Normative data and naming times for action pictures

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The present article provides Spanish norms for name agreement, printed word frequency, word compound frequency, familiarity, imageability, visual complexity, age of acquisition, and word length (measured by syllables and phonemes) for 100 line drawings of actions taken from Druks and Masterson (2000). In addition, through a naming-time experiment carried out with a group of 54 Spanish students in a pool of 63 of these line drawings, we determined the best predictors of naming actions. In the multiple regression analysis, age of acquisition and name agreement emerged as the most important determinants of action-naming reaction time.

The retrieval of words for speech is a fast and efficient process, as is indicated by the fact that in normal conditions we can produce two to three words every second with no more than one or two errors per thousand words (Levelt, 1989, 1999; Levelt, Roelofs, & Meyer, 1999). However, this is not always the case, as sometimes we cannot find the word we are looking for—for example, when we are in the “tip-of-the-tongue” state (Brown, 1991; Brown & McNeill, 1966). Which variables determine speed and accuracy in lexical access during oral production?

In the past few years, many studies have been carried out using the methodology of picture naming. In the majority of them, it has been found that the age at which words are acquired (age of acquisition) is the most important predictor of naming time: Objects with names learned early in life are named more quickly than objects with names learned later in life (Carroll & White, 1973; Morrison, Ellis, & Quinlan, 1992). Other determinant variables are the familiarity of the object, the frequency of the name, and name agreement (Barry, Morrison, & Ellis, 1997; Cuetos, Ellis, & Alvarez, 1999; Ellis & Morrison, 1998; Snodgrass & Yuditsky, 1996). However, the stimuli used in all these studies were object pictures having concrete nouns as their names. In contrast, we have little information about naming time for other kinds of words, such as verbs, in spite of the fact that verbs play an important role in building sentences.

Verbs have different properties than nouns. The most obvious of these is that they play different syntactic roles in the sentence: Verbs play the role of function, and nouns the role of argument. But there are other, more subtle dif-

ferences. According to Gentner (1981), the semantic representations of verbs are more complex than the semantic representations of nouns, because nouns need only the referent of the object to be represented, whereas verbs involve relational concepts.

In fact, nouns and verbs may be processed by different areas of the brain, as is indicated by the double dissociation found in aphasic patients (although Devlin et al., 2002, claim that dissociations in patients do not necessarily indicate the involvement of different neural systems). There are patients who have problems in recovering verbs and normal performance with nouns (Caramazza & Hillis, 1991; Rapp & Caramazza, 1998; Silveri & Di Betta, 1997) and patients with the opposite problem (Caramazza & Hillis, 1991; Shapiro, Shelton, & Caramazza, 2000; Silveri & Di Betta, 1997). Also, neuroimaging studies have shown that different areas of the brain are activated when subjects retrieve nouns and verbs: Nouns activate areas of the left temporal lobe, whereas verbs activate the left frontal lobe (Damasio & Tranel, 1993; Daniele, Giustolisi, Silveri, Colosimo, & Gainotti, 1994; Tranel, Damasio, & Damasio, 1998). This was confirmed in a recent study by Shapiro, Pascual-Leone, Mottaghy, Gangitano, and Caramazza (2001), in which stimulation of the frontal area in normal subjects with the repetitive transcranial magnetic stimulation technique provoked difficulties in recovering verbs, whereas the recovery of nouns was not affected.

For a complete view of the lexical retrieval processes in production, it will be necessary to investigate verb processing as well as noun processing. From a theoretical point of view, differences between verb and noun processing are anticipated. If the semantic representations of actions are more complex and more difficult to designate with a name than are those of objects, it is possible that some semantic variables, such as familiarity and imageability, may be more influential in the processing of verbs than in that of nouns.

To this end, researchers have started to collect normative data on verbs. Fiez and Tranel (1997) published norms

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on visual complexity, image agreement, name agreement, and familiarity for 280 photographs of actions. Masterson and Druks (1998) collected data on visual complexity, imageability, familiarity, and age of acquisition for 102 line drawings representing actions. Also, Bird, Franklin, and Howard (2001) and Chiarello, Shears, and Lund (1999) have gathered normative data on verbs. However, to our knowledge, there have been no studies aimed at probing the determinants of the speed of naming actions.

The motivation for the present study was twofold. The first goal was to provide normative data in Spanish for the Druks and Masterson (2000) pictures in order to help researchers to design more carefully controlled experiments and clinicians to test their patients' abilities to process nouns and verbs. The second goal was to discover whether the variables that determine naming times for verbs are the same as those that account for naming times for pictured nouns. We chose Druks and Masterson's pictures because they are simple line drawings similar to those of Snodgrass and Vanderwart (1980) for nouns that are commonly used in research and clinical practice.

NORMATIVE STUDY

Method

Name Agreement

Fifty undergraduate students of psychology at the University of Oviedo participated in this study. All were native speakers of Spanish. Each participant was shown 100 line-drawing pictures of actions from the Druks and Masterson (2000) battery individually, one by one, and was asked to name them aloud. The order of presentation of the pictures was randomized for each participant. The task was self-paced; the participants were under no pressure to respond quickly. The experimenter wrote the responses given by each participant on a sheet. Appendix A shows the most frequent name and the other responses given for each picture.

