

First-order approximation to English, second-order approximation to English, and orthographic neighbor ratio norms for 925 nouns

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First- and second-order approximations to English and orthographic neighbor ratio values are provided for Paivio, Yuille, and Madigan's (1968) 925 nouns. First- and second-order approximations to English are information theory measures of the probability of generating a word on a letter-by-letter basis. The orthographic neighbor ratio is the frequency of a word divided by the sum of the frequencies of all words that can be generated by changing one of its letters. Thus, the orthographic neighbor ratio provides a measure of a sophisticated guessing model in which partial information about a word is obtained and a decision is made on the basis of the relative frequencies of the possible responses. Correlations with existing norms are reported.

The 925 nouns scaled by Paivio, Yuille, and Madigan (1968) have received over 350 citations in the last 5 years (*Social Science Citation Index*, 1977-1981). In addition to the originally published values of imagery, concreteness, and meaningfulness and easily obtained frequency measures (e.g., Rubin, 1980), scales of familiarity (Paivio, Note 1) and free recall (Christian, Bickley, Tarka, & Clayton, 1978) are available for these 925 nouns. The purpose of this paper is to add three scales to this collection: first-order approximation to English, second-order approximation to English, and orthographic neighbor ratio.

Manelis (1974) distinguishes between two types of variables: Structural variables depend on relations internal to the strings of letters, whether or not they are words, whereas lexical variables depend on the properties of words as wholes. First- and second-order approximations to English are structural variables; that is, the values obtained are independent of whether or not a string of letters is a word. As these two measures are calculated on a letter-by-letter basis, they are most appropriate for models that assume that people process words in a similar fashion.

The shorter or more common the spelling of a word, the easier it should be to process in a host of psychological tasks (e.g., Engel, 1974; Miller, Bruner, & Postman, 1954; Rice & Robinson, 1975). As high-frequency words tend to be shorter (Miller, Newman, & Friedman, 1958) and have more common spellings than low-frequency words (Landauer & Streeter, 1973), spelling patterns need to be measured if frequency effects are

to be isolated. The concept of order of approximation to English (Miller & Selfridge, 1950) can be used to determine how likely words occur in the process of randomly sampling letters. This method was chosen over several other measures of letter statistics (Massaro, Venezky, & Taylor, 1979; Travers & Olivier, 1978) because of its direct tie to information theory. In zero-order approximation, the word "boy" is created with a probability equal to the probability of drawing a blank, then a "b," then an "o," then a "y," then another blank. As there are 27 characters (26 letters plus blank), all equally likely in a zero-order approximation, the probability is $(1/27)^5$. In general, it is $(1/27)$ to the $(L + 2)$ power, where L is the length in letters. For the first-order approximation, the five $1/27$ figures are replaced by their actual probabilities of occurrence. For the second-order approximation, the probabilities of drawing a blank, a "b" given the blank, an "o" given the "b," a "y" given the "o," and a blank given the "y" are multiplied. More details on the mathematics for a similar measure can be found in Travers and Olivier (1978). In order to convert the products of probabilities obtained in the zero- through second-order approximations to an information measure, the logarithm to the base two is taken. This compresses the range of values and makes their distribution more normal. The logarithm also makes the zero-order approximation a linear transformation of length in letters, allowing the simpler term length in letters to be used while conceptually placing it on a continuum. Length in letters is known to correlate highly with pronounceability (Spren & Schulz, 1966), as well as with other variables, and has been studied as a factor in tachistoscopic recognition threshold (Richards & Heller, 1976).

The probabilities used in the calculations are from

Reprints and computer-readable norms are available from the author. I wish to thank Allan Paivio and Donald Olivier for making their norms available to me.

unpublished tables by Olivier (Note 2). These tables were formed by counting the probabilities of letters and bigrams (including blanks as a letter) in the first five million letters of the corpus on which the Kučera and Francis (1967) word count was made. The five million letters include nearly the total corpus of slightly over one million words used by Kučera and Francis. To use Miller and Selfridge's (1950) term, the Kučera and Francis count can be considered as the appropriate "text" approximation to English.

The orthographic neighbor ratio is taken from Landauer and Streeter (1973). It is the ratio of the frequency of a word in the Kučera and Francis (1967) count divided by the sum of the frequencies of all its orthographic neighbors. A neighbor is defined as any word that can be formed by changing up to one letter of the original word. Thus, for example, the neighbors of "boar" are "bear," "boat," "boaz," "roar," and "boar" itself. Words not listed in Kučera and Francis are given a frequency of zero. The orthographic neighbor ratio provides an index of how well a word would fare in a tachistoscopic recognition or similar task under a sophisticated guessing hypothesis in which partial information about the stimulus is obtained and a decision is made on the basis of the relative frequencies of the possible responses. The orthographic neighbor ratio can give reasonable results only when length in letters is held constant, as it was in the original Landauer and Streeter (1973) article. There are fewer neighbors for longer words, and therefore the effect of this variable, when length is free to vary, is the opposite of that expected from a sophisticated guessing or other reasonable model. As the variable may work with length held constant, it provides a plausible psychological theory if word length is used as a cue in searching lexical memory. Similarly, first- and second-order approximations to English are most valuable when length is held constant, because they correlate highly with length, $-.97$ and $-.92$, respectively, for the 925 nouns used here, allowing length to mask any independent effects of these variables.

