

Age of acquisition and imageability ratings for a large set of words, including verbs and function words

HELEN BIRD, SUE FRANKLIN, and DAVID HOWARD

University of Newcastle upon Tyne, Newcastle upon Tyne, England

Age of acquisition and imageability ratings were collected for 2,645 words, including 892 verbs and 213 function words. Words that were ambiguous as to grammatical category were disambiguated: Verbs were shown in their infinitival form, and nouns (where appropriate) were preceded by the indefinite article (such as *to crack* and *a crack*). Subjects were speakers of British English selected from a wide age range, so that differences in the responses across age groups could be compared. Within the subset of early acquired noun/verb homonyms, the verb forms were rated as later acquired than the nouns, and the verb homonyms of high-imageability nouns were rated as significantly less imageable than their noun counterparts. A small number of words received significantly earlier or later age of acquisition ratings when the 20–40 years and 50–80 years age groups were compared. These tend to comprise words that have come to be used more frequently in recent years (either through technological advances or social change), or those that have fallen out of common usage. Regression analyses showed that although word length, familiarity, and concreteness make independent contributions to the age of acquisition measure, frequency and imageability are the most important predictors of rated age of acquisition.

The imageability and age of acquisition of words have been demonstrated to affect latencies in normal production and accuracy in aphasic production. The majority of ratings available, particularly for age of acquisition, are only those for nouns. Consequently, studies utilizing these ratings have not investigated other grammatical categories, and studies investigating specific grammatical category dissociations have not controlled for imageability or age of acquisition. We present ratings for these two variables that might serve to aid future research in these neglected areas.

Psycholinguistic Variables

Word frequency and age of acquisition. In recent years, the critical-variable approach advocated by Shallice (1988) has become a popular means of assessing the factors affecting the performance of aphasic patients in various tasks. It has been shown repeatedly that the frequency with which a word is used is a strong predictor of the speed with which that word is uttered in picture and word naming in normal subjects (Forster & Chambers, 1973; Oldfield & Wingfield, 1965). Word frequency has also been demonstrated to play an important role in naming by aphasic patients (Howard, Patterson, Franklin,

Morton, & Orchard-Lisle, 1984; Kay & Ellis, 1987). The reliability of such effects, however, has been called into question because word frequency is highly correlated with age of acquisition: High-frequency words tend to be learned early in life. Studies comparing the effects of rated age of acquisition and word frequency have shown the former to be the better predictor of naming (Carroll & White, 1973; Morrison, Ellis, & Quinlan, 1992), but not word recognition (Gilhooly & Logie, 1981; Morrison & Ellis, 1995) in normal subjects. Recent studies have compared directly the relative effects of these variables in the naming accuracy of aphasic patients (Howard, Best, Bruce, & Gatehouse, 1995; Nickels & Howard, 1995) and those with progressive aphasia (Lambon Ralph, Graham, Ellis, & Hodges, 1998), and significant independent effects of both frequency and age of acquisition have been demonstrated.

Imageability and concreteness. *Imageability* is defined as the ease with which a word gives rise to a sensory mental image (Paivio, Yuille, & Madigan, 1968), and this variable has been shown to predict word reading, word association, and picture naming performance in normal subjects (Barry, Morrison, & Ellis, 1997; Daveelaar & Besner, 1988; DeGroot, 1989; James, 1975; Strain, Patterson, & Seidenberg, 1995) as well as written and auditory comprehension and word production in aphasic patients (Allport & Funnell, 1981; Franklin, Howard, & Patterson, 1994, 1995; Hanley & Kay, 1997). *Concreteness* refers to the ability to see, hear, and touch something and is very highly correlated with imageability (Paivio et al., 1968), but these terms are not synonymous. Paivio et al. found that many “emotion” words (e.g., *anger*)

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were rated as quite highly imageable, but very low on concreteness, while only a few nouns, probably because they refer to objects rarely experienced, are concrete but low in imageability (e.g., *armadillo*). Visual word recognition has been shown to be affected by imageability but not concreteness in normal subjects and in some aphasic patients (Marcel & Patterson, 1978; Richardson, 1975), and Nickels and Howard (1995) showed that naming performance was better predicted by imageability than by concreteness in a group of aphasic subjects. Imageability ratings might have greater psychological salience due to their close correlation with ease of predication (the ease of putting a word into simple factual statements), as demonstrated by Jones (1985). In the Plaut and Shallice (1993) connectionist model of reading, imageability was represented by the number of semantic features within a semantic representation.