Frequency of Printed Words

This value was obtained from the LEXESP database (Sebastián, Martí, Carreiras, & Cuetos, 2000), counted from a corpus of five million words. The measure is the frequency of the infinitive form of the verb that the participants used to name the action picture—for example, *bailar* [to dance], *leer* (to read), and so forth.

Compound Frequency

Some models of lexical processing (e.g., Allen & Badecker, 1999; Caramazza, Laudanna, & Romani, 1988; Laudanna, Badecker, & Caramazza, 1992) posit morphological decomposition on words in the mental lexicon. According to these models, the recovery of a word involves retrieving the stem of that word and adding the corresponding affix. If these models are correct, for verbs the frequency of the infinitive form might be less important than the frequency of all forms of the verb combined—that is, the frequency of the stem. For this reason, we created a new variable by adding the frequency of all forms of the verb. (In Spanish, each verb has many different forms, because numerous different suffixes indicate tense, mood, person, number, etc.; so, for example, to the frequency of the action verb *bailar* [to dance], we added those of the forms *bailo*, *bailaba*, *bailará*, *bailamos*, etc.)

Familiarity

This variable was also taken from the LEXESP database. To create it, the participants were asked to judge the degree to which they come in contact with or think about the action represented by the

word. A 7-point rating scale was used, on which 1 meant *very unfamiliar* and 7 *very familiar*.

Imageability

This variable too was taken from the LEXESP database. On a 7-point rating scale, the participants were to indicate the degree of difficulty in eliciting the image of the action represented by the modal verb. The number 1 indicated that the image arises with the greatest difficulty, and 7, that it arises very easily.

Visual Complexity

This variable was taken from Masterson and Druks (1998), since we assume that visual complexity, as a perceptual variable, will be similar for speakers of different languages. In fact, in the comparison made by Alario and Ferrand (1999) between several indices for English samples (Snodgrass & Vanderwart, 1980), Spanish samples (Sanfeliu & Fernández, 1996), and French samples (Alario & Ferrand, 1999), they found that there were small differences between image agreement, familiarity, and visual complexity—that is, for variables referring to the objects. However, for variables referring to the names of the objects, such as name agreement, they found strong differences among the different languages. A 7-point rating scale was used, on which 1 meant *not at all visually complex* and 7 meant *very visually complex*.

Age of Acquisition

Following the Gilhooly and Logie (1980) procedure, which has been used by many researchers (e.g., Morrison, Chappell, & Ellis, 1997), 53 undergraduate students at the University of Oviedo judged the age at which they thought they had learned each of the 100 action words. The words were shown in written form on sheets, and the participants were asked to indicate, on a 7-point scale, the age at which they thought they had learned each of them. Each point on the scale represented 2 years in the life of the participant; thus, 1 indicated that the participant had learned the word in the first 2 years of life, 2 between 3 and 4 years of age, and, finally, 7 indicated that the participant had learned the word after 13 years of age.

Results

Table 1 shows the means, standard deviations (*SDs*), and minimum and maximum values of each variable. Appendix B shows the values of all those variables for each of the pictures. (These norms are available at <http://gip.uniovi.es/NPC/actionpictures.xls>.)

NAMING-TIME EXPERIMENT

Method

Participants

Fifty-four undergraduate students of psychology at the University of Oviedo participated voluntarily in this experiment. All were mono-

Table 1
Mean and Standard Deviation for Each Variable

	Mean	SD	Min	Max
Name agreement (%)	83.58	21.29	24	100
Word Frequency (per million)	24.10	54.84	1	508
Compound frequency (per million)	175.87	584.681	1	5,715
Familiarity (1–7)	6.12	0.633	4.23	6.90
Imageability (1–7)	5.35	0.644	3.68	6.51
Visual complexity (1–7)	4.20	0.82	1.25	6.00
Age of acquisition	2.75	0.73	1.47	4.60
Number of phonemes	6.40	1.75	4	13
Number of syllables	2.46	0.78	2	6

Table 2
Correlation Matrix Among All Independent Variables and Naming Times

Variable	1	2	3	4	5	6	7	8	9	10	11
1. RT1 (msec)	1.000										
2. RT2 (msec)	.767**	1.000									
3. VC (1–7)	.102	.194	1.000								
4. <i>H</i>	.573**	.409**	–.135	1.000							
5. WF (per million)	–.238	–.099	–.069	–.069	1.000						
6. CF (per million)	–.219	–.112	.124	–.063	.830**	1.000					
7. Imageability (1–7)	–.071	–.011	–.189	–.345*	–.025	–.143	1.000				
8. Familiarity (1–7)	–.271	–.232	–.099	–.265	.548**	.426**	.186	1.000			
9. AoA (1–7)	.498**	.483**	.283+	.226	–.453**	–.437**	–.290+	–.544**	1.000		
10. Number of phonemes	.196	.185	.056	.101	–.404**	–.339**	.108	–.133	.325**	1.000	
11. Number of syllables	.312+	.332*	.127	.153	–.342**	–.308*	.150	.026	.299+	.886*	1.000

Note—RT1, reaction time in Phase 1; RT2, reaction time in Phase 2; VC, visual complexity; WF, word frequency; CF, compound frequency; AoA, age of acquisition. + $p < .05$. * $p < .01$. ** $p < .001$.

lingual Spanish speakers, and all had normal or corrected-to-normal vision. None had participated in the normative study.

