Age of acquisition and subjective frequency estimates for all generally known monosyllabic French words and their relation with other psycholinguistic variables

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Running-head: Age of acquisition and subjective frequency estimates

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Abstract

Ratings for age of acquisition (AoA) and subjective frequency were collected for the 1,493 monosyllabic French words that were known to French students. AoA ratings were collected by asking participants to indicate for each word an estimate in years of when they learned the word. Subjective frequency ratings were collected on a 7-point scale, ranging from never encountered to encountered several times a day. Results were analyzed to address the relationship between AoA and subjective frequency ratings with other psycholinguistic variables (objective frequency, imageability, number of letters, and number of orthographic neighbours). The results showed high reliability ratings with other databases. The full database of AoA and subjective frequency ratings can be downloaded from ludovic.ferrand.googlepages.com/databases.

Visual word recognition is a fast, efficient, and relatively effortless cognitive skill in adults. These aspects of performance obscure the complexity of the processes involved in this behaviour, but previous studies have identified a number of relevant variables that affect the speed and accuracy with which words can be processed (e.g., Balota, Cortese, Sergent-Marshall, Spieler, & Yap, 2004; Balota, Yap, & Cortese, 2006). Among these variables, most of them are objective (such as printed frequency, number of letters, number of phonemes, orthographic neighbourhood, regularity, etc.), and based on large corpora of words (e.g., Celex for English and Dutch: Baayen, Piepenbrock, & Van Rijn, 1993; Lexique for French: New, Pallier, Brysbaert & Ferrand, 2004). However, other variables such as age of acquisition, subjective frequency and imageability, are subjective and have to be collected by asking participants to rate the stimuli. Because of the time-consuming nature of this data collection, it is good practice to make these ratings available whenever someone has collected them, so that they can be shared by other researchers.

In recent years, norms have become available for large numbers (more than 1,000 stimuli) of English words for the following subjective variables: age of acquisition (Bird, Franklin, & Howard, 2001; Cortese & Khanna, in press; Stadthagen-Gonzales & Davis, 2006), subjective frequency (Balota, Pilloti, & Cortese, 2001) and imageability (Bird et al., 2001; Cortese & Fugett, 2004; Stadthagen-Gonzales & Davis, 2006). Similar norms have been collected for age of acquisition in Dutch (Ghyselinck, De Moor, & Brysbaert, 2000) and Portuguese (Marques, Francisca, Morais, & Pinto, 2007). In French, there have been a few published norming studies for AoA (Alario & Ferrand, 1999; Ferrand, Grainger & New, 2003; Bonin et al., 2003a, 2003b) and subjective frequency (Bonin et al., 2003a; Flieller & Tournois, 1994) but all of them were limited to a reasonably small number of stimuli that were used in a typical line of research.

Norms are particularly interesting when they are available for a complete group of stimuli (rather than a selected subsample). In that case, they can be used in the multiple regression analyses on unselected stimulus samples that are currently becoming important (see in particular the work by Balota; e.g., Balota et al, 2005; also see Baayen et al, 2006). The motivation of the present study was to provide age of acquisition and subjective frequency ratings for all interesting French monosyllabic words (for a total of 1,493; see below for more details). Much research on visual word recognition is done with monosyllabic words (e.g., Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; Seidenberg & McClelland, 1989; Harm & Seidenberg, 2004; Perry, Ziegler & Zorzi, 2007) and, therefore, these ratings are needed most. However, an effort was made to include not only nouns, but also verbs, adjectives, adverbs, numerals, and function words.

Age of acquisition refers to the age at which a word was learned (e.g., Gilhooly & Logie, 1980). This measure can be obtained by asking adults to estimate this age (subjective AoA; Morrison & Ellis, 1995) or by the analysis of children's production (objective AoA; Morrison, Chappell, & Ellis, 1997). Both methods have been found to produce similar estimates (Chalard, Bonin, Méot, Boyer, & Fayol, 2003; Morrison et al., 1997). A large number of studies have systematically shown that words acquired early in life are processed faster and more accurately than words acquired later in life (see Johnston & Barry, 2006, and Juhasz, 2005, for recent reviews). The age-of-acquisition effect has been found in many different tasks (e.g., object, face and action naming, word naming, lexical decision) and in different populations (e.g., children, young and old adults, aphasics), although there still is quite some discussion to what extent it is a genuine variable or can be explained on the basis of cumulative frequency measures and/or differences in frequency trajectory (Bonin, Barry, Méo-, & Chalard, 2004; Cortese & Khanna, 2007; Zevin & Seidenberg, 2002).