RESULTS

Table 1 presents values of first- and second-order approximations to English (FOA and SOA) and orthographic neighbor ratio (ONR) for the 925 Paivio et al.

Table 1
Values for FOA, SOA, and ONR for 925 Nouns

WORD	FOA	SOA	ONR
3 LETTER WORDS			
AIR	-17.284	-17.749	0.4914
ARM	-18.809	-17.314	0.0197
BAR	-19.556	-16.093	0.0514
BOY	-21.513	-18.536	0.4007
CAR	-18.483	-15.337	0.0865
CAT	-17.905	-14.852	0.0085
EGO	-18.307	-22.097	0.0478
FOX	-23.898	-21.845	0.0013

WORD	FOA	SOA	ONR
FUN	-20.310	-17.008	0.0837
PUR	-20.506	-17.111	0.0012
GEM	-19.882	-19.400	0.0050
INK	-20.828	-17.513	0.1795
INN	-17.261	-16.875	0.1200
JOY	-24.775	-20.304	0.0622
KEG	-21.971	-20.500	0.0110
LAD	-18.819	-16.826	0.0010
LAW	-19.918	-21.965	0.2741
LIP	-19.835	-21.789	0.0861
NON	-18.712	-19.825	0.0038
PEP	-20.058	-20.174	0.0000
ROD	-18.297	-17.699	0.0264
SPA	-16.430	-17.849	0.0650
SKY	-23.057	-20.500	0.0975
TOY	-18.905	-16.992	0.0025

4 LETTER WORDS

ARMY	-24.971	-20.915	0.5197
BABY	-27.748	-20.088	0.8857
BARD	-24.532	-20.025	0.0058
BIRD	-24.659	-22.347	0.6458
BODY	-26.489	-22.666	0.9583
BOOK	-26.994	-24.307	0.1758
BOSS	-23.735	-20.828	0.0637
BOWL	-26.306	-25.014	0.5000
CAMP	-25.632	-22.845	0.1012
CANE	-21.563	-17.364	0.0090
CASH	-22.921	-21.154	0.0713
CELL	-23.323	-20.021	0.0387
CHIN	-22.941	-16.513	0.1667
CITY	-24.194	-20.108	0.9470
CLAW	-25.157	-25.615	0.0085
CODE	-22.529	-19.148	0.0493
COIN	-22.403	-19.935	0.0595
CORD	-23.536	-18.374	0.0086
CORE	-21.835	-15.792	0.0110
CORN	-22.646	-19.623	0.1100
COST	-22.174	-19.407	0.1279
CRAG	-24.476	-22.473	0.0000
DAWN	-24.101	-26.506	0.0286
DEED	-21.553	-20.114	0.0086
DELL	-23.061	-20.759	0.0030
DIRT	-22.051	-22.599	0.6324
DOLL	-23.775	-22.549	0.0826
DOOR	-22.287	-22.702	0.7156
DOVE	-24.184	-20.035	0.0049
DUST	-23.413	-20.828	0.0351
DUTY	-25.383	-21.988	0.8592
FACT	-23.589	-21.304	0.4928
FATE	-21.626	-18.885	0.0299
FIRE	-22.330	-19.028	0.2024
FLAG	-25.519	-23.263	0.1758
FOAM	-24.200	-24.639	0.0892
FORK	-26.658	-20.689	0.0088
FORM	-24.569	-21.031	0.4901
FOWL	-25.678	-24.529	0.0108
FRUG	-24.997	-22.755	0.0002
GIFT	-24.469	-25.482	0.5323
GILT	-23.665	-24.589	0.0536
GIRL	-24.243	-26.213	0.9865
GIST	-22.978	-20.623	0.0045
GOLD	-24.888	-22.264	0.0294
GOLF	-25.595	-25.067	0.2982
GORE	-22.589	-19.084	0.0027
HALL	-23.250	-18.570	0.1154
HAPP	-23.639	-24.419	0.0040
HIDE	-21.868	-18.995	0.0353
HINT	-21.406	-17.254	0.1364
HOME	-22.406	-18.254	0.1740
HOOF	-23.240	-20.297	0.0235
HOPE	-22.709	-19.998	0.2002
HOUR	-23.340	-19.018	0.0966
IDEA	-21.254	-22.127	1.0000
IRON	-21.446	-19.114	0.9556
ITEM	-21.632	-21.044	0.6506
JAIL	-27.456	-24.921	0.1105
JOKE	-29.542	-22.180	0.4000
JURY	-30.558	-19.965	0.3918
KINE	-24.104	-20.310	0.0000
KING	-26.821	-19.905	0.1679
KISS	-25.127	-21.842	0.0545
LAKE	-24.772	-20.981	0.0175
LARK	-25.778	-22.662	0.0040
LAWN	-24.004	-25.316	0.1064
LICE	-22.483	-19.025	0.0007
LIFE	-22.928	-21.862	0.2601
LIME	-25.845	-26.805	0.1351