Grammatical Categories

According to Denes and Dalla Barba (1998), the Neapolitan philosopher G. B. Vico was the first to describe the dissociation between the ability to retrieve verbs and nouns following brain damage. In 1744 Vico wrote that "in our city there is a gentleman who, having been affected by an apoplectic stroke, could remember nouns, but had forgotten verbs," evidence, he believed, of the evolutionary development of the first language: "Those who created the languages have left the verbs last, in the same way as children learn nouns and particles before verbs . . . every speech must necessarily start with nouns." In connected speech, verbs and function (or closed class) words are indispensable for grammatical output, but investigations into the effects of psycholinguistic variables in aphasia tend to be based on single word production, and in particular, picture naming, so concrete nouns have been the main focus. Studies of aphasic naming that have compared verbs and nouns have usually controlled only for word frequency and length (number of syllables and/or phonemes), assuming that in picture naming all items must necessarily be highly imageable (Bastiaanse & Jonkers, 1998; Berndt, Mitchum, Haendiges, & Sandson, 1997). Case studies of reading and writing deficits specific to verbs have also failed to take imageability into account (Caramazza & Hillis, 1991; Hillis & Caramazza, 1995; Orpwood & Warrington, 1995; Rapp & Caramazza, 1998), in spite of the evidence that verbs tend to be rated as less imageable (and have lower ease of predication ratings) than nouns (Jones, 1985), even when both nouns and verbs are pictureable (Masterson & Druks, 1998).

Noun/verb homonyms. One of the difficulties in obtaining ratings for nouns and verbs in English is their ambiguity: Many action verbs also function as nouns. Published imageability ratings are usually confined to one word class (those collected by Paivio et al. 1968, were nouns only, and Klee and Legge's (1976) are for concreteness of verbs only), and ratings of words that are am-

biguous in regard to word class (e.g., Gilhooly & Logie, 1980) are also potentially unreliable when the aim is to contrast the two classes, since one cannot be sure whether individuals rated the noun or the verb meaning of ambiguous words. To take an example from Gilhooly and Logie (1980), in their meaning dominance assessment, the word *dart* was given a noun meaning by 80% of subjects and a verb meaning by 20%, even though the verb is used slightly more frequently than the noun (the CELEX database; Baayen, Piepenbrock, & Gulikers, 1995); combined spoken and written frequencies for these items are approximately 3 per million for the noun and 8.5 per million for the verb forms of *dart*). It is therefore feasible that 20% of subjects rated the verb form of *dart* for the variables investigated. Masterson and Druks (1998) disambiguated their nouns and verbs by using the infinitival form of the verb, and their results showed that verbs tended to be rated as less imageable than nouns. Nevertheless, these authors also presented nouns and verbs in two separate lists, which might have diminished the differences between the grammatical classes, since subjects were comparing only nouns with nouns and verbs with verbs.

Function words and imageability. Function words tend to attract relatively low imageability ratings, and it has been suggested that imageability effects give rise to the apparent word class deficits in acquired language disorders such as deep dyslexia and agrammatism (Allport & Funnell, 1981; Morton & Patterson, 1980), in which function words (and, to a lesser extent, verbs) are more susceptible to error. Nevertheless, many researchers do not attempt to control for this variable in their assessments of function and content words (Friederici & Schoenle, 1980; ter Keurs, Brown, Hagoort, & Stegeman, 1999). Investigations regarding the processing of different grammatical classes in normal subjects, likewise, have failed to control for imageability (Molfese, Burger-Judisch, Gill, Golinkoff, & Hirsch-Pasek, 1996; Pulvermüller, Mohr, Sedat, Hadler, & Rayman, 1996; Warburton et al., 1996), in spite of evidence that control for imageability can eliminate apparent word class effects in normal subjects (Davelaar & Besner, 1988) and aphasic patients (Howard & Franklin, 1988).