Subjective frequency, the other subjective variable estimated in the present study, is considered as a measure of the frequency of exposure to a word. Gernsbacher (1984) suggested that subjective familiarity is a better predictor of word performance than objective word frequency, especially for low-frequency words. However, Balota, Pilotti, and Cortese (2001) have suggested that the subjective familiarity ratings as collected by Gernsbacher, (1984) included semantic and/or orthographic/phonological component(s). Therefore, they used different instructions for their subjective frequency ratings, which we replicate here. These instructions minimize the potential influence of additional sources of information. Thus, participants had to rate words on a relatively neutral frequency-of-exposure 7-point scale (with 1 = never encountered, 2 = once a year, 3 = once a month, 4 = once a week, 5 = once every two day, 6 = once a day, 7 = several times a day). Subjective frequency measures are important to assess the extent to which objective frequency measures capture the full processing differences due to the amount of exposure and play an increasingly important role in the research on the AoA vs. frequency debate. Balota et al. (2001) investigated the relationship between objective frequency and subjective frequency of encounter estimates for a mega-study of lexical decision performance (including 2,928 monosyllabic English words; see also Balota et al., 2004) and showed that subjective frequency estimates were a slightly better predictor of lexical decision times than the available objective frequency measures.

METHOD

Participants

Fifty-nine psychology students from the University Blaise Pascal, Clermont-Ferrand, France, participated in this study, 28 in the subjective frequency task, and 31 in the age of

acquisition task. The participants (10 males and 49 females; mean age 21.3 years; range 18-33 years) were all native speakers of French and received 25 euros for their participation.

The Word Corpus

All French monosyllabic word forms were extracted from Lexique 2 (New, Pallier, Brysbaert & Ferrand, 2004) and Lexique 3 (New, Brysbaert, Veronis, & Pallier, 2007). These are based on very large corpora of contemporary French texts and television subtitles. From this sample, we excluded the words we would never use as targets in word recognition experiments (such as words we never use, load words from English, sexually charged words, abbreviations) and all polymorphemic words (in particular plurals and verb inflections other than the infinitive form). Next we presented to words to a group of ?? students and excluded the words more than 67% indicated as not-known. This left us with a total sample of 1,493 words. For each word, printed frequency, number of letters, number of phonemes and number of orthographic neighbours were taken from Lexique 3 (New et al., 2007). Imageability ratings were taken from Bonin, Ferrand, Méot and Roux (in preparation). Table 1 lists the descriptive statistics for these variables.

<Insert Table 1 about here>

Procedure

Ratings were collected via microcomputers in a computer lab in two sessions held one week apart. Each task was run using PsyScope 1.2.5 on an Apple PowerMac computer. Each session lasted about 1 hour. Seven-hundred and forty-six words were rated in one block and 747 words in the other block. The order of the word presented in each block was counterbalanced across the participants. Within the blocks, the order of items was random for each participant.

For both tasks, a fixation point was presented on each trial at the centre of the screen for 500 msec, immediately followed by a word presented in lowercase (font 48, Chicago), which remained on the screen until the participant's response. The next trial was initiated 3 s later.

For the subjective frequency task, a 1-7 scale was presented at the bottom of the screen. Raters of subjective frequency were asked to provide ratings using the 7-point scale used by Balota et al. (2001), with 1 assigned to words the never see/heard, 2 = once a year, 3 = once a month, 4 = once a week, 5 = every two days, 6 = once a day, 7 = several times a day. The rating was entered via the keyboard. The instructions employed in this task were similar to those used by Balota et al. (2001):

Throughout our lives, we hear and see many words. These words differ in how commonly or frequently they have been encountered. Some words are encountered very frequently, whereas other words are encountered infrequently. The purpose of this study is to determine, according to your estimation, the frequency of the words you encounter, in their written or spoken form. You should base your frequency ratings according to the following 7-point scale: 1 = never, 2 = once a year, 3 = once a month, 4 = once a week, 5 = every two days, 6 = once a day, 7 = several times a day. Your task is to type your estimation on the keyboard. For instance, if you think that you never encountered a word, you type 1. Or if you think that you encountered the word "detergent" once a week, you type 4. If you think you encountered the word "bread" several times a day, you type 7. When making your ratings, try to be as accurate as possible, but do not spend too much time on any one word. If you have any question, ask the experimenter now. Otherwise, press <Enter> to begin the study.