WORD	FOA	SOA	ONR
LIME	-22.808	-19.417	0.0032
LINK	-25.708	-22.144	0.0389
LORD	-23.177	-20.875	0.1950
LOVE	-24.087	-19.553	0.3463
LUMP	-26.851	-25.861	0.0824
MAST	-22.423	-18.294	0.0016
MEAT	-21.506	-18.696	0.0664
MIND	-23.715	-16.118	0.2706
MONK	-26.343	-22.048	0.4706
MOOD	-23.569	-22.197	0.0318
MOSS	-22.988	-21.064	0.0053
MULE	-24.260	-19.307	0.0231
NAIL	-21.968	-24.645	0.0311
OATS	-20.848	-22.367	0.0843
ODOR	-22.287	-21.832	0.7778
OVEN	-23.293	-17.952	0.0025
PACT	-23.772	-20.267	0.0038
PELT	-22.775	-22.307	0.0900
PIPE	-24.097	-22.161	0.1220
POET	-21.885	-25.190	0.3402
POLE	-23.061	-18.935	0.0506
ROCK	-26.213	-23.622	0.5597
SEAT	-20.134	-19.161	0.1023
SERP	-22.483	-21.891	0.0000
SHIP	-23.675	-24.868	0.3979
SKIN	-25.021	-20.666	0.6351
SOIL	-22.151	-24.529	0.3553
SOUL	-23.602	-20.118	0.3730
STAR	-21.141	-19.304	0.1429
STUB	-24.748	-26.004	0.2308
SUDS	-23.901	-22.901	0.2368
TANK	-24.406	-21.191	0.0313
TIME	-21.632	-16.819	0.9552
TOMB	-24.619	-23.695	0.2037
TOOL	-21.612	-21.164	0.0567
TREE	-19.586	-18.972	0.1037
UNIT	-22.370	-21.955	0.9115
VEST	-23.114	-19.124	0.0040
WIFE	-24.124	-19.971	0.1855
WINE	-22.526	-16.271	0.0584

5 LETTER WORDS

ABODE	-27.516	-24.283	0.0104
ABYSS	-29.821	-24.708	1.0000
ADAGE	-27.120	-25.100	0.7500
AGONY	-29.193	-24.645	0.8182
AMOUR	-28.290	-22.456	
ANGER	-26.599	-19.174	0.6857
ANGLE	-27.197	-20.745	0.6711
ANKLE	-28.858	-25.516	0.1356
APPLE	-28.851	-23.207	0.1111
ARRAY	-27.602	-24.390	1.0000
ARROW	-27.592	-26.565	1.0000
BARON	-27.632	-21.632	0.0426
BEAST	-26.446	-21.712	0.0185
BLOOD	-29.196	-25.562	0.7035
BLOOM	-29.784	-26.014	0.0805
BOARD	-28.522	-26.609	0.9019
BOSOM	-29.097	-26.615	1.0000
BRAIN	-27.682	-23.516	0.2601
BRUTE	-28.113	-24.944	0.6000
CABIN	-28.638	-23.476	0.8846
CANDY	-29.426	-21.825	0.2857
CHAIR	-27.050	-24.512	0.5238
CHAOS	-26.911	-29.529	0.9444
CHARM	-28.575	-24.077	0.5200
CHASM	-28.486	-25.632	0.0435
CHIEF	-27.814	-25.373	0.8750
CHILD	-28.711	-21.961	0.9103
CIGAR	-28.515	-25.542	1.0000
CLOCK	-32.050	-27.834	0.1923
COAST	-26.087	-24.815	0.6224
CRIME	-27.449	-23.572	0.4304
DEATH	-25.446	-22.440	0.8394
DEMON	-26.941	-23.320	0.3000
DEVIL	-29.113	-25.376	0.8929
DRAMA	-27.698	-28.266	1.0000
DREAM	-27.060	-27.814	0.6882
DRESS	-25.967	-24.622	0.3317
DUMMY	-32.807	-29.020	0.5000
EARTH	-24.752	-24.891	0.8876
ELBOW	-29.582	-33.435	1.0000
EVENT	-26.283	-23.220	1.0000
FAULT	-28.721	-28.897	0.7857
FIORD	-28.020	-23.280	0.0000
FLASK	-31.372	-28.711	0.1786
FLESH	-27.609	-26.818	0.3133

