Subjective frequency norms for 330 Spanish simple and compound words

ALAIN DESROCHERS AND JUANA M. LICERAS
University of Ottawa, Ottawa, Ontario, Canada

RAQUEL FERNÁNDEZ-FUERTES
University of Valladolid, Valladolid, Spain

AND

GLENN L. THOMPSON
University of Ottawa, Ottawa, Ontario, Canada

Ratings were collected from 102 native speakers of Spanish on the subjective frequency of occurrence of 330 Spanish words, including 120 deverbal compounds and their constituents. These ratings were found to be highly reliable, whether items were analyzed together or separately by type (i.e., compounds, nouns, verbs), as evidenced by indexes of internal consistency and test–retest reliability that were equal to or greater than .98. The validity of the normative ratings was attested to by statistically significant correlations with objective frequency, estimated at .63 for all items together, and .41, .51, and .78 for compounds, nouns, and verbs, respectively. Among the substantive issues addressed was the potential dependency in ratings for compounds and their associated verb–noun constituents. No relationship was discerned, supporting the idea that compound and constituent ratings are statistically independent in this experimental task. The theoretical and methodological implications of the findings are discussed. The ratings can be downloaded from <http://brm.psychonomic-journals.org/content/supplemental>.

Two common word-formation procedures in modern alphabetical languages are derivation and compounding. A word is said to be derived by affixation when an affix (e.g., a prefix or a suffix) is added to a root word (e.g., *read* + *er* → *reader*) or when an affix is substituted for another (e.g., *reader* → *reading*). A word is said to be derived by compounding when two lexemes (rarely more) are joined (e.g., *flycatcher*). Thus, compound words arise from the concatenation of distinct lexemes, which have their own frequency of occurrence in print and/or speech. In the study of lexical processing, this feature of compound words raises several theoretically important issues. For instance, if the lexicalization of compound words is complete, all properties of their constituents (e.g., their frequency of occurrence) may be opaque to language users and have no bearing on the perception of the whole words (for a discussion, see Chialant & Caramazza, 1995; McQueen & Cutler, 1998). The two primary aims of the present study are to establish subjective frequency norms for an extended set of Spanish words and address open questions, such as whether subjective evaluations of compounds and their constituents are interdependent.

Estimating Lexical Frequency

The two most commonly used sources for lexical frequency information are drawn from (1) the summed fre-

quency of occurrence of individual word forms within a corpus of text (or transcribed speech) and (2) the subjective ratings of lexical frequency provided by a sample of respondents. The former is referred to as *objective frequency* and typically reflects the frequency with which professional writers (e.g., novelists, newspaper reporters) use these words. The latter is referred to as *subjective frequency* and reflects the experiences of a sample of participants asked to estimate word frequency by using a Likert-like scale, usually of 7 points, anchored by labels (e.g., 1 = *very infrequent*; 7 = *very frequent*). Texts, in the case of objective frequency, and participants, in the case of subjective frequency, may be sampled from a specific target population, depending on the interests of the researchers (e.g., movie transcripts, university students).

It has been argued that both objective and subjective frequency norms should be used jointly in the selection of lexical stimuli, regardless of whether word frequency is being experimentally controlled or manipulated (Gernsbacher, 1984; Thompson & Desrochers, 2009; for examples of applications, see Bertram & Hyönä, 2003; Monsell, Doyle, & Haggard, 1989). One factor limiting the adoption of this recommendation is the relative imbalance of availability for these two types of norms. For instance, sources of objective frequency are now available in many alphabetic languages (for English, see, e.g., Baayen, Piepenbrock, & Gulikers,

A. Desrochers, alain.desrochers@uottawa.ca

1995; Zeno, Ivens, Millard, & Duvvuri, 1995; for Dutch, see, e.g., Baayen et al., 1995; for French, see, e.g., Lété, Sprenger-Charolles, & Colé, 2004; New, Pallier, Brysbaert, & Ferrand, 2004; for German, see, e.g., Baayen et al., 1995; for Greek, see, e.g., Ktori, van Heuven, & Pitchford, 2008; for Portuguese, see, e.g., Marques, Fonseca, Morais, & Pinto, 2007; for Spanish, see, e.g., Alameda & Cuetos, 1995; Sebastián-Gallés, Martí, Cuetos, & Carreiras, 2000). In comparison, the range of alphabetic languages for which subjective frequencies are available is limited (for English, see, e.g., Balota, Pilotti, & Cortese, 2001; Carroll, 1971; Shapiro, 1969; Tryk, 1968; for French, see, e.g., Bonin et al., 2003; Desrochers & Bergeron, 2000; Desrochers & Thompson, 2009; Ferrand et al., 2008; Flieller & Tournois, 1994; Forget, 2005; Gonthier, Desrochers, Thompson, & Landry, 2009), as is the pool of words for which subjective frequency estimates are available in these languages. This imbalance may be attributed, in part, to the cost of collecting such ratings.