For the age of acquisition task, participants were asked to type (on the keyboard) below each word an estimate in years of when they learned the word (following Ghyselinck, De Moor, & Brysbaert's 2000 procedure; see also Stadthagen-Gonzalez & Davis, 2006). The instructions employed in this task were similar to those used Stadthagen-Gonzalez and Davis (2006):

We acquire words throughout our lives. Some words are acquired at a very early stage, some are acquired later, and others fall in between. The purpose of this study is to determine the approximate age for which words have been acquired (in its written or spoken form). By "learning a word" we mean the age at which you have understood that word if somebody had used it in front of you, even if you did not use, read or write it at that time. Your task is to type in years the age at which you learned each of the word presented on the screen. An approximate age is good enough for this rating. For instance, if you think you learn the word "dragon" at the age of 3 years, then you type 3 below this word. Or if you think you learn the word "tax" at the age of 16, then type 16. If you do not know the meaning of a word, type a N below the word. When making your ratings, try to be as accurate as possible, but do not spend too much time on any one word. If you have any question, ask the experimenter now. Otherwise, press <Enter> to begin the study.

We used this AoA measure rather than the 7-point scale used by Gilhooly & Logie (1980), because participants find the instruction easier to follow and because gives more precise information (for instance when we want to calculate the variable "years-known" defined at the difference between the current age and the age of acquisition).

In both tasks, reaction times to the ratings were measured, although the participants were not informed of this and were not instructed to respond as quickly as possible. Following Cortese and Fugett (2004), the primary interest of recording reaction times was to allow us to eliminate ratings that were made prematurely.

RESULTS

Following Cortese and Khanna (in press), latencies and ratings were eliminated whenever a rating was made in less than 500 msec. Speed was not instructed in the instructions so no upper limit for response latencies was set. This criterion eliminated less than 2 % of the data in both rating tasks. For the subjective frequency task, the average latency was 2486 ms (SD = 1214) and for the age of acquisition rating task, the average latency was 3353 ms (SD = 915).

Mean AoA and subjective frequency ratings and their respective standard deviation are presented in the full database by alphabetical order (Excel file). This database may be downloaded from ludovic.ferrand.googlepages.com/databases.

To assess the reliability of our ratings, we correlated them with other published norms For age of acquisition (see Table 2), there were 113 words in common with Alario and Ferrand (1999), 99 in common with Bonin et al. (2003b), 310 in common with Ferrand et al. (2003), 81 in common with Sirois et al. (2006), 653 in common with one-to-one translations of Cortese and Khanna (in press), and 243 in common with one-to-one translations of Stadhagen-Gonzalez and Davis (2006).Despite that some studies were conducted in French, Canadian French, Amercian English or British English, all correlations were high (between .69 and .95). The correlation between our subjective AoA ratings and the objective AoA ratings reported by Chalard et al. (2003) for French was somewhat lower (r = . 64, N = ??) but still very acceptable.

<Insert Table 2 about here>

For subjective frequency (see Table 3), there were 277 words in common with Bonin et al. (2003a), 360 in common with Desrochers and Bergeron (2000), 111 in common with Flieller and Tournois (1994), 681 in common with one-to-one translations of Balota et al. (2001), and 243 in common with one-to-one translations of Stadthagen-Gonzalez and Davis (2006). The first three studies were conducted in French (one in Canadian French) and the other two were conducted in English (American and British English). Despite these differences, the correlations were high (between .70 and .87; see Table 3).

<Insert Table 3 about here>

Overall, these correlations (in both tasks) provide evidence for congruent validity. As in Cortese and Khanna (2007, in press), our large-scale study with 1,493 words provided

subjective frequency ratings and AoA ratings similar to smaller studies with fewer trials. Therefore, the length of the testing sessions did not negatively affect participants's ratings, as was already shown in other published mega-studies (e.g., Balota et al., 2004; Cortese & Fugett, 2004; Cortese & Khanna, 2007, in press).

Relation Between the Subjective Norms and Other Lexical Variables

Table 4 shows the correlations between AoA and subjective frequency and a selection of lexical variables: word length (number of letters and number of phonemes), number of orthographic neighbours, a variety of measures of frequency (printed frequency/film frequency from Lexique 3, Manulex), and imageability. As can be seen, AoA is significantly correlated with all of these variables. The direction of these correlations is in agreement with expectations regarding the age at which words are acquired. Words that are acquired later tend to be less frequent (both subjectively and objectively), less imageable, and to be longer (with less fewer orthographic neighbors) than words that are acquired earlier.