WORD	FOA	SOA	ONR
FLOOD	-28.569	-28.256	0.0633
FOLLY	-30.645	-21.387	0.0833
GEESE	-25.061	-24.831	0.5000
GHOST	-27.456	-25.549	1.0000
GLORY	-30.356	-25.938	0.8750
GRASS	-27.622	-24.659	0.1900
GREED	-26.851	-23.918	0.0130
GREEN	-25.961	-24.738	0.6010
GRIEF	-28.323	-28.220	0.1205
HORSE	-25.316	-22.430	0.1475
HOTEL	-25.426	-25.818	0.8025
HOUND	-28.120	-20.662	0.0075
HOUSE	-26.526	-21.682	0.8152
IDIOM	-27.658	-25.290	0.7778
IRONY	-27.609	-23.984	0.6316
JELLY	-33.821	-24.074	0.0938
JUDGE	-34.359	-28.476	0.9277
LEMON	-26.844	-23.632	0.6429
MAKER	-29.738	-23.064	0.0522
MERCY	-29.572	-25.708	0.6452
METAL	-26.386	-24.732	0.8971
MONEY	-28.127	-23.586	0.8660
MONTH	-26.921	-20.955	0.5417
MORAL	-27.678	-22.755	0.9221
MOOSE	-24.582	-27.506	0.0309
NYMPH	-31.256	-32.854	0.3333
OCEAN	-25.552	-23.655	1.0000
OPIUM	-30.000	-33.156	1.0000
OWNER	-26.758	-24.712	0.4925
PANIC	-28.193	-25.705	0.9167
PAPEP	-28.253	-23.745	0.9290
PARTY	-28.977	-24.101	0.6136
PEACH	-27.871	-24.546	0.0073
PIANO	-26.944	-26.466	1.0000
PLAIN	-27.834	-22.612	0.9600
PLANK	-31.449	-25.360	0.0186
PLANT	-27.499	-21.593	0.3453
POWER	-28.539	-22.742	0.7037
PRIDE	-27.489	-22.300	0.1634
PROXY	-34.525	-29.628	0.8750
PUPIL	-31.193	-27.579	1.0000
QUEEN	-31.253	-26.831	0.8723
QUEST	-31.788	-24.924	0.2909
RIVER	-27.821	-22.283	0.8088
ROVIN	-25.639	-24.004	0.0000
SALAD	-26.924	-23.835	1.0000
SAUCE	-27.160	-26.722	0.9091
SHAME	-26.522	-22.576	0.0820
SHOCK	-30.651	-27.217	0.1314
SHOES	-25.227	-27.306	0.2378
SHORE	-25.316	-21.327	0.1128
SKULL	-32.146	-31.133	0.0652
SLAVE	-28.203	-24.572	0.5882
SLUSH	-28.333	-29.512	0.0000
SNAKE	-28.170	-29.778	0.5366
SPIRE	-26.705	-24.705	0.0521
SPRAY	-29.465	-23.792	0.5714
SPREE	-25.941	-23.390	0.6667
STEAM	-24.984	-22.566	0.1765
STEAM	-25.698	-25.047	0.4146
STONE	-24.297	-20.407	0.3432
STORM	-26.781	-24.094	0.1028
STYLE	-27.263	-26.323	0.8750
SUGAR	-28.921	-25.443	1.0000
SWAMP	-30.661	-30.020	0.3571
TABLE	-27.133	-22.367	0.9340
THIEF	-26.280	-22.636	0.0630
THORN	-25.639	-20.955	0.6000
TOAST	-24.552	-24.200	0.1939
TOWER	-26.376	-21.323	0.0265
TRUCK	-27.040	-24.546	0.0562
TRUCK	-31.419	-26.841	0.4634
TRUTH	-26.758	-23.931	1.0000
VENOM	-28.858	-25.164	1.0000
VIGOR	-30.246	-26.526	1.0000
WATER	-26.300	-20.324	0.5182
WENCH	-28.253	-23.214	0.0000
WHALE	-27.721	-19.413	0.0000
WHEAT	-26.546	-19.726	0.7500
WOMAN	-28.678	-20.812	0.4686
WOODS	-28.273	-27.276	0.0600
WORLD	-29.253	-24.130	0.2248
YACHT	-28.595	-31.515	0.6667