Objective frequency is often taken to be an indicator of the occurrence of words in the lexical environment, whereas subjective frequency reflects the impression left by these occurrences on the speaker or reader. As expected, these two estimates of word frequency are significantly and strongly correlated, but their association is far from perfect. Table 1 reports correlation coefficients drawn from studies carried out with different samples of native speakers of English or French ($r > .46$). Note that similar correlation coefficients are obtained between objective frequency and subjective ratings of word familiarity ($r > .55$; Benjafield & Muckenheimer, 1989; Bird, Franklin, & Howard, 2001; Stadthagen-Gonzalez & Davis, 2006). This pattern is not surprising since standard instructions for rating familiarity explicitly refer to word frequency as a decision criterion (Toglia & Battig, 1978), and the anchor labels used at each end of the rating scale may explicitly designate frequency of occurrence—for example, 1 (*never seen before*) and 7 (*seen nearly every day*)—(Stadthagen-Gonzalez & Davis, 2006). Subjective frequency and familiarity ratings may therefore be tapping

the same latent construct. However, it has been argued that subjective frequency is preferable as an operational definition because it is seemingly less confounded than familiarity with semantic variables (Balota et al., 2001).

Several factors may account for the less than perfect correlation between objective and subjective frequency estimates over and above measurement or sampling error (see Baayen, 2001; Thompson & Desrochers, 2009). For instance, a common limitation of objective frequency estimates is that the probability of encountering certain items—usually those of low frequency—is constrained by context (e.g., topics, media). These words are characterized as *underdispersed* in quantitative lexicography. Underdispersion entails, among other things, marked instability in objective frequency estimates across studies. If underdispersed words happen to be particular to a writing style or thematic domain that falls outside the population used to assemble the corpus, their estimated objective frequency will be biased downward. Conversely, underdispersed words that fall within the sampled population will see their estimated objective frequency systematically overestimated. There is reason to question the reliability or validity of objective frequency estimates for some words, and the validity of subjective frequency estimates has also been challenged. Balota et al. (2001), for instance, reported results that suggested that subjective estimation of word frequency is co-determined by word characteristics other than the frequency with which words are encountered, such as meaningfulness and the familiarity of orthographic or phonological patterns (see also Baayen, Feldman, & Schreuder, 2006; Gonthier et al., 2009; Thompson & Desrochers, 2009). One way of identifying items with dubious validity may then be to obtain both objective and subjective frequency estimates for as large a number of words as possible and to cross-validate them against each other.

Word Frequency As a Determinant of Lexical Processing

The importance of accurately estimating lexical frequency cannot be overstated. Of all the lexical charac-

Table 1
Correlations Between Objective ($\log_{10}$) and Subjective Frequency Estimates Drawn From Different Studies in Two Alphabetic Languages

Study	Source of Objective Frequencies	Word Sample Size	Pearson's r
English			
Balota et al. (2001)	CELEX	480	.81
Tryk (1968)	Thorndike & Lorge (1944)	100	.76
Carroll (1971)	Kučera & Francis (1967)	60	.93
Shapiro (1969)	Kučera & Francis (1967)	60	.92
French			
Desrochers & Thompson (2009)	New et al. (2004)	3,505	.67
Desrochers & Bergeron (2000)	Imbs (1971)	1,916	.66
Gonthier et al. (2009)	New et al. (2004)	1,612	.71
Ferrand et al. (2008)	New & Pallier (2005); New et al. (2004)	1,493	.81
Flieller & Tournois (1994)	Imbs (1971)	998	.76
Bonin et al. (2003)	New et al. (2001)	866	.46
Forget (2005)	New et al. (2004)	565	.67
Denis (1975)	Imbs (1971)	100	.61

Note—All correlation coefficients are statistically significant ($p < .001$).

teristics known to influence visual word recognition, frequency of occurrence is clearly among the most potent: The accuracy and speed of responses to printed words are directly and positively related to their frequency of use in tasks that involve isolated words (e.g., lexical decision, single-word reading, word categorization; for reviews, see Monsell, 1991; Norris, 2006) and sentences (for a review, see Rayner, 1998). This lexical characteristic can also moderate the effect of other variables, such as orthographic regularity (Lupker, Brown, & Colombo, 1997) and imageability (de Groot, 1989; James, 1975). Because of its ubiquitous influence on lexical processing, word frequency needs to be rigorously controlled when it is not intentionally manipulated in psycholinguistic experiments (i.e., in the case of a quasi-experiment evaluating a “between-words” variable).