<Insert Table 4 about here>

Subjective frequency is significantly correlated with AoA, printed frequency, length (both number of letters and number of phonemes), number of orthographic neighbours and imageability. Thus, more (subjective) frequent words tend to be acquired earlier, are more objectively frequent, tend to be shorter, are less imageable, and have more orthographic neighbours than less (subjective) frequent words. As in previous studies (e.g., Balota et al., 2001; Stadthagen-Gonzalez & Davis, 2006), there were strong correlations between subjective frequency and both written and spoken frequency, suggesting that subjective frequency reflect frequency of exposure.

<Insert Table 5 about here>

In order to study the contribution of each of these variables, a simultaneous multiple regression analysis was conducted with AoA as the dependent variable and five independent variables (see Table 5). To avoid problems of multicollinearity among the independent variables, we used only a single measure of frequency (printed frequency from Lexique 3) and a single measure of length (number of letters). The overall regression equation was significant [$F(5,1487)=574.68$, $p<.0001$, $R = .812$], and taken together, the predictor variables accounted for 66% of the variance. As can be seen in Table 5, four out of the five variables included in the regression made independent contributions to predicted rated AoA, with the best predictors being imageability, subjective frequency and printed frequency, followed by number of orthographic neighbours. As in Marques et al.'s (2007) study, the number of letters was not a significant predictor. These findings are consistent with previous studies of AoA on different set of words (Bird et al., 2001; Gilhooly & Logie, 1980; Marques et al., 2007; Stadthagen-Gonzalez & Davis, 2006).

CONCLUSION

We have collected age of acquisition and subjective frequency norms for all useful monosyllabic French words, including nouns, verbs, adjectives, adverbs, numerals, and function words. This makes it possible to do all types of regression analyses on unselected word samples. In addition, it no longer restricts researchers to a limited subset of possible stimuli if they want to match their stimuli on AoA and subjective frequency. The reliability of the data is demonstrated by the high correlations with previously published norms. This database should be useful for researchers interested in manipulating or controlling these factors in word recognition, neuropsychological, or memory studies.

REFERENCES

Alario, F.-X., & Ferrand, L. (1999). A set of 400 pictures standardized for French: Norms for name agreement, image agreement, familiarity, visual complexity, image variability, and age of acquisition. *Behavior Research Methods, Instruments, & Computers, 31,* 531-552.

Baayen, R.H., Piepenbrock, R.., & Van Rijn, H. (1993). *The CELEX lexical database* (CD-ROM). Philadelphia: University of Pennsylvania, Linguistic Data Consortium.

Balota, D.A., Cortese, M.J., Sergent-Marshall, S.D., Spieler, D.H., & Yap, M.J. (2004). Visual word recognition for single syllable words. *Journal of Experimental Psychology: General, 133,* 283-316.

Balota, D.A., Pilotti, M., & Cortese, M.J. (2001). Subjective frequency estimates for 2,938 monosyllabic words. *Memory & Cognition, 29,* 639-647.

Balota, D.A., Yap, M.J., & Cortese, M.J. (2006). Visual word recognition: The journey from features to meaning (a travel update). In M.J. Traxler & M.A. Gernsbacher (Eds.), Handbook of Psycholinguistics (2nd edition). London: Academic Press.

Bird, H., Franklin, S., & Howard, D. (2001). Age of acquisition and imageability ratings for a large set of words, including verbs and function words. *Behavior Research Methods, Instruments, & Computers, 33,* 73-79.

Bonin, P., Barry, C., Méot, A., & Chalard, M. (2004). The influence of age of acquisition in word reading and other tasks: A never ending story? *Journal of Memory and Language, 50,* 456-476.

Bonin, P., Méot, A., Aubert, L., Malardier, N., Niedenthal, P., & Capelle-Toczek, M.-C. (2003a). Normes de concrétude, de valeur d'imagerie, de fréquence subjective et de valence émotionnelle pour 866 mots [Concreteness, imageability, subjective frequency and emotionality ratings for 866 words]. *L'Année Psychologique, 104,* 655-964.

Bonin, P. Peereman, R., Malardier, N., Méot, A., & Chalard, M. (2003b). A new set of 299

pictures for psycholinguistic studies: French norms for name agreement, image agreement, conceptual familiarity, visual complexity, image variability, age of acquisition, and naming latencies. *Behavior Research Methods, Instruments, & Computers, 35,* 158-167.