6 LETTER WORDS

ABBESS	-33.246	-29.412	
ADVICE	-33.385	-28.791	0.8361

WORD	FOA	SOA	ONR	WORD	FOA	SOA	ONR
AMOUNT	-31.797	-25.831	1.0000	METHOD	-31.087	-26.333	1.0000
ANIMAL	-31.445	-25.908	1.0000	MIRAGE	-32.116	-28.851	
ANSWER	-30.874	-28.313	1.0000	MISERY	-32.565	-25.217	1.0000
ARTIST	-28.894	-24.775	1.0000	MOMENT	-31.233	-25.399	1.0000
AUTHOR	-30.957	-25.765	1.0000	MORGUE	-33.644	-30.857	1.0000
AVENUE	-31.984	-28.366	0.9583	MOTHER	-30.392	-22.951	0.9038
BANDIT	-32.080	-24.489	1.0000	MUCOUS	-35.016	-26.057	
BANKER	-34.571	-27.203	0.1429	MURDER	-32.920	-27.894	1.0000
BANNER	-31.004	-28.449	0.0526	NECTAR	-29.549	-30.120	1.0000
BARREL	-31.993	-29.509	0.6000	NEPHEW	-32.156	-34.365	1.0000
BEAVER	-33.000	-24.619	0.2000	NUTMEG	-33.163	-37.089	1.0000
BEGGAR	-34.817	-31.759	1.0000	ORIGIN	-31.479	-25.768	0.9362
BELFRY	-35.644	-29.316	1.0000	OXYGEN	-37.730	-40.368	1.0000
BELIEF	-32.515	-29.356	0.4812	PALACE	-32.136	-25.619	0.9500
BOTTLE	-30.914	-31.545	0.4606	PATENT	-29.598	-25.160	0.5147
BREAST	-30.728	-26.266	1.0000	PENCIL	-32.435	-28.439	1.0000
BREEZE	-35.774	-33.000	0.6667	PEPPER	-33.482	-28.137	1.0000
BRONZE	-37.299	-31.359	1.0000	PERSON	-30.741	-25.542	0.9887
BULLET	-33.591	-26.648	0.3733	PISTON	-30.927	-25.187	0.1750
BUTTER	-31.817	-27.702	0.0525	PLEDGE	-33.316	-28.286	1.0000
CATTLE	-29.764	-29.472	0.4949	POETRY	-32.329	-33.269	1.0000
CELLAR	-31.518	-26.386	0.6047	PORTAL	-31.685	-27.738	0.1500
CHANCE	-31.329	-23.546	0.3531	POSTER	-30.359	-26.532	0.0741
CHURCH	-34.355	-30.940	1.0000	POTATO	-30.216	-28.349	1.0000
CIRCLE	-32.003	-30.864	1.0000	PRAYER	-32.831	-28.104	0.3043
COFFEE	-32.196	-27.240	0.9873	PRIEST	-30.409	-26.652	1.0000
COLONY	-33.395	-27.014	1.0000	PRISON	-31.505	-25.087	0.8077
COMEDY	-34.256	-25.911	0.9750	PYTHON	-33.385	-32.020	1.0000
CORNER	-30.203	-26.602	0.9829	RATING	-31.067	-24.127	0.1176
CORPSE	-31.894	-30.067	1.0000	RATTLE	-28.808	-31.010	0.0265
COTTON	-29.761	-27.545	0.9048	REFLEX	-35.621	-33.827	1.0000
CRADLE	-31.615	-31.004	1.0000	REVOLT	-32.073	-32.611	1.0000
CRISIS	-31.033	-26.406	0.7961	RITUAL	-31.359	-30.558	1.0000
CUSTOM	-33.229	-28.014	1.0000	ROBBER	-33.502	-32.023	0.0741
DANSEL	-31.851	-33.399	1.0000	RUBBLE	-35.601	-33.372	0.0588
DEBIT	-29.559	-29.941	0.0909	SAFETY	-31.980	-33.967	0.7833
DECREE	-29.372	-29.160	0.0234	SALARY	-32.392	-27.037	1.0000
DELUGE	-32.940	-29.346	0.5000	SALOON	-30.100	-28.419	0.7500
DOCTOR	-31.229	-30.103	1.0000	SALUTE	-30.505	-28.123	1.0000
DOLLAR	-31.970	-28.914	0.7302	SATIRE	-28.456	-26.253	1.0000
EFFORT	-31.668	-31.083	1.0000	SAVANT	-31.751	-28.452	
ENCORE	-29.196	-24.755		SEASON	-28.698	-26.413	0.3026
ENGINE	-29.804	-25.632	1.0000	SERIES	-28.306	-25.675	0.7784
EQUITY	-37.797	-30.489	1.0000	SERIES	-28.306	-25.675	0.7784
ERRAND	-29.864	-26.602	1.0000	SHADOW	-32.724	-31.236	1.0000
EXCUSE	-35.697	-30.236	0.8710	SHRIEK	-33.020	-36.654	0.5000
FABRIC	-34.518	-32.864	1.0000	SIMILE	-31.040	-26.954	0.0062
FELINE	-30.289	-25.898	0.3333	SINGER	-30.917	-23.436	0.1471
FLOWER	-33.236	-29.163	0.5476	SONATA	-28.848	-29.173	1.0000
FOIBLE	-33.229	-30.369		SPEECH	-31.425	-30.768	1.0000
FOREST	-30.176	-23.453	0.9851	SPIRIT	-31.173	-29.884	1.0000
FRIEND	-31.392	-26.257	1.0000	SQUARE	-36.279	-27.751	0.9662
GADFLY	-36.657	-37.767	1.0000	STREET	-27.482	-29.014	1.0000
GAIETY	-32.136	-33.468	0.8889	STRING	-31.346	-24.406	0.0538
GALAXY	-39.086	-34.993	1.0000	SULTAN	-31.316	-28.914	0.7500
GARDEN	-31.575	-29.127	0.9231	SUNSET	-29.990	-28.160	1.0000
GARRET	-30.499	-31.422	0.0000	SURTAX	-35.807	-34.465	
GENDER	-30.937	-25.350	0.0690	TEMPLE	-31.615	-25.270	1.0000
GENIUS	-32.126	-33.003	1.0000	THEORY	-30.990	-24.230	1.0000
GOBLET	-33.203	-32.233	0.0000	TICKET	-32.665	-26.021	0.5517
HAMLET	-30.914	-34.385	1.0000	TIDBIT	-31.824	-33.439	1.0000
HAMMER	-32.176	-27.170	0.6429	TRIPOD	-31.907	-29.731	1.0000
HATRED	-29.728	-23.991	0.9524	TROOPS	-31.073	-31.014	1.0000
HEALTH	-29.877	-26.200	0.8015	UPKEEP	-36.478	-42.517	1.0000
HEAVEN	-31.020	-24.018	0.8958	VACUUM	-37.641	-41.876	1.0000
HONOUR	-31.415	-25.865	1.0000	VALLEY	-35.053	-29.180	0.8690
HUMOUR	-34.395	-29.645	1.0000	VANITY	-33.847	-29.472	0.6364
HURDLE	-32.482	-32.485	0.4286	VAPOUR	-35.485	-30.319	
ICEBOX	-17.603	-14.394		VEssel	-31.758	-29.077	1.0000
IMPACT	-33.375	-28.240	0.9437	VICTIM	-34.528	-30.077	1.0000
IMPACT	-33.375	-28.240	0.9437	VIRTUE	-32.734	-33.229	1.0000
INFANT	-30.562	-27.612	0.9167	VISION	-32.289	-27.074	1.0000
INJURY	-38.684	-28.024	1.0000	VOLUME	-35.143	-32.326	1.0000
INSECT	-29.585	-26.472	0.4118	WARPTH	-33.116	-34.478	1.0000
KETTLE	-31.542	-33.904	0.1071	WEAPON	-32.256	-26.821	1.0000
LEADER	-29.652	-27.628	0.6066	WIGWAM	-36.711	-36.707	
LENGTH	-31.515	-29.127	1.0000	WINDOW	-34.292	-26.629	0.9917
LETTER	-28.170	-30.316	0.2095	WINTER	-30.512	-22.808	0.8469
LOCKER	-34.369	-29.279	0.2093				
MAIDEN	-30.904	-27.545	0.0952				
MALADY	-34.458	-27.841	1.0000				
MALICE	-31.960	-24.064	1.0000	ABDOMEN	-37.166	-38.079	1.0000
MAMMAL	-34.448	-28.280	0.5000	ABILITY	-38.099	-32.083	0.9610
MANTLE	-30.472	-26.144	1.0000	ACROBAT	-36.402	-33.658	
MARKET	-33.442	-28.326	0.6301	ADMIRAL	-36.618	-36.106	
MASTER	-29.980	-24.615	0.1702	AGILITY	-37.780	-31.937	0.0390
MEADOW	-32.844	-31.014	1.0000	ALCOHOL	-36.468	-40.408	1.0000
MEMORY	-33.897	-26.223	1.0000	ALGEBRA	-37.618	-42.511	1.0000
MENACE	-30.402	-26.240	1.0000	ALIMONY	-37.684	-29.329	1.0000