As noted above, in the implementation of this sort of experimental control, compound words raise a special problem: The compound and its constituents are words, each with its own distinct frequency of occurrence in print. This feature has been exploited in experiments designed to investigate the possibility that compound words are decomposed into their constituents as they are processed. Such a view would be supported if constituent frequency was found to account for a significant amount of variance in reading tasks over and above the frequency of the compound itself. So far, most of these experiments have been carried out with speakers of Basque, Dutch, English, Finnish, German, or Spanish. These studies vary considerably in their choice of experimental tasks, design, item selection criteria, and dependent measures. It is perhaps unsurprising then that the results obtained in such experiments vary widely.

Some lexical decision studies of lexicalized concatenated compound words have failed to detect any significant constituent frequency effect (e.g., de Jong, Feldman, Schreuder, Pastizzo, & Baayen, 2002; van Jaarsveld & Rattink, 1988). Using the same methodology, other studies have reported a significant constituent frequency effect for the first lexeme only (Taft & Forster, 1976), for the second lexeme only (Duñabeitia, Perea, & Carreiras, 2007; Juhasz, Starr, Inhoff, & Placke, 2003), or for both lexemes (Andrews, 1986; Inhoff, Starr, Solomon, & Placke, 2008; Zwitserlood, 1994).¹ These studies suggest that the pattern of frequency effects in compound word processing could depend on the way compound words are constructed in different languages, task requirements, the dependent variables being measured, and/or the interactions among these factors.

Of all the techniques currently available to researchers, the study of eye movements in the course of silently reading compound words embedded in sentences is particularly well suited to the investigation of word structure analysis. This experimental paradigm makes it possible to track the effect of item variables in the early stages of lexical processing through the analysis of first-fixation duration and, in later stages, through the analysis of subsequent fixations, regressive eye movements, and total fixation duration (see, e.g., Inhoff, Radach, & Heller, 2000). When lexical processing is broken down into time-locked

events, the conditions under which the characteristics of compound words or their constituents influence reading yield finer experimental observations. For instance, Pollatsek, Hyönä, and Bertram (2000) detected a significant frequency advantage (i.e., shorter fixation duration) for the first lexeme only on the first fixation; frequency effects for the compound words and all constituent lexemes were observed when total gaze duration (i.e., the sum of all fixation durations on a word prior to moving to another word) was examined (for similar results, see Andrews, Miller, & Rayner, 2004). Follow-up studies have found that the magnitude of the constituent frequency effect was larger for the lexeme that contributes most to the meaning of the whole compound word (i.e., dominant vs. non-dominant constituent; Inhoff et al., 2008). It may indeed be more efficient to process constituent lexemes, which are often more familiar than the full form, as the meaning of the compound word is accessed. In any case, the frequency of compounds, as well as of their constituents, may play a role in reading under certain conditions. It is therefore essential to estimate this lexical characteristic accurately.

As argued earlier, collecting subjective frequency ratings is an important part of ensuring that lexical frequency is accurately estimated. In the special case of compounds, multiple subjective frequency ratings are required: those of whole words, as well as those of their constituents. Such norms are valuable in and of themselves because they support the efforts of researchers in effecting statistical control or experimental control via matched lists and careful item selection. In addition, as with other experimental tasks (e.g., lexical decision, reading aloud or silent reading with eye tracking), subjective frequency judgment can be used to directly investigate the relationship between compound and constituent frequency. The results of such an investigation would speak at once to both the validity of the subjective frequency norms (e.g., is the estimation of compound frequency biased by constituent frequency?) and the same kind of substantive issue that is addressed by the studies reviewed above (i.e., are compounds processed independently of their constituent lexemes?).

Purpose

Accordingly, the purpose of the present study is twofold. First, it is intended as a contribution to the development of an extended Spanish lexical database for psycholinguistic research. To this end, we provide reliable subjective frequency ratings for a sizable set of compound–constituent pairs for research applications. Second, the study was designed to address a theoretically important issue that pertains directly to the validity of the reported norms—namely, the potential cross-contamination posed by the influence of constituent frequency on the estimation of compound frequency and vice versa.