Brysbaert, M., & Ghyselinck, M. (2006). The effect of age of acquisition: Partly frequency related, partly frequency independent. *Visual Cognition, 13,* 992-1011.

Chalard, M., Bonin, P., Méot, A., Boyer, B., & Fayol, M. (2003). Objective age-of-acquisition (AoA) norms for a set of 230 object names in French: Relationships with psycholinguistic variables, the English data from Morrison et al. (1997), and naming latencies. *European Journal of Cognitive Psychology, 15,* 209-245.

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A Dual Route Cascaded model of visual word recognition and reading aloud. *Psychological Review, 108,* 204-256.

Cortese, M.J., & Fugett, A. (2004). Imageability ratings for 3,000 monosyllabic words. *Behavior Research Methods, Instruments, & Computers, 36,* 384-387.

Cortese, M.J., & Khanna, M.M. (2007). Age of acquisition predicts naming and lexical-decision performance above and beyond 22 other predictor variables: An analysis of 2,342 words. *Quarterly Journal of Experimental Psychology, 60,* 1072-1082.

Cortese, M.J., & Khanna, M.M. (in press). Age of acquisition ratings for 3,000 monosyllabic words. *Behavior Research Methods.*

Desrochers, A., & Bergeron, M. (2000). Valeurs de fréquence subjective et d'imagerie pour un échantillon de 1,916 substantifs de la langue française [Norms of rated subjective frequency of use and imagery for 1,916 French nouns]. *Canadian Journal of Experimental Psychology, 54,* 274-325.

Ferrand, L., Grainger, J., & New, B. (2003). Normes d'âge d'acquisition pour 400 mots monosyllabiques [Age-of-acquisition for 400 monosyllabic French words]. *L'Année Psychologique, 104,* 445-468.

Flieller, A., & Tournois, J. (1994). Imagery value, subjective frequency an d objective frequency, date of entry in the language, and degree of polysemy in a sample of 998 French words. *International Journal of Psychology, 29,* 471-509.

Gernsbacher, M.A. (1984). Resolving 20 years of inconsistent interactions between lexical familiarity and orthography, concreteness, and polysemy. *Journal of Experimental Psychology: General, 113,* 256-281.

Ghyselinck, M., De Moor, W., & Brysbaert, M. (2000). Age-of-acquisition ratings for 2816 Dutch four- and five-letter nouns. *Psychologica Belgica, 40,* 77-98.

Ghyselinck, M., Lewis, M.B., & Brysbaert, M. (2004). Age of acquisition and the cumulative-frequency hypothesis: A review of the literature and a new multi-task investigation. *Acta Psychologica, 115,* 43-67.

Gilhooly, K.J., & Logie, R.H. (1980). Age-of-acquisition, imagery, concreteness, familiarity, and ambiguity measures for 1,944 words. *Behavior Research Methods, & Instrumentation, 12,* 395-427.

Harm, M.W., & Seidenberg, M.S. (2004). Computing the meanings of words in reading: Cooperative division of labor between visual and phonological processes. *Psychological Review, 111,* 662-720.

Johnston, R.A., & Barry, C. (2006). Age of acquisition and lexical processing. *Visual Cognition, 13,* 789-845.

Juhasz, B.J. (2005). Age-of-acquisition effects in word and picture identification. *Psychological Bulletin, 131,* 684-712.

Lété, B., Sprenger-Charolles, L., & Colé, P. (2004). MANULEX: A grade-level lexical database from French elementary-school readers. *Behavior Research Methods, Instruments, & Computers, 36,* 156-166.

Marques, J.F., Fonseca, F.L., Morais, A.S., & Pinto, I.A. (2007). Estimated age of acquisition norms for 834 Portuguese nouns and their relation with other psycholinguistics variables. *Behavior Research Methods, 39,* 439-444.

Morrison, C., Chappell, T., & Ellis, A. (1997). Age of acquisition norms for a large set of object names and their relation to adult estimates and other variables. *Quarterly Journal of Experimental Psychology, 50A,* 528-559.

Morrison, C., & Ellis, A. (1995). The role of word frequency and age of acquisition in word naming and lexical decision. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 116-133.

New, B., Brysbaert, M., Veronis, J., & Pallier, C. (2007). The use of film subtitles to estimate word frequencies. *Applied Psycholinguistics, 28,* 661-677.

New, B., Pallier, C., Brysbaert, M., & Ferrand, L. (2004). Lexique 2: A new French lexical database. *Behavior Research Methods, Instruments, & Computers, 36,* 516-524.