7 LETTER WORDS

WORD	FOA	SOA	ONR	WORD	FOA	SOA	ONR
ANXIETY	-39.405	-39.039	1.0000	PASSION	-35.329	-30.024	1.0000
ARBITER	-34.857	-32.963	1.0000	PERJURY	-43.982	-38.069	1.0000
ASSAULT	-35.335	-36.428	1.0000	PHANTOM	-36.701	-30.791	1.0000
BAGPIPE	-40.315	-44.507	1.0000	PIANIST	-34.890	-31.900	0.9333
BIVOUAC	-40.926	-38.016	1.0000	PICTURE	-36.946	-30.505	1.0000
BILISTER	-35.734	-27.552	0.7500	POVERTY	-39.222	-29.944	1.0000
BLOSSOM	-38.169	-34.618	1.0000	PRAIRIE	-34.747	-32.844	1.0000
BOREDOM	-37.438	-30.505	1.0000	PRESENT	-33.731	-27.529	0.8196
BOULDER	-38.255	-29.007	1.0000	PREVIEW	-38.757	-34.867	1.0000
BOUQUET	-43.388	-40.136	1.0000	PRODUCT	-38.597	-33.870	0.5148
BRAVERY	-40.169	-29.386	0.5000	PROFILE	-37.066	-28.117	0.9375
BUFFOON	-40.285	-34.259	1.0000	PUDDING	-40.478	-33.917	0.0000
BUILDER	-38.305	-31.651	1.0000	QUALITY	-43.315	-31.930	0.8837
BUTCHER	-37.880	-30.558	1.0000	RECITAL	-34.382	-32.359	1.0000
CAPTIVE	-37.980	-31.130	1.0000	REPTILE	-34.372	-33.080	
CARAVAN	-37.289	-29.944	1.0000	RESIDUE	-34.581	-33.625	1.0000
CHARTER	-34.272	-28.678	0.2705	ROBBERY	-39.664	-35.186	0.5882
CIRCUIT	-37.083	-37.235	1.0000	SADNESS	-33.877	-37.182	0.3529
COLLEGE	-36.581	-30.987	0.9468	SCARLET	-34.535	-34.837	0.6000
COMRADE	-36.289	-32.243	1.0000	SCIENCE	-34.395	-33.126	1.0000
CONCEPT	-36.448	-32.684	0.6855	SESSION	-33.017	-29.655	0.9877
CONTEXT	-38.222	-29.389	0.3070	SETTLER	-32.362	-35.465	0.0405
COSTUME	-36.505	-31.057	1.0000	SHOTGUN	-37.033	-41.694	1.0000
COTTAGE	-34.867	-34.040	1.0000	SILENCE	-34.036	-29.485	1.0000
COWHIDE	-37.172	-28.715	1.0000	SKILLET	-37.674	-34.252	0.0625
CRANIUM	-37.664	-39.491	0.0000	SLIPPER	-37.451	-35.206	0.0750
CREATOR	-33.734	-29.675	1.0000	SPEAKER	-37.508	-32.170	0.9608
CUISINE	-35.412	-30.934	1.0000	SPINACH	-36.913	-33.468	1.0000
DEBACLE	-36.920	-36.764	1.0000	STEAMER	-33.256	-29.475	0.1429
DIAMOND	-36.594	-30.744	1.0000	STUDENT	-34.478	-31.681	1.0000
DISEASE	-32.914	-30.000	1.0000	SULPHUR	-39.780	-38.833	1.0000
DOORMAN	-35.850	-32.804	0.5714	SUNBURN	-38.989	-38.568	1.0000
DREAMER	-34.618	-32.243	0.0800	TEACHER	-33.266	-26.552	0.8791
DWELLER	-36.694	-35.113	1.0000	TEMPEST	-34.631	-29.010	1.0000
DYNASTY	-38.245	-38.740	0.6250	THICKET	-37.192	-27.496	0.1429
ECONOMY	-37.355	-32.767	1.0000	THOUGHT	-36.986	-29.698	1.0000
EDIFICE	-35.578	-31.927	1.0000	TOBACCO	-37.435	-34.668	1.0000
EDITION	-33.159	-29.306	1.0000	TRAGEDY	-37.355	-32.495	1.0000
EPISODE	-34.664	-36.053	1.0000	TRELLIS	-34.302	-27.419	
EPISTLE	-34.282	-35.508		TRIBUTE	-35.857	-31.296	0.6486
ESSENCE	-32.585	-31.319	1.0000	TROUBLE	-36.983	-29.250	0.9926
EXHAUST	-39.328	-37.694	1.0000	TRUMPET	-36.937	-34.515	1.0000
FACTORY	-38.023	-30.877	0.2319	TYPHOON	-37.375	-35.927	1.0000