Stimuli

From the results of the normative study, 73 pictures with clear names were selected. We used name clarity as the criterion for selection, because in RT experiments it is necessary to use pictures that can be named unambiguously; otherwise, there will be great variability in the data. Therefore, 27 of the original 100 pictures were not used in this experiment, because (1) they did not have a one-word name in Spanish (e.g., for the picture representing the action of tickling, the participants said “hacer cosquillas”; for the picture representing the action of juggling, they said “hacer malabarismos”) or (2) they had low name agreement (that is, many of the actions represented by the pictures can be named in Spanish with different words (e.g. *caminar* and *andar* for “to walk,” *llamar* and *picar* for “to knock,” *parar* and *detener* for “to stop”). Of the 73 pictures selected, 63 were used as experimental stimuli (each one had name agreement above 80%), and 10 were used for practice.

Procedure

All the participants performed the experiment individually in a soundproof cubicle in the laboratory of the department. The participants were seated individually in front of the screen with the microphone held near the mouth by a headset. After adjustments were made for the sensitivity of the voice key, Phase 1 of the experiment began. First, the participants were given written instructions explaining that this was an experiment involving action naming. The participants were warned not to move their heads or breathe loudly during the experiment. In the instructions, the participants were asked to name the pictures as quickly and as accurately as possible. Presentation of pictures and recording of RTs were controlled by the Superlab program (Abboud & Sugar, 1997). Each trial began with the presentation of a fixation point in the middle of the screen for 1,000 msec. Then, each picture was presented in the center of the monitor screen and remained there until the participants had made a response. Finally, a question mark appeared until the experimenter pressed a key. Each picture subtended about 6.4° of horizontal $\times$ 5.4° of vertical visual angle. The first 10 pictures were displayed for practice. These were followed immediately by the experimental pictures. The order of presentation was randomized for each participant. The experimenter noted all naming errors, hesitations, and voice-key failures, and at the end of the experiment indicated to the participants which stimuli had been named incorrectly. Then, Phase 2 started, in which the experiment was run again following exactly the same procedure, but this time the participants were not informed of their errors. Two phases were used to reduce the variability produced in the recognition of the action. The first time that the participants saw a drawing, they could spend a lot of time trying to identify the

action it depicted, reducing the weight of other variables, especially the lexical variables. Introducing a second phase allowed us to reduce the surprise effect.

Results

The stimuli used for practice were not considered in the analysis of the results. From the experimental items, responses above and below 3 *SDs* from the mean were eliminated. These responses were naming errors—that is, all responses different from the targets according to the name-agreement list. Voice-key failures were also eliminated. In the first phase of the experiment, 489 responses (14.37% of the total) were removed, 347 (10.2%) of which corresponded to naming errors, 75 (2.2%) to outliers, and 67 (1.97%) to voice-key failures. The global mean of the naming time for all 63 items was 948 msec, and the *SD* was 121. In the second phase of the experiment, 219 (6.4% of the total) responses were removed: 116 (3.4%) were naming errors, 62 (1.8%) were outliers, and 41 (1.2%) were voice-key failures. The mean of the naming times was 848 msec, and the *SD* 68. The difference in naming times for the two phases of the experiment was significant [$t(62) = 9.73, p < .001$]. In Appendix C, the 10 easiest and the 10 most difficult items are shown, according to the RTs in both phases.

A correlation analysis was carried out with all the variables together, including the RTs of the two phases of the experiment. The values for simple frequency and cumulative frequency were transformed using the formula $\log(1 + x)$. The name-agreement values were converted to the *H* statistic following the procedure used by Snodgrass and

Table 3
Results of the Multiple Regression Analysis With Naming Times as the Dependent Variable in Phase 1

Measure	β	<i>SE</i>	<i>t</i>	<i>p</i>
Visual complexity (1–7)	.139	22.119	1.117	.272
<i>H</i>	.590	66.471	4.159	.000
Word frequency (per million)	.133	45.803	0.814	.422
Imageability (1–7)	.295	34.384	2.010	.053
Familiarity (1–7)	.071	31.064	0.429	.671
Age of acquisition (1–7)	.542	30.030	2.986	.005
Number of syllables	.053	34.041	0.366	.717

Table 4
Results of the Multiple Regression Analysis With Naming Times as the Dependent Variable in Phase 2

Measure	β	SE	<i>t</i>	<i>p</i>
Visual complexity (1–7)	.011	11.807	.091	.928
<i>H</i>	.382	35.484	2.814	.008
Word frequency (per million)	.182	24.450	1.163	.254
Imageability (1–7)	.278	18.355	1.980	.057
Familiarity (1–7)	–.052	16.583	–.331	.743
Age of acquisition (1–7)	.552	16.031	3.181	.003
Number of syllables	.278	18.172	1.992	.055

Vanderwart (1980). As can be seen in Table 2, RTs in both phases had significant correlations with age of acquisition, name agreement, and length in syllables. No other variable correlated significantly with RT. There were also highly significant correlations between the following independent variables: familiarity and age of acquisition; frequency and familiarity; frequency and length; age of acquisition and frequency; and, finally, length and age of acquisition.