METHOD

Participants

The sample comprised 102 Spanish-speaking volunteers (61 female) who were students in the Faculties of Arts, Science, and Engineering at the University of Valladolid. Their mean age was

23.78 years ($SD = 3.9$), with a distribution ranging from 19 to 43 years. All participants were native speakers of Spanish, were free of a history of reading problems, and had normal or corrected-to-normal vision.

Materials

The lexical material included 124 deverbal compounds,² 102 nouns, and 104 verbs. The compound words (e.g., *cazamoscas*, “fly-catcher”) were sampled from dictionaries so as to represent a broad range of familiarity. The nouns and verbs included those found in the structure of the compound words (e.g., *cazar*, “to catch”; *mosca*, “fly”). Most deverbal compounds are in the *Diccionario de la Lengua Española* (Real Academia Española, 2001), and the others were gleaned from blogs and advertisements on the Internet. The validity of the latter sample of words was attested to by an independent group of 12 Spanish adults, who rated the compound words included in the study as genuine and assigned to them a consistent meaning (Liceras, Mongeon, Cuza, Senn, & Spradlin, 2004).

The response booklet included two distinct parts. The first part included rating instructions and the 124 compound words mixed with 26 repeated items, for a total of 150 items. The second part included rating instructions and the 206 noun and verb items mixed with 24 repeated items, for a total of 230 items. These sets of items were presented separately in order to minimize the possibility of unintended priming of the compounds by their constituents. Within each set, the order of items was randomized. Each set was presented in two columns over five pages, with 15 items per column for compounds and 23 items per column for nouns and verbs. Each page was typed double spaced, and each item was accompanied by a space between parentheses to provide the frequency rating. The 7-point rating scale was presented horizontally at the top of each page of items. The label “poco frecuente” (*very infrequent*) appeared to the left of value 1 of the scale, and the label “muy frecuente” (*very frequent*) appeared to the right of value 7. The last page of the booklet was included to collect demographic data from the participants (e.g., age, gender, mother tongue, university program).

Procedure

Participants were tested in small groups of 5 to 10 people in a quiet classroom at the University of Valladolid and given as much time as they required to rate all items. At the beginning of each session, the purpose of the study was explained and instructions were provided. These instructions pointed out that some words occur more or less frequently in use. They provided explanations on the organization of the questionnaire and on the utilization of the 7-point scale. Participants were asked to examine the items and identify those to which they would give a rating of 1 or a rating of 7 before they started rating all items. They were asked explicitly to make use of the entire range of the scale. The verbatim instructions were adapted into Spanish from those used by Denis (1975).

RESULTS

The results are reported in the following order: First, we describe the screening procedure that was used to identify potential outliers among the participants. Second, the distributional properties of the subjective frequency norms are presented. Third, the internal consistency of the ratings is estimated using Cronbach’s alpha and Guttman split-half correlation coefficients. Fourth, these tests are followed by an examination of the test–retest reliability for the subset of repeated items in the list. Fifth, the validity of the norms is assessed via correlations with available objective frequency and familiarity norms. Finally, substantive issues regarding the relationship between compound words and their verbal and noun constituents are investigated.

Participant Screening

In a normative study, the roles of items and participants are reversed so that the words are assigned a trait score that is based on their performance with the sample of participants. It is, therefore, possible to compute correlations between each participant’s ratings and the mean ratings of the entire group. Low or negative correlations might indicate that the participants misunderstood the instructions (e.g., reversed the rating scale) or might belong to a different population of respondents. When all items in the study were considered together, the “participant–group” correlations observed with the present sample ranged from .60 to .91, with one exceptional case producing a value of .42 ($M = .80$, $SD = .08$). Thus, all participants exceeded the .40 item–total correlation cutoff that is typically employed as a decision rule in the item-screening procedures of assessment-tool developers.

Distributional Characteristics

Overall, the distribution of mean ratings reported in this article was characterized by an average score of 4.69, a standard deviation of 1.67, a median of 5.23, and a range of 5.68 out of the possible 6 afforded by the 7-point scale, with a minimum value of 1.19 and a maximum value of 6.86. The skewness value of -0.58 ($SE = 0.13$) and kurtosis value of -1.05 ($SE = 0.27$) corresponded to standardized values of -4.92 and -4 , respectively, denoting significant negative skew and platykurtosis. Visual inspection of Figure 1 confirms a slightly *j*-shaped distribution, reflecting a larger representation of items at the high end of the frequency spectrum in the present sample.