Grammatical class and age of acquisition. The relationship between grammatical class and rated age of acquisition is not documented, but it is fairly well accepted that English-speaking children begin learning nouns before other types of vocabulary, and function words are generally produced only when the child begins to use multiword utterances (Bates et al., 1994; Caselli et al., 1995; Gentner, 1982). Therefore one might expect to see a correlation between imageability and age of acquisition looking across word classes, due to the order of imageability shown across word classes (nouns>verbs>function words). In a study of only pictureable nouns, Morrison, Chappell, and Ellis (1997) found that imageability was

highly correlated with rated age of acquisition (with more imageable words being acquired earlier), but the correlation was even stronger between imageability and true "objective" age of acquisition.

The Validity of Rated Age of Acquisition

Morrison et al. (1997) demonstrated that the rated age of acquisition of pictureable nouns was an extremely reliable measure of the actual order in which children acquire this vocabulary, providing validation for the rating method. There were some notable exceptions to this reliability when individual words were examined; for example, *microwave* was acquired much earlier than ratings suggested, and *ashtray* much later. These anomalies probably represent changes in vocabulary usage over time, since the ratings were provided by adult subjects, who might well have learned these particular items at different stages from those at which contemporary children learned them. Ratings of age of acquisition (and other variables) are usually taken from university students, who are (as a group) considerably younger than the aphasic patients normally assessed for the effects of variables on their performance. For age of acquisition in particular, there might be similar differences in the true age at which certain words are acquired according to individual age, but these differences should be confined to a small number of items.

METHOD

Word Sample

The original basis for obtaining ratings was to ascertain the effects of imageability and age of acquisition on a range of tasks in which aphasic patients and normal control subjects (all of whom were native speakers of British English) took part in separate study (Bird, 1999). These included spontaneous production in narratives, production of synonyms and associates of abstract nouns and verbs, naming of nouns and verbs in categories, reading and writing of noun/verb homonyms, and comprehension of function and content words in a forced choice task. As a consequence, the resulting word set might seem somewhat eclectic, containing examples of categories such as politics and religions as well as animals. The breakdown across grammatical categories is shown in Table 1; function words are here classified as those that are not nouns, verbs, adjectives, numerals, or adverbs ending in *-ly*. Some two-word phrases are also included, since these were occasionally produced, particularly in the generation of names of occupations. All 2,694 words were used in a questionnaire for age of acquisition, and a subset of 2,019 words was used in an imageability questionnaire (the remainder were unambiguous words for which imageability ratings were already available in the MRC database; Coltheart, 1981a).

Table 1
Number of Words in Whole Corpus
and Their Distribution Over Grammatical Classes

Grammatical Category	Number of Words
Nouns	1,304
Verbs	892
Adjectives	245
Numerals	12
Adverbs	28
Function words	213
Total	2,694

Ratings Procedure

The same procedure and instructions were used for imageability and age of acquisition ratings as in Gilhooly and Logie (1980). Both types of rating were made on a 7-point scale (1 = *least imageable*; 7 = *most imageable*). To reduce the possibility of error in the age of acquisition ratings, however, subjects circled actual age bands (for example 3–4, 5–6) rather than having to refer to a conversion table. These age bands were converted to a 1–7 scale in the analysis (1 = 0–2 years; 7 = age 13 and over), with interim bands of 2 years each, as in the Gilhooly and Logie (1980) procedure. The major departure from Gilhooly and Logie (1980) was in the presentation: Verbs were shown in their infinitival form (except for a few inflected forms), and nouns (where appropriate) were preceded by the indefinite article. The word list was presented in alphabetical order, so that noun/verb homonyms could be directly compared, and attention was drawn in the instructions to the difference between grammatical categories as follows:

Some words can have many meanings, and fulfill different roles in a sentence. It is possible that the different versions of a word (each sounding or looking the same) might also differ in the ease with which they arouse imagery. For example, the word "brief" can be a noun (object, thing) as in "he told his brief all about it,"¹ an adjective (describing word), as in "he was very brief about it," or a verb (action, "doing word") as in "he is going to brief her about it." Items on the list for which the verb, or action word, meaning is to be assessed, have had the word to added (*to brief*). There are very few exceptions to this: *threw*, for example, is a past tense of the verb, but *to threw* would not make sense, (and *threw* is in any case unambiguous), so generally, if the word begins with *to* it is the action or *doing word* to be assessed. Cases in which the noun (thing) meaning is to be assessed have been prefixed with *a* or *an*, where this serves to disambiguate it from another meaning of the word (*a brief* rather than just *brief*). Many nouns, however, cannot be prefixed by *a* (*rice* or *happiness*). Please study each word carefully to make sure you have correctly identified it before you rate it.

Different categories of function words could not be disambiguated in this context. This could have been achieved only if sentence contexts were provided, or if the subjects had an in-depth knowledge of grammatical categories, which for the majority is probably not the case.

The mean rating for each item was multiplied by 100 to give ratings on a scale of 100 to 700, as shown in the MRC database.

Subjects

The majority of subjects were volunteers aged 50–80 who were members of a subject panel previously used to obtain norming data on assessments for aphasic patients (Bird, 1999). A further set of younger volunteers also completed the questionnaires, as well as some undergraduates at the University of Newcastle upon Tyne who took part for course credit. In total 78 subjects (mean age = 65.0, *SD* = 18.7 years) completed the imageability questionnaire, and 45 subjects completed the age of acquisition questionnaire (*M* = 60.7, *SD* = 15.5). Very high correlations have been reported across different studies in which ratings have been collected from subjects numbering as few as 20 (Morrison et al., 1997). The ratio of male to female subjects was approximately 1:2 for both questionnaires. Gilhooly and Hay (1977) checked reliability across male and female raters of imageability (*n* = 50) and age of acquisition (*n* = 40) and found correlations of .904 and .960, respectively; it was not, therefore, deemed a problem to have a bias toward female subjects in this study.

RESULTS AND DISCUSSION

Within both questionnaires were included some items that were relatively unambiguous as to word class (if a word could be used as both a noun and a verb, one was of very low frequency relative to the other), for which ratings

were available in the MRC database. This overlap, which represented a wide range of imageability (MRC ratings of 206–635, $M = 462$), age of acquisition (MRC ratings of 153–518, $M = 327$), and word frequency (CELEX database spoken and written combined lemma frequency of 2–5,401 occurrences per million, $M = 289$) allowed checks for reliability across studies. Seventy-five items in the imageability questionnaire had MRC ratings, and there was a significant correlation ($r = .92, p < .001$) between the imageability ratings in this study and those in the MRC database. Eighty-one items in the age of acquisition questionnaire had MRC ratings, and these also showed significant correlation ($r = .91, p < .001$). The means and ranges differed slightly from the MRC ratings for both sets of results; the ratings were linearly transformed so that they could be used in conjunction with previously published data. The same method was applied as had been employed to merge ratings from three different studies for use in the MRC database (see Appendix 2 of the *MRC Psycholinguistic Database User Manual: Version 1*; Coltheart, 1981b). Using the items in common across the present data and the MRC ratings, we calculated the slope and intercept, and applied the formula $[(R - \text{intercept})(1/\text{slope})]$, where R is the raw mean rating for each item. The transformed ratings of the items in common were thus of the same mean and standard deviation as those that were included in the MRC database, and the new items were transformed accordingly. The resulting imageability and age of acquisition ratings are available from <http://www.mrc-cbu.cam.ac.uk/Language/archives/helen.bird/BRMIC/Bird.htm>.² Word class is also indicated, but within the category of function words, different types of function words are not differentiated since these could not be disambiguated. The classification of some content words is also arguable (e.g., the classification of some participles as adjectives—*disappointed* and *disgusting*), but the questionnaire could not differentiate between verb participles and adjectives. Words that are not nouns, verbs, adjectives, numerals, or adverbs ending in *-ly* are here classed as function words. Words marked as function words are those that can, but might not always, be used as such (many might also be used as adjectives). The distribution of words according to these broad classifications is shown in Table 1.