One simultaneous multiple regression analysis was carried out for each phase, with the seven main variables taken as predictors (only one frequency—the simple frequency—and one measure of length—number of syllables—were considered).¹ The results for Phase 1 and Phase 2 are shown in Table 3 and Table 4, respectively. The overall equation for multiple regression was significant in both the analysis corresponding to Phase 1 [$R = .784$; $F(7,38) = 7.05$, $p < .001$] and that corresponding to Phase 2 [$R = .775$; $F(7,38) = 6.66$, $p < .001$].

As can be seen from the results, in Phase 1 name agreement (*H* statistic) and age of acquisition made independent contributions to naming time. Imageability approached significance. In Phase 2, name agreement and age of acquisition were again the main predictors, but now the number of syllables approached significance.

Regression analyses were also carried out on the number of naming errors made for each picture. The results are quite similar to those obtained with the RTs, as is demonstrated in Tables 5 and 6.

Again, name agreement and age of acquisition were the two main predictors, although imageability is no longer a significant variable.

In summary, age of acquisition and name agreement are the best predictors of naming times for actions. Number of syllables and imageability approached significance. However, the variables of familiarity, word frequency, compound frequency, number of phonemes, and visual complexity did not make independent contributions to the ability to predict the naming times or the number of errors.

DISCUSSION

One of the objectives of the present study was to provide normative data for verbs in Spanish. These data (see Appendices A and B) will help researchers to design more carefully controlled experiments aimed at investigating some potential processing differences between nouns and

verbs in Spanish. The norms provided here on variables such as word frequency, compound frequency, imageability, familiarity, age of acquisition, and name agreement from the Druks and Masterson (2000) battery of pictures will be, without a doubt, very useful for experiments on RTs in normal subjects and for studies involving aphasic patients.

The second aim of this study was to discover the determinants of action naming. What we found in the experiments presented above was that the most important variables were age of acquisition and name agreement. To a lesser extent, imageability and word length as measured in syllables are other determinant variables.

Age of acquisition, as estimated by the ratings of the participants, has emerged as the principal variable of naming times in several studies of object naming (Carroll & White, 1973; Morrison et al., 1992). In this experiment, we have found that the same happens with action naming: Action names learned early in life produce shorter RTs than do names learned later in life.

The other important variable in action naming—that is, name agreement—does not seem to play such an important role in object naming, however, since it appears significant in many studies (e.g., Barry et al., 1997; Cuetos et al., 1999; Lachman, Shaffer, & Hennrikus, 1974; Snodgrass & Yuditsky, 1996; Vitkovich & Tyrrell, 1995), but it usually does not have the same strength as do variables such as age of acquisition and frequency. Probably, this variable is more important in action naming because words that designate actions have representations in the mental lexicon that are less accurate than nouns. Also, it is possible that action pictures that have more alternative names and, hence, are subject to more competition between different responses, are produced when participants try to name action pictures.

When the participants saw the pictures for the first time (Phase 1), name agreement was the most important predictor variable, but in Phase 2 age of acquisition was the better predictor variable. Our interpretation of these results is that in Phase 1 the participants spent additional time recognizing the action represented by the pictures and trying to find the most appropriate name for that action. Thus, when an action can be given several names, RTs are lengthened by the need to select from among them, and for that reason name agreement is the most important variable. However, in Phase 2, less time was needed to recognize the action and to select the most appropriate name for that action. As a consequence, the

Table 5
Results of the Multiple Regression Analysis With Number of Naming Errors as the Dependent Variable in Phase 1

Measure	β	SE	<i>t</i>	<i>p</i>
Visual complexity (1–7)	.172	1.145	1.460	.154
<i>H</i>	.733	3.441	5.453	.000
Word frequency (per million)	.214	2.371	1.381	.177
Imageability (1–7)	.402	1.780	2.896	.007
Familiarity (1–7)	–.073	1.608	–.468	.643
Age of acquisition (1–7)	.464	1.555	2.703	.011
Number of syllables	–.089	1.762	–.643	.525

Table 6
Results of the Multiple Regression Analysis With Number of
Naming Errors as the Dependent Variable in Phase 2

Measure	β	SE	t	p
Visual complexity (1–7)	-.118	.393	-1.094	.282
H	.713	1.180	5.776	.000
Word frequency (per million)	.238	.813	1.672	.105
Imageability (1–7)	.364	.610	2.854	.008
Familiarity (1–7)	-.220	.552	-1.535	.135
Age of acquisition (1–7)	.434	.533	2.749	.010
Number of syllables	-.184	.604	-1.447	.158

main determiner in this phase is age of acquisition, a variable that the majority of researchers assume has its locus at the lexical level or in lexical access (Barry, Hirsh, Johnston, & Williams, 2001; Ellis & Morrison, 1998), although some postulate that the locus of age of acquisition is at the semantic level (Brysbaert, Wijnendaele, & De Deyne, 2000).

Length, measured in syllables, and imageability are slightly significant in the correlation analysis. Length rarely reaches significance in object naming, at least in English. In Spanish, however—a language with greater variability in word length and syllabic structure—it is an important variable in object naming (Cuetos et al., 1999). With regard to imageability, it is probable that with a larger range of values an effect could arise. But the range used in this study, as in the majority of studies using pictures, was quite restricted. In the error analysis, it clearly emerged as an important predictor. Familiarity, visual complexity, word frequency, compound frequency, and length in phonemes did not produce significant effects, even in the correlation analysis.