FALLACY	-39.720	-32.831	1.0000	UTENSIL	-34.717	-33.648	
FANTASY	-36.704	-32.485	1.0000	VEHICLE	-37.179	-35.508	1.0000
FATIGUE	-37.149	-33.641	1.0000	VICTORY	-39.358	-30.964	1.0000
FIGMENT	-37.395	-34.880	0.1818	VILLAGE	-38.923	-32.684	0.9600
FORTUNE	-35.561	-30.897	1.0000	VOLCANO	-38.039	-40.870	1.0000
FREEDOM	-36.096	-33.648	1.0000	WARBLER	-38.069	-31.283	
GALLERY	-38.435	-29.851	1.0000	WELFARE	-36.435	-31.601	1.0000
GINGHAM	-39.166	-31.648	1.0000				
GLACIER	-36.671	-35.624	1.0000				
GLUTTON	-36.897	-35.887					
GODDESS	-36.644	-36.887	0.6000	ALLEGORY	-42.424	-34.203	1.0000
GRAVITY	-40.036	-32.777	1.0000	ANECDOTE	-37.508	-42.494	1.0000
HAIRPIN	-35.804	-35.129	1.0000	APTITUDE	-40.019	-37.794	0.0263
HARNESS	-33.518	-31.346	1.0000	ATROCITY	-40.082	-35.923	
HARING	-35.166	-25.878	0.3077	ATTITUDE	-37.857	-35.780	0.9386
HEROISM	-34.920	-33.977	1.0000	BACTERIA	-39.727	-37.146	1.0000
HISTORY	-35.947	-27.652	1.0000	BANALITY	-42.059	-33.405	
HOSTAGE	-34.644	-32.834	1.0000	BARNACLE	-40.949	-37.637	
IMPULSE	-38.358	-33.193	1.0000	BASEMENT	-39.371	-33.585	0.9394
INANITY	-35.080	-29.522		BETRAYAL	-41.491	-40.341	1.0000
INTERIN	-34.040	-28.964	1.0000	BEVERAGE	-42.268	-31.645	0.8333
INVOICE	-36.611	-35.116		BLESSING	-42.019	-31.286	1.0000
JOURNAL	-41.265	-34.316	1.0000	BUILDING	-44.866	-33.847	1.0000
JUGGLER	-44.537	-36.086		BUNGALOW	-45.789	-35.578	1.0000
JUSTICE	-40.564	-28.808	0.9913	BUSYBODY	-48.646	-44.192	
LEAFLET	-34.661	-37.873	1.0000	CAPACITY	-43.125	-36.478	1.0000
LECTURE	-35.196	-31.043	1.0000	CASEMENT	-38.298	-32.824	0.0000
LEOPARD	-36.232	-36.438	0.0000	CEREBRUM	-42.770	-41.720	
LIBRARY	-38.920	-34.149	1.0000	CEREMONY	-40.923	-32.515	1.0000
LOBSTER	-35.684	-35.395	1.0000	CHLORIDE	-40.258	-37.711	0.1316
LOYALTY	-38.740	-41.604	0.7586	CITATION	-37.764	-32.482	1.0000
MACHINE	-35.694	-27.147	1.0000	CLEMENCY	-42.770	-37.016	0.6667
MADNESS	-35.249	-35.212	0.1176	CLOTHING	-41.507	-31.359	1.0000
MALARIA	-35.555	-32.093	1.0000	CONQUEST	-45.102	-35.910	1.0000
MASTERY	-36.143	-27.778	0.1370	CONTENTS	-37.325	-31.063	0.5161
MEETING	-34.987	-29.688	0.8785	CONTRACT	-39.205	-33.402	0.4478
MILEAGE	-35.990	-31.751	1.0000	COPYBOOK	-48.251	-48.281	
MIRACLE	-36.242	-32.432	1.0000	CREATURE	-38.511	-33.037	1.0000
MISSILE	-35.232	-30.339	0.9796	DAFFODIL	-43.192	-42.580	
MONARCH	-36.651	-33.140	1.0000	DAYBREAK	-45.537	-44.846	1.0000
NURSERY	-36.820	-33.458	1.0000	DAYLIGHT	-43.245	-44.202	1.0000
OFFICER	-37.242	-28.881	0.6918	DELIRIUM	-41.597	-43.773	1.0000
OPINION	-35.146	-30.708	1.0000	DERELICT	-38.720	-32.608	1.0000
OUTCOME	-36.302	-31.060	1.0000	DEVOTION	-40.003	-36.292	1.0000
PAINTER	-34.216	-28.791	0.3134	DISASTER	-37.624	-34.213	1.0000