Noun/Verb Homonyms and Imageability

Ambiguous items ($n = 110$) were included both in their noun and verb forms in order to test the hypothesis that verbs usually attract lower imageability ratings than nouns, even when they share the same word form. Their mean imageability ratings are shown in Table 2. The mean verb imageability is significantly lower than that for nouns [paired 2-sample $t(109) = 3.66, p < .001$]. As can be seen from the range of imageability ratings for nouns, many of these items were very abstract.

The set was divided in half according to the rated imageability of the noun pairs; this demonstrated that the verb homonyms of the high-imageability nouns were rated as significantly less imageable than their noun counterparts

Table 2
Mean Imageability Ratings for Ambiguous Nouns and Verbs

Noun/Verb Homonyms	Imageability Rating			
	<i>M</i>	<i>SD</i>	Min.	Max.
Nouns				
All ($n = 110$)	462	115	195	663
High imageability ($n = 55$)	561	54	460	663
Low imageability ($n = 55$)	363	81	195	459
Verb Homonyms				
$n = 110$	424	85	200	595
$n = 55$	472	74	289	595
$n = 55$	376	66	200	537

Note—The ratings on the 1 to 7 scale were averaged across subjects and multiplied by 100 to give mean ratings on the 100 to 700 scale employed by the MRC database.

[$t(54) = 7.19, p < .001$], but the verb homonym pairs for the low-imageability nouns did not differ in rated imageability from their noun counterparts [$t(54) = -1.48, p = .15$]. Moreover, only 6/55 of the high-imageability nouns received lower imageability ratings than their verb homonyms (these were *post*, *dance*, *iron*, *smack*, and *attack*), while 35/55 of the low-imageability nouns were given lower ratings than their verb counterparts. This means that even if control for word form is attempted on a pictureable set of nouns and verbs—for example, comparing naming of *snow* and *to snow*—the verbs will be consistently less imageable than the nouns, and this might affect performance. Matching can be achieved, however, if more abstract items are used.

Noun/Verb Homonyms and Age of Acquisition

The rated age of acquisition was also compared across the same 110 noun/verb homonyms, and a paired 2-sample t test showed that verbs were significantly later acquired than the nouns [$t(109) = -2.93, p = .004$]. The means and ranges are shown in Table 3. When these items are split into half according to the age of acquisition of the nouns (the items did not correspond across high-imageability and early acquired sets), it is demonstrated that the early acquired nouns are significantly earlier acquired than their verb counterparts [$t(54) = -6.37, p < .001$]. The late acquired nouns, however, do not differ in rated age of acquisition from their verb counterparts [$t(54) = -.09, p = .93$]. This suggests that for very early acquired words, the noun form is learned prior to the verb form, but this does not apply to learning words later in life (in this case from about 6 years and upward). Only 8/55 early acquired nouns were rated as later acquired than their verb counterparts (these were *want*, *dance*, *iron*, *taste*, *hope*, *help*, *smile*, and *promise*), but 20/55 of the late acquired nouns were acquired after their verb homonyms.