When the results of this experiment on action naming are compared with those of the object-naming experiment run by participants from the same pool (Cuetos et al., 1999), the notable differences are not only the determinants of naming times for actions and objects (name agreement is more important for verbs than for nouns, and, conversely, familiarity and frequency are significant variables for nouns and not for verbs), but also the difference in the RTs, which are longer in action naming than in object naming (913 vs. 829, respectively, using in both cases 2 SDs as the criterion for removing the outliers). This is probably because there is usually more happening in an action picture than in an object picture. Action pictures often depict either a person and an object or more than one person. Another (complementary) possibility is that it is more difficult to retrieve verbs because they have a less accurate representation in the lexicon or because of the competition between the different alternative responses. Clearly, that difference cannot be attributed to the characteristics of the words, because they were matched (at random) in both experiments in the main variables: Name agreement was 95.8% in the experiment on action naming and 96.2% in the object-naming experiment, the number of syllables was 2.32 for verbs and 2.51 for nouns, and the frequency was 17.9 for verbs and 17.7 for nouns. The only significant differences were in age of acquisition and familiarity,

but in both cases the differences favored action items, in that verbs had an age-of-acquisition mean of 2.85 and nouns one of 4.22, and familiarity was at 6.07 for verbs and at 3.24 for nouns.

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NOTE

1. Regression analyses, including the interaction between age of acquisition and word frequency, were also performed according to the procedure suggested by Aiken and West (1991), and yielded nonsignificant results.

APPENDIX A

Modal and Other (Nontarget) Responses of 50 Spanish Participants to the Druks and Masterson (2000) Pictures

No. of Subjects Giving Modal Response	Modal Response	Other Responses (Number of Subjects Per Response)
45	Abrir	Cerrar (5)
49	Acariciar	Mimar (1)
33	Acunar	Mecer (12), Arrullar (1), Dormir (1), Mover (1), Zarandear (1), Balancear (1)
47	Afeitarse	Rasurar (1), Limpiar (2)
29	Agacharse	Inclinarse (3), Buscar (2), Doblarse (12), Flexionarse (2), Encogerse (1), Mirar (1)
34	Apoyarse	Pensar (1), Descansar (8), Esperar (1), Sujetar (1), Sostenerse (1), Reposar (1), Respaldarse (1), Recostar (1), Estar apoyado (1)
45	Arrodillarse	Rezar (4), Relajar (1)
45	Atar	Abrochar (2), Anudar (3)
50	Bailar	
50	Beber	
50	Besar	
50	Bostezar	
48	Botar	Jugar (1), Rebotar (1)
25	Cabalgar	Montar (18), Galopar (4), Trotar (3)
39	Caminar	Andar (9), Pasear (2)
50	Cantar	
38	Cavar	Trabajar (3), Palotear (1), Empujar (3), Recoger (1), Excavar (4)
50	Cocinar	
49	Columpiarse	Balancearse (1)
48	Comer	Bostezar (1), Alimentarse (1)
50	Conducir	
25	Construir	Tapiar (1), Comprobar (1), Edificar (2), Levantar (2), Adosar (1), Trabajar (2), Colocar (11), Poner ladrillos (2), Hacer edificio (1), Equilibrar (1), Apilar (1)
50	Correr	
36	Cortar	Recortar (14)
48	Coser	Costurar (1), Tejer (1)
44	Cruzar	Pasar (4), Andar (1), Caminar (1)
44	Derretirse	Nevar (1), Deshacer (2), Descongelar (2), Helarse (1)
40	Desfilar	Marchar (3), Andar (1), Caminar (1), Formar (1), Pasear (1), Alinearse (1), Hacer instrucción (2)
26	Deslizarse	Bajar (13), Lanzarse (2), Descender (2), Jugar (2), Tirarse (4), Caerse (1)
42	Dibujar	Pintar (5), Retratar (3)
45	Disparar	Cazar (5)
47	Doblar	Plegar (3)
49	Dormir	Soñar (1)
22	Echar	Rellenar (1), Trasvasar (1), Llenar (5), Vaciar (2), Verter (15), Servir (4)
47	Empujar	Arrastrar (3)
47	Encender	Prender (3)
15	Enviar	Echar una carta (19), Cartear (2), Remitir (1), Meter (6), Comunicar (1), Introducir una carta (2), Franquear (1), Mandar carta (3)
50	Escribir	
25	Escribir	Mecanografiar (12), Teclear (12), Taquigrafiar (1)
50	Esquiar	
46	Estornudar	Toser (3), Resoplar (1)
44	Flotar	Naufragar (3), Navegar (2), (botella) (1)
50	Fumar	
50	Gatear	
17	Golpear	Chutar (8), Dar una patada (6), Lanzar (7), Jugar (2), Pegar patada (4), Patear (5), Dar a la pelota (1)
48	Gotear	Perder agua (1), Caer agua (1)
35	Hacer	
	cosquillas	Reír (2), Rascar (4), Acariciar (6), Relajar (1), Jugar (2)
23	Hacer	
	malabares	Jugar (22), Entretener (1), Tirar (2), Lanzar (2)
41	Hundirse	Naufragar (9)
48	Jugar	Colocar (1), Construir (1)
47	Ladrar	Aullar (3)
49	Lamer	Chupar (1)
12	Lanzarse	Saltar (23), Zambullirse (4), Caer (1), Nadar (4), Tirarse (6)