Internal Consistency

Responses to the items used in this study ($N = 330$) were found to have a high degree of internal consistency. Both the Cronbach alpha and the Guttman lower-bound split-half coefficients were .99. The same analysis was

Figure 1. Distribution of subjective frequency ratings by half-points on the 7-point scale.

performed separately for the compounds ($n = 124$, Cronbach and Guttman = .99), nouns ($n = 101$, Cronbach = .98, Guttman = .99), and verbs ($n = 105$, Cronbach and Guttman = .99), yielding identical results. Therefore, the internal consistency of these ratings meets very high psychometric standards.

Test–Retest Reliability

The stability of the ratings across time was assessed using both items and participants as the units of analysis. The results of the by-items analysis are reported first, followed by the analyses conducted by subjects. All reported correlations are Pearson product–moment r , and all statistical tests were evaluated at the nominal .05 level of significance.

The by-items analysis indicated a strong test–retest correlation that approached unity [$r(50) = .99$] when all words were included in the analysis. When the three classes of words were considered separately, the test–retest coefficients remained uniformly high: For compound words, $r(26) = .99$; for nouns, $r(12) = .98$; and for verbs, $r(12) = .99$. Paired-samples t tests failed to detect any practice effects whether all words [$t(49) = 0.10$, $SE = 0.02$, $p = .93$] were considered simultaneously or whether compounds [$t(25) = 0.86$, $SE = 0.04$, $p = .40$], nouns [$t(11) = -1.44$, $SE = 0.04$, $p = .18$], or verbs [$t(11) = -0.24$, $SE = 0.04$, $p = .81$] were considered individually.

A by-subjects analysis of the data, whereby correlations were performed separately for each participant, indicated that the average test–retest correlation was .88 ($SD = .09$) when all items were included in the analysis. The average correlation dropped slightly to .80 ($SD = .14$) for compounds, to .80 ($SD = .24$) for nouns, and to .86 ($SD = .15$) for verbs considered separately. In accord with the by-items analysis, the by-subjects analysis of practice effects, conducted using the random coefficient methodology proposed by Lorch and Myers (1990), failed to detect any reliable change with repetition. This result remained consistent whether all items were considered together [$t(101) = 0.10$, $SE = 0.02$, $p = .49$] or separately as compounds [$t(101) = 1.00$, $SE = 0.03$, $p = .49$], nouns [$t(101) = -1.79$, $SE = 0.03$, $p = .49$], or verbs [$t(101) = -0.26$, $SE = 0.03$, $p = .49$].

Convergent Validity: Comparison With Objective Frequency and Familiarity

To establish the validity of the ratings, the mean subjective frequency ratings were correlated with their log ob-

jective frequency and mean subjective familiarity ratings, both of which were drawn from the Spanish lexical database LEXESP (Sebastián-Gallés et al., 2000). The present norms overlapped sufficiently with the LEXESP data to permit tests for the overall item sample, compounds only, nouns only, and verbs only. These correlation coefficients were positive and statistically significant (all $ps < .001$) (see Table 2). The magnitude of these relationships is within the typical range for correlations between subjective and objective frequency estimates (see Table 1), whether compounds or their constituents are considered. As noted in the introduction, rating instructions for the estimation of word familiarity often refer to lexical frequency as a decision criterion. Given this conceptual overlap, the strong correlation that was observed between subjective frequency and the familiarity ratings was not unexpected.

Construct Validity: Compound Versus Constituent Frequency

The morphological relationships among the items used in the present study allow another substantive issue to be addressed—namely, the association between the frequency of a compound word and that of its constituent lexemes, which in this case comprise a verb and a noun. We investigated this relationship in two ways.

First, since compounds are expected to be constructed from relatively familiar components, the possibility of significant differences between the mean subjective frequency of compounds and that of their component words was examined. This verification was carried out with two paired-samples t tests: one with nouns and the other with verbs. The result indicates that compounds ($M = 3.81$, $SD = 1.71$) were indeed significantly lower in subjective frequency than either their constituent nouns ($M = 6.08$, $SD = 0.58$) [$t(121) = -14.17$, $SE = 0.16$, $p < .001$] or their constituent verbs ($M = 5.69$, $SD = 1.02$) [$t(123) = -11.30$, $SE = 0.17$, $p < .001$]. This result mirrors that observed with objective frequency, whereby compound words were found to be of lower log frequency ($M = 1.20$, $SD = 0.21$) than either their nouns ($M = 2.38$, $SD = 0.64$) [$t(50) = 13.77$, $SE = 0.09$, $p < .001$] or their verbs ($M = 2.03$, $SD = 0.47$) [$t(51) = 12.04$, $SE = 0.07$, $p < .001$].