An Effect of Age on Age of Acquisition

It was hypothesized that some age of acquisition ratings might differ according to the age of the individuals rating them, owing to changes in vocabulary usage over time. Subjects were divided into two age groups (50–80,

Table 3
Mean Age of Acquisition Ratings
for Ambiguous Nouns and Verbs

Noun/Verb Homonyms	Age of Acquisition Ratings			
	<i>M</i>	<i>SD</i>	Min.	Max.
Nouns				
All (<i>n</i> = 110)	357	96	178	611
Early acquired (<i>n</i> = 55)	280	54	178	361
Late acquired (<i>n</i> = 55)	434	76	364	611
Verb Homonyms				
<i>n</i> = 110	395	87	211	613
<i>n</i> = 55	356	75	211	504
<i>n</i> = 55	435	81	230	613

Note—The ratings on the 1 to 7 scale were averaged across subjects and multiplied by 100 to give mean ratings on the 100 to 700 scale employed by the MRC database.

$M = 69.6$, $n = 28$; and 20–40, $M = 29.5$ years, $n = 17$); there were no subjects aged 41–49. The items with the largest difference between mean ratings from the two age groups were examined. *T* tests revealed that 25 items were rated as significantly earlier acquired by the older age group than by the younger subjects (all $ps < .05$), and these comprise words that are probably less frequently used currently than they were formerly (the nouns *airman*, *confectioner*, *dairyman*, *joiner*, *pitman*, *preacher*, *tinker*, *attendance*, *disobedience*, *fettle*, *a hiding*, *cinder*, and *grate*; the verbs *to attend*, *to awake*, *to bawl*, *to better*, *to bide*, *to condemn*, *to defy*, and *to depart*; and the function words *thus*, *hither*, *hence*, and *thence*). In contrast, 19 items were rated as significantly later acquired by the older than the younger group, some of which are quite unsurprising (*television*, *TV*, *air stewardess*, and the verbs *to telephone*, *to Hoover*, *to vacuum*, *to park*, *to type*, and *to defrost*); others probably reflect changes in lifestyle rather than technology (*judo*, *childminder*, *to babysit*, *to jog*, *hamster*, *gerbil*, *guinea pig*, *koala*, *orang-utan*, and *dolphin*). The animals are perhaps the most unexpected result: The first three probably reflect the kinds of pets that were commonly kept by children in the 1960s to 1980s but not in the 1920s to 1950s, and the latter three have perhaps been acquired earlier in recent years due to television coverage and increased awareness of conservation issues.

Correlation Between Variables

Morrison et al. (1997) found that both objective and rated age of acquisition correlated significantly with word frequency, object familiarity, number of phonemes,

and imageability. In a multiple regression analysis, they demonstrated that all these independent variables contributed to predicting both age of acquisition measures, but that they were most heavily influenced by imageability. Out of the total of 2,694 words for which age of acquisition ratings were collected in the present study, measures of familiarity were available for 1,217 and concreteness for 1,070 from the MRC database. Table 4 shows the correlation matrix including these variables, as well as the 2,019 imageability ratings collected, combined spoken and written word frequency from the CELEX database (these are also specified for word class, and the lemma frequency is used here, which combines all inflected forms of verbs) and length measured in syllables and phonemes. It should be remembered, however, that the ratings for familiarity and concreteness were given for words not specified for word class. The correlation matrix shows that rated age of acquisition correlates with all the independent variables except for concreteness. It is interesting that while imageability is highly correlated with both age of acquisition and concreteness, age of acquisition is highly correlated with imageability but not concreteness; however, concreteness ratings are included for items here specified as verbs that were probably given with the noun meaning in mind (e.g., *to snow* and *to telephone*). No doubt if concreteness ratings had been collected specifically for the verb forms, they would have been much lower (and the same might apply to familiarity in many cases in which the action is encountered less often than the object).

Table 5 shows the results of a simultaneous multiple regression analysis using age of acquisition as the dependent variable and frequency, imageability, syllables, phonemes, familiarity, and concreteness as independent variables. This demonstrates, as shown by Morrison et al. (1997), that all these variables make independent contributions to the age of acquisition measure, but that imageability and familiarity are the most important predictors of rated age of acquisition. When concreteness and familiarity are removed, however (thus eliminating the potential unreliability regarding word class mentioned above, and allowing 2,019 data points to enter the analysis), number of phonemes is no longer a significant predictor, and frequency is as important a predictor of age of acquisition as imageability (Table 6).