APPENDIX A (Continued)

No. of Subjects Giving Modal Response	Modal Response	Other Responses (Number of Subjects Per Response)
47	Lavar	Asearse (3)
50	Leer	
17	Llamar	Picar (25), Tocar (3), Golpear (4), Cerrar (1)
14	Llevar	Pujar (1), Transportar (13), Acarrear (1), Coger (1), Cargar (14), Trasladar (1), Sostener (3), Sujetar (2)
50	Llorar	
50	Llover	
50	Morder	
50	Nadar	
50	Navegar	
50	Nevar	
28	Parar	Dirigir (6), Detener (10), Ordenar (2), Prohibir (1), Señalizar (1), Señalar (2)
50	Patinar	
42	Pedir	Mendigar (8)
50	Peinarse	
43	Pelar	Mondar (7)
50	Pellizcar	
48	Pesarse	Doblarse (1), Mirar (1)
50	Pescar	
50	Pintar	
50	Planchar	
47	Plantar	Transplantar (1), Sembrar (1), Cultivar (1)
20	Recoger	Coger (17), Jugar (3), Recibir (6), Lanzar (2), Tirar (2)
13	Recoger	Rastrillar (9), Limpiar (4), Pradear (1), Apañar (1), Arrastrar (4), Atropar (3), Barrer (13), Aganzar (1), Amontonar (1)
50	Regar	
49	Reír	Sonreír (1)
25	Remover	Revolver (16), Batir (8), Mezclar (1)
48	Rezar	Orar (2)
41	Rugir	Gruñir (6), Bostezar (1), Gritar (1), Asustar (1)
49	Saltar	Jugar (1)
46	Saltar	Bajar (4)
39	Saludar	Despedir (11)
47	Sangrar	Manchar (1), Mancharse (1), Curarse (1)
41	Sentarse	Descansar (6), Meditar (1), Escuchar (1), Mirar (1)
43	Señalar	Apuntar (2), Indicar (4), Dirigir (1)
41	Sonreír	Reír (8), Mirar (1)
49	Soñar	Dormir (1)
50	Soplar	
41	Subir	Tregar (3), Bañarse (1), Gatear (2), Saltar (1), Escalar (1), Hacer gimnasia (1)
46	Taladrar	Atornillar (2), Perforar (2)
46	Tejer	Hacer punto (2), Coser (1), Hacer calceta (1)
41	Tejer	Hilar (6), Trabajar (1), Coser (2)
19	Tirar	Correr (4), Jugar (6), Pasear (1), Arrastrar (8), Empujar (3), Trasladar (1), Llevar (4), Amaestrar (1), Domar (1), Transportar (2)
23	Tirar	Caer (10), Dejar caer (4), Romper (2), Soltar (6), Arrojar (3), Jugar (1), Resbalar (1)
26	Tocar	Tintinear (2), Repicar (1), Sonar campana (16), Llamar (1), Campanear (1), Sacudir campana (1), Hacer ruido (1), Agitar (1)
28	Tocar	Rozar (3), Chocar (1), Unir (11), Juntar (3), Conectar (1), Contactar (1), Señalar (2)
37	Ver la TV	Observar (3), Visionar (1), Mirar (8), Escuchar (1)
50	Volar	

APPENDIX B

The following information is shown for each stimulus of the Druks and Masterson (2000) battery: Spanish word, its English translation, visual complexity (VC), percentage of name agreement (%NA), *H* statistic, word frequency (WF) per million, compound frequency (CF) per million, imageability, familiarity, age of acquisition (AoA), and word length in number of phonemes and syllables.

