.1.01wur

Wurm, L. H., & Seaman, S. R. (2008). Semantic effects in naming and perceptual identification, but not in delayed naming: Implications for models and tasks. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *34*, 381–398. doi: https://doi.org/10.1037/0278-7393.34.2.381.

Xiao, X., Dong, Q., Chen, C., & Xue, G. (2016). Neural pattern similarity underlies the mnemonic advantages for living words. *Cortex*, *79*, 99-111. doi: https://doi.org/10.1016/j.cortex.2016.03.016