8 LETTER WORDS

WORD	FOA	SOA	ONR	WORD	FOA	SOA	ONR
DOMICILE	-41.052	-35.910	1.0000	ADVANTAGE	-45.716	-41.727	1.0000
ELEPHANT	-38.578	-37.378	1.0000	ADVERSITY	-46.487	-39.381	1.0000
EMPORIUM	-43.122	-43.610		AFFECTION	-44.663	-40.617	1.0000
ENSEMBLE	-39.910	-36.385	1.0000	AFTERLIFE	-43.786	-44.530	
EVIDENCE	-40.109	-35.837	1.0000	AGREEMENT	-42.418	-38.511	1.0000
EXERTION	-40.876	-36.764	1.0000	ALLIGATOR	-44.643	-35.691	1.0000
FACILITY	-42.710	-36.395	1.0000	AMAZEMENT	-48.650	-40.052	1.0000
FALCONER	-40.398	-37.637		AMBULANCE	-47.723	-36.893	1.0000
FOOTWEAR	-39.963	-39.295	1.0000	AMPLIFIER	-46.593	-39.973	0.5000
FOREHEAD	-38.973	-35.126	1.0000	ANIMOSITY	-44.740	-38.986	1.0000
FRICITION	-40.112	-32.821	0.4250	ANTITOXIN	-45.786	-37.352	
FRONTAGE	-39.976	-34.339	1.0000	APPLIANCE	-46.128	-38.485	1.0000
GARMENTS	-40.059	-34.172	1.0000	ARMADILLO	-45.487	-39.272	1.0000
HARDSHIP	-41.375	-41.969	1.0000	ATHLETICS	-42.524	-42.570	1.0000
HARDWOOD	-41.780	-42.418		ATTENDANT	-40.411	-36.697	1.0000
HENCHMAN	-40.268	-34.864	0.3333	ATTRIBUTE	-43.474	-40.514	1.0000
HEREDITY	-39.292	-32.402	1.0000	AVALANCHE	-45.690	-33.621	1.0000
HILLSIDE	-39.860	-35.565	1.0000	BLANDNESS	-44.962	-39.428	0.0769
HOMICIDE	-40.700	-34.870	1.0000	BLASPHEMY	-49.743	-40.182	1.0000
HOSPITAL	-40.162	-38.747	1.0000	BRASSIERE	-42.813	-37.794	1.0000
ILLUSION	-40.647	-33.943	0.9250	BRUTALITY	-47.537	-40.195	1.0000
IMMUNITY	-43.700	-33.923	0.7000	BUTTERFLY	-48.543	-42.823	1.0000
INCIDENT	-38.494	-33.286	1.0000	CANDIDATE	-43.172	-35.873	1.0000
INDUSTRY	-41.983	-32.498	1.0000	CAUSALITY