Perry, C., Ziegler, J.C., & Zorzi, M. (2007). Nested incremental modelling in the development of computational theories: The CDP+ model of reading aloud. *Psychological Review, 114,* 273-315.

Sirois, M., Kremin, H., & Cohen, H. (2006). Picture-naming norms for Canadian French: Name agreement, familiarity, visual complexity, and age of acquisition. *Behavior Research Methods, 38,* 300-306.

Stadthagen-Gonzalez, H., & Davis, C.J. (2006). The Bristol norms for age of acquisition, imageability, and familiarity. *Behavior Research Methods, 38,* 598-605.

Zevin, J.D., & Seidenberg, M.S. (2002). Age of acquisition effects in word reading and other tasks. *Journal of Memory and Language, 47,* 1-29.

Zevin, J.D., & Seidenberg, M.S. (2004). Age-of-acquisition effects in reading aloud: Tests of cumulative-frequency and frequency trajectory. *Memory & Cognition, 32,* 31-38.

Acknowledgments

This work was supported by an ANR grant n°06-CORP-00101 to Ludovic Ferrand (Agence Nationale de la Recherche, France).

We wish to thank Emmanuelle Neuville and Claire Rastoul for testing the participants and collecting the norms.

TABLE 1

Summary Statistics

Variable	Number	Mean	SD	Range
Subjective Frequency	1,493	4.24	1.04	2.32-7
Age of Acquisition	1,493	7.79	2.35	2.81-15.45
Printed Frequency[a]	1,493	271.07	1659.26	0-37,524.35
Number of Letters[a]	1,493	4.72	1.12	2-8
Number of Phonemes[a]	1,493	3.49	1.08	1-7
Number of O-Neighbors[a]	1,493	6.52	4.94	0-24
Imageability[b]	1,493	4.54	1.55	1.06-6.93

a: taken from Lexique 3: New et al. (2007). b: taken from Bonin et al. (in preparation) on a 7-point scale.

TABLE 2

Correlations of the present subjective AoA measures with those provided by other databases

Language	Study	Correlation With the Present Study r	n
French	Alario & Ferrand (1999)	.91	113
French	Bonin et al. (2003b)	.88	99
French	Chalard et al. (2003)[a]	.64	78
French	Ferrand et al. (2003)	.95	310
Canadian French	Sirois et al. (2006)	.88	81
American English	Cortese & Khanna (in press)	.73	653
British English	Stadthagen-Gonzalez & Davis (2006)	.69	243

All correlation are significant at the $p<.0001$ level. [a]: Objective AoA.

TABLE 3

Correlations of the present subjective frequency measures with those provided by other databases for common items

Language	Study	Correlation With the Present Study r	n
French	Bonin et al. (2003a)	.87	277
Canadian French	Desrochers & Bergeron (2000)	.73	360
French	Flieller & Tournois (1994)	.86	111
American English	Balota et al. (2001)	.78	681
British English	Stadthagen-Gonzalez & Davis (2006)	.70	243

All correlation are significant at the $p<.0001$ level.

TABLE 4

Correlations Between Age-of-Acquisition, Subjective Frequency and Other Lexical Variables (Printed Frequency, Number of Letters, Number of Phonemes, Number of Orthographic Neighbors, and Imageability)

Variable	Age of Acquisition	Subjective Frequency
Age of Acquisition	+1.00	–0.57
Subjective Frequency	–0.57	+1.00
Log_{10} (Lexique 3 written + 1)	–0.60	+0.73
Log_{10} (Lexique 3 spoken + 1)	–0.59	+0.81
Log_{10} (Manulex + 1)	–0.75	+0.73
Number of Letters	+0.20	–0.28
Number of Phonemes	+0.28	–0.26
Number of O-Neighbors	–0.22	+0.23
Imageability	–0.32	–0.28

Note. Lexique 3 (from New et al., 2007); Manulex (from Lété et al., 2004). All correlations are significant at the $p<.01$ level (bilateral).

TABLE 5

Multiple-Regression Analysis With Rated Age of Acquisition as the Dependent Variable and Five Independent Variables

Independent Variable	β	SE	t	p
Imageability	–.528	.016	–33.398	.001
Subjective Frequency	–.411	.023	–17.947	.001
Printed Frequency	–.386	.023	–16.983	.001
Number of O-Neighbors	–.100	.017	–5.729	.001
Number of Letters	–.002	.018	–.106	.915

Note. Printed frequency, $\log_{10}$ (Lexique 3 + 1).