Second, the strength of the association between compounds and their component words was examined. The subjective frequency of the compounds was not found to be significantly correlated either with noun subjective frequency [$r(122) = .09$, $p = .35$] or with verb frequency

Table 2
Correlation Between Subjective Frequency, Objective Frequency ($\log_{10}$), and Familiarity Estimates in Spanish

LEXESP Data	Subjective Frequency			
	Overall Sample	Compounds Only	Nouns Only	Verbs Only
Objective frequency	.65 (248)	.37 (53)	.53 (102)	.80 (93)
Familiarity	.75 (143)	.64 (10)	.76 (92)	.84 (41)

Note—All correlation coefficients are statistically significant ($p < .001$). The values in parentheses are the numbers of words available in the LEXESP database (Sebastián-Gallés et al., 2000) for computing these coefficients.

out. Objective frequency estimates are largely dependent on text sampling procedures and sample size (see Baayen, 2001; Burgess & Livesay, 1998); subjective frequency judgment may be influenced by other lexical attributes, such as imageability (see Thompson & Desrochers, 2009). These considerations do not imply that the experimental or statistical control of frequency cannot be achieved with a high level of accuracy (especially if estimates are cross-validated using both objective and subjective frequency), but as Cutler (1981) once emphasized, caution is in order.

In the present study, a potential source of bias in subjective frequency ratings was investigated: the role of word constituents—in particular, their lexical frequency—in determining the subjective frequency estimates of Spanish deverbal compounds. Since these compounds are constructed from distinct lexemes with a frequency of use of their own, there was a priori a potential source of estimation bias that needed to be examined more closely. The potential bias failed to materialize, as the results reported here yielded no evidence of a direct or indirect influence of constituent frequency in the estimation of compound subjective frequency. The null findings suggest that, for this particular task, the processing of deverbal compounds is immune to the influence of constituent frequency. In the introduction, we reviewed evidence that the extent of this immunity may depend on compound construction procedures (see note 2), languages under consideration, experimental tasks, and dependent measures. The present results are only a part of the puzzle, a contribution to the growing body of empirical work cataloging the circumstances under which various frequency parameters are relevant to lexical processing.

Ultimately, the way compound words are processed may depend on what people do automatically when they read (i.e., the processes that are not under conscious control), as well as what they are reading for (i.e., the processes that are under conscious control). If we can assume that readers aim at activating lexical representations that best serve their immediate purpose, then future investigations could be directed to identifying the conditions under which the properties of constituent lexemes influence reading processes. A complete account of these dynamic processes will likely require multiple behavioral and physiological indicators. The set of norms reported here is intended to provide support for such empirical investigations.

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NOTES

1. In the studies we reviewed, the constituent frequency effect for the first lexeme is typically robust in the analysis by subjects but marginal in the analysis by items. This pattern of results is often interpreted as being indicative of a failure to adequately capture between-items variability. It is also particularly ambiguous since the by-item test is typically the most robust to Type I error inflation due to aggregation bias (see Baayen, Davidson, & Bates, 2008).

2. Spanish deverbal compounds are composed of a verb and a noun. The verb form corresponds to the third-person singular of the present in-

dicative, and the noun form takes a generic *-s* marker (e.g., *abrebotellas*, "bottle opener"; *lavaplatos*, "dishwasher"). The head-initial pattern of Spanish deverbals is also found in other alphabetic languages, such as French (e.g., *ouvre-boîtes*, "can opener"; *gratte-ciel*, "skyscraper"). By contrast, English deverbals are head-final (e.g., *skyscraper*, rather than **scrapesky*). The verb typically takes an agentive *-er* suffix, and the noun takes the singular form.

3. The correlations among the objective frequencies of the compounds and their constituents are based on 48 and 49 words for verbs and nouns, respectively. Two words were found to be disproportionately influential in determining the estimated correlation according to a plot of Cook's distance values (see Cohen, Cohen, West, & Aiken, 2003, p. 404) and were removed from this particular analysis.

SUPPLEMENTAL MATERIALS

The word norms discussed in this article may be downloaded from <http://brm.psychonomic-journals.org/content/supplemental>.

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