Spanish	English	VC	%NA	<i>H</i>	WF	CF	Imageability	Familiarity	AoA	Phonemes	Syllables
<i>abrir</i>	to open	3.35	90	0.47	275	912	5.28	6.45	1.83	5	2
<i>acariciar</i>	to stroke	3.63	98	0.14	39	298	6.51	6.35	3.21	9	4
<i>acunar</i>	to rock	4.15	66	1.45	1	21	—	—	2.75	6	3
<i>afeitarse</i>	to shave	5.75	94	0.38	23	106	5.83	6.34	3.94	9	4
<i>agacharse</i>	to bend	3.23	58	1.79	4	58	—	—	2.11	8	4
<i>apoyarse</i>	to lean	4.43	68	1.70	83	988	4.75	6.17	2.79	8	4
<i>arrodillarse</i>	to kneel	3.83	90	0.54	1	70	—	—	2.36	10	5
<i>atar</i>	to tie	4.45	90	0.75	25	28	5.23	6.27	2.53	4	2
<i>bailar</i>	to dance	4.70	100	0.00	114	394	5.72	6.70	2.43	6	2
<i>beber</i>	to drink	4.00	100	0.00	166	601	6.09	6.65	1.72	5	2
<i>besar</i>	to kiss	3.55	100	0.00	34	240	6.17	6.85	3.06	5	2
<i>bostezar</i>	to yawn	3.03	100	0.00	4	21	—	—	3.77	8	3
<i>botar</i>	to bounce	3.90	96	0.28	4	15	—	—	2.98	5	2
<i>cabalgar</i>	to ride	4.73	50	1.57	7	73	—	—	3.45	8	3
<i>caminar</i>	to walk	3.53	78	0.91	139	1,683	5.16	6.64	1.64	7	3
<i>cantar</i>	to sing	3.55	100	0.00	137	711	5.06	6.21	2.04	6	2
<i>cavar</i>	to dig	4.30	76	1.31	11	44	—	—	3.08	5	2
<i>cocinar</i>	to cook	5.33	100	0.00	15	454	—	—	2.74	7	3
<i>columpiarse</i>	to swing	4.43	98	0.14	1	29	—	—	2.45	11	4
<i>comer</i>	to eat	4.35	96	0.28	487	567	6.29	6.90	1.47	5	2
<i>conducir</i>	to drive	4.88	100	0.00	94	543	4.93	6.38	3.40	8	3
<i>construir</i>	to build	5.20	50	2.40	213	636	4.59	6.29	3.06	9	2
<i>correr</i>	to run	3.58	100	0.00	292	426	5.60	6.44	3.09	5	2
<i>cortar</i>	to cut	3.73	72	0.86	101	147	5.74	5.73	1.85	6	2
<i>coser</i>	to sew	4.48	96	0.28	32	91	5.69	5.30	3.32	5	2
<i>cruzar</i>	to cross	4.38	88	0.68	100	777	4.81	5.92	3.24	6	2
<i>derretirse</i>	to melt	4.60	88	0.76	1	18	—	—	3.30	9	4
<i>desfilar</i>	to march	5.63	80	1.25	25	158	5.77	5.01	4.06	8	3
<i>deslizarse</i>	to slide	4.88	52	2.14	5	186	4.71	5.55	4.04	10	4
<i>dibujar</i>	to draw	4.50	84	0.79	27	304	5.74	6.67	1.98	7	3
<i>disparar</i>	to shoot	4.33	90	0.47	45	370	4.91	5.22	3.89	8	3
<i>doblar</i>	to fold	3.60	94	0.33	39	219	—	4.75	3.11	6	2
<i>dormir</i>	to sleep	4.50	98	0.14	339	843	6.22	6.61	1.60	6	2
<i>echar</i>	to pour	3.53	44	2.08	207	92	3.68	6.48	3.90	4	2
<i>empujar</i>	to push	1.25	94	0.33	4.2	66.2	—	—	2.40	7	3
<i>encender</i>	to light	3.98	94	0.33	82	509	5.20	6.53	3.23	8	3
<i>enviar</i>	to post	4.55	30	2.37	62	543	4.08	5.89	3.64	6	2
<i>escribir</i>	to type	5.53	50	1.60	488	1,472	5.99	6.75	2.62	8	3
<i>escribir</i>	to write	3.68	100	0.00	488	1,473	5.99	6.75	2.28	8	3
<i>esquiar</i>	to ski	3.88	100	0.00	6	10	—	—	3.87	6	2
<i>estornudar</i>	to sneeze	4.75	92	0.47	4	28	—	—	3.06	10	4
<i>flotar</i>	to float	3.15	88	0.70	29	251	5.41	4.87	3.60	6	2
<i>fumar</i>	to smoke	4.38	100	0.00	167	446	5.64	5.93	3.68	5	2
<i>gatear</i>	to crawl	3.58	100	0.00	2	12	—	—	2.73	6	3
<i>golpear</i>	to kick	4.28	34	2.64	50	293	5.81	6.11	2.51	7	3
<i>gotear</i>	to drip	2.38	96	0.28	1	14	—	—	3.85	6	3
<i>hacer cosquillas</i>	to tickle	4.43	70	0.50	1	1	—	—	1.94	12	5
<i>hacer malabares</i>	to juggle	5.28	46	1.52	1	1	—	—	4.02	13	6
<i>hundirse</i>	to sink	4.65	82	0.68	29	359	5.10	6.29	3.79	7	3
<i>jugar</i>	to play	4.70	96	0.28	384	1,174	5.42	6.70	1.57	5	2
<i>ladrar</i>	to bark	5.58	94	0.33	16	57	4.80	6.48	2.09	6	2
<i>lamer</i>	to lick	4.83	98	0.14	6	66	—	—	3.26	5	2
<i>lanzarse</i>	to dive	4.38	24	2.07	93	778	5.16	6.00	3.26	8	3
<i>lavar</i>	to wash	4.15	94	0.33	35	272	5.97	6.35	2.32	5	2
<i>leer</i>	to read	4.33	100	0.00	395	1,216	5.36	6.64	2.68	4	2
<i>llamar</i>	to knock	4.08	34	1.68	317	4,365	4.55	6.58	1.85	5	2
<i>llevar</i>	to carry	3.13	28	2.41	574	4,719	4.30	6.47	2.06	5	2

APPENDIX B (Continued)