The results of the regression analyses, therefore, support the finding of Morrison et al. (1997), but researchers

Table 4
Correlation Matrix for All Independent Variables

	1	2	3	4	5	6	7
1. Age of acquisition	1	-.495**	-.631**	.560**	.559**	-.518**	-.048
2. Imageability		1	.135**	-.232**	-.202**	-.030	.661**
3. Frequency			1	-.509**	-.534**	.551**	-.382**
4. Syllables				1	.892**	-.211**	-.007
5. Phonemes					1	-.247**	.076*
6. Familiarity						1	-.105**
7. Concreteness							1

*Correlation significant at the .05 level (two-tailed). **Correlation significant at the .01 level (two-tailed).

Table 5
Multiple Regression Analysis With Rated Age of Acquisition as the Dependent Variable and Six Independent Variables

Independent Variable	Coefficient			
	Unstandardized		Standardized	
	<i>B</i>	<i>SE</i>	β	<i>t</i>
Imageability	-.541	.039	-.564	-13.728**
Familiarity	-.652	.070	-.322	-9.350**
Frequency	-23.642	4.189	-.200	-5.644**
Concreteness	.177	.038	.197	4.672**
Syllables	24.688	7.680	.153	3.215**
Phonemes	7.711	3.351	.109	2.301*

* $p < .05$; ** $p < .01$.

Table 6
Multiple Regression Analysis With Rated Age of Acquisition as the Dependent Variable (Familiarity and Concreteness Not Included)

Independent Variable	Coefficient			
	Unstandardized		Standardized	
	<i>B</i>	<i>SE</i>	β	<i>t</i>
Imageability	-.396	.016	-.387	-25.510**
Frequency	-41.985	1.735	-.414	-24.199**
Syllables	19.967	3.536	.188	5.647**
Phonemes	2.766	1.602	0.58	1.726

** $p < .01$.

who wish to use verbs in experiments should use caution with regard to previously published variables that have been collected using lists not specified for word class. The argument that the verb is used more frequently than the noun form (such as the *dart* example mentioned above) does not necessarily render ratings of imageability, concreteness, and familiarity "safe"; it is probable that when an individual is given the task of, for example, rating how concrete a concept is, the most concrete concept will be brought to mind, regardless of relative frequency compared with the verb form. It is important in future data collection to specify when the verb form is required to be rated.

Conclusions

We collected imageability and age of acquisition ratings for a total of 2,694 words, including many verbs and function words. The reliability of these data is demonstrated by the high correlations with previously published ratings.

Content words that were ambiguous as to grammatical class were disambiguated, and the ratings were compared across 110 pairs of noun/verb homonyms. Verbs were shown to be significantly less imageable than nouns of the same word form; however, when divided into high and low imageability according to the noun's rating, this difference was significant only for higher imageability items. This means that, if control for word form is sought, imageability cannot be controlled for pictureable items. Similarly, when early and late age of acquisition nouns are compared with their verb homonyms, the verb form is significantly later acquired only for the early acquired set (below 7 years of age).

Regression analysis showed that age of acquisition was highly correlated with imageability, frequency, familiarity, and length. For some words, rated age of acquisition was influenced by the age of the subjects. Some items were identified as being significantly later acquired by the younger than the older age group, but some showed the reverse effect. Caution should be exercised when one is using ratings (which are normally collected from young adults) to assess the performance of subjects drawn from an older population.

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NOTES

1. For the benefit of speakers of non-British English, this noun usage of *brief* is an informal term for a lawyer.

2. These data are available to download free of charge as an Excel file, a Word file, .txt, or .csv formats. Where ratings for these variables were already available from the MRC database, these are also given with the kind permission of Max Coltheart. CELEX frequency data are also provided with the kind permission of Richard Piepenbrock.

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