Spanish	English	VC	%NA	H	WF	CF	Imageability	Familiarity	AoA	Phonemes	Syllables
<i>llorar</i>	to cry	3.58	100	0.00	232	607	6.38	6.40	1.85	5	2
<i>llover</i>	to rain	2.60	100	0.00	39	229	—	—	2.11	5	2
<i>morder</i>	to bite	6.00	100	0.00	20	164	6.05	6.12	1.98	6	2
<i>nadar</i>	to swim	4.33	100	0.00	40	3,898	5.85	6.62	2.55	5	2
<i>navegar</i>	to sail	4.90	100	0.00	32	89	5.92	6.10	3.85	7	3
<i>nevar</i>	to snow	4.35	100	0.00	5	300	—	—	2.42	5	2
<i>parar</i>	to stop	4.98	56	2.17	200	28,576	4.38	6.64	1.92	5	2
<i>patinar</i>	to skate	3.50	100	0.00	10	25	—	—	3.21	7	3
<i>pedir</i>	to beg	5.20	84	0.63	282	1,727	4.37	6.60	2.57	5	2
<i>peinarse</i>	to comb	4.00	100	0.00	9	153	—	—	2.11	7	3
<i>pelar</i>	to peel	4.60	86	0.58	12	657	—	—	3.04	5	2
<i>pellizcar</i>	to pinch	3.70	100	0.00	3	42	—	—	3.24	8	3
<i>pesarse</i>	to weigh	3.93	96	0.62	82	1,156	4.46	5.52	3.36	7	3
<i>pescar</i>	to fish	5.60	100	0.00	30	273	5.61	5.10	3.04	6	2
<i>pintar</i>	to paint	3.83	100	0.00	47	507	5.77	6.40	2.26	6	2
<i>planchar</i>	to iron	5.30	100	0.00	13	98	5.76	4.89	3.47	7	2
<i>plantar</i>	to plant	4.53	94	0.42	19	574	—	—	3.32	7	2
<i>recoger</i>	to catch	3.63	40	2.04	100	689	4.14	6.41	1.58	7	3
<i>recoger</i>	to rake	3.50	26	2.73	151	752	4.48	6.36	2.49	7	3
<i>regar</i>	to water	4.48	100	0.00	9	79	—	—	3.20	5	2
<i>reír</i>	to laugh	2.90	98	0.14	154	684	6.06	6.47	1.98	4	2
<i>remover</i>	to stir	3.55	50	1.56	22	77	4.96	6.21	3.49	7	3
<i>rezar</i>	to pray	4.55	96	0.24	55	235	4.82	5.89	2.79	5	2
<i>rugir</i>	to roar	5.98	82	0.99	9	74	—	—	3.19	5	2
<i>saltar</i>	to skip	3.95	92	0.40	99	604	6.28	5.68	1.77	6	2
<i>saltar</i>	to jump	3.93	98	0.14	99	606	6.28	5.68	2.11	6	2
<i>saludar</i>	to wave	4.75	78	0.76	60	422	5.57	6.21	1.87	7	3
<i>sangrar</i>	to bleed	4.00	94	0.42	11	55	—	—	2.30	7	2
<i>sentarse</i>	to sit	3.75	82	1.38	47	1,990	5.25	6.71	1.51	8	3
<i>señalar</i>	to point	3.08	86	0.78	145	1,182	4.90	6.78	2.30	7	3
<i>sonreír</i>	to smile	3.45	82	0.77	114	742	5.50	5.75	1.92	7	3
<i>soñar</i>	to dream	4.38	98	0.14	57	1,092	5.14	6.35	2.68	5	2
<i>soplar</i>	to blow	3.78	100	0.00	16	146	—	—	2.50	6	2
<i>subir</i>	to climb	4.65	82	1.12	207	1,072	5.80	6.72	2.34	5	2
<i>taladrar</i>	to drill	5.05	92	0.48	5	24	—	—	4.60	8	3
<i>tejer</i>	to weave	6.00	82	0.80	24	209	5.91	4.23	3.72	5	2
<i>tejer</i>	to knit	4.40	92	0.52	24	284	5.91	4.23	3.36	5	2
<i>tirar</i>	to pull	4.45	38	2.78	93	820	5.13	6.64	3.00	5	2
<i>tirar</i>	to drop	3.98	46	2.29	93	820	5.13	6.64	2.42	5	2
<i>tocar</i>	to touch	3.08	56	1.96	188	976	5.42	5.56	2.70	5	2
<i>tocar</i>	to ring	2.65	52	1.89	188	976	5.42	5.56	2.36	5	2
<i>ver la tele</i>	to watch	4.40	74	1.21	2,542	3,494	4.23	6.71	1.53	9	4
<i>volar</i>	to fly	4.28	100	0.00	96	236	4.96	5.28	2.79	5	2

APPENDIX C
The 10 Easiest and 10 Most Difficult Items
Used in Experiment 2

10 Easiest		10 Most Difficult	
1.	<i>Peinar</i> (to comb)	1.	<i>Derretir</i> (to melt)
2.	<i>Besar</i> (to kiss)	2.	<i>Flotar</i> (to float)
3.	<i>Pintar</i> (to paint)	3.	<i>Acariciar</i> (to stroke)
4.	<i>Beber</i> (to drink)	4.	<i>Fumar</i> (to smoke)
5.	<i>Cantar</i> (to sing)	5.	<i>Afeitarse</i> (to shave)
6.	<i>Reír</i> (to laugh)	6.	<i>Desfilar</i> (to march)
7.	<i>Llover</i> (to rain)	7.	<i>Taladrar</i> (to drill)
8.	<i>Bailar</i> (to dance)	8.	<i>Navegar</i> (to sail)
9.	<i>Leer</i> (to read)	9.	<i>Tejer</i> (to knit)
10.	<i>Llorar</i> (to cry)	10.	<i>Soñar</i> (to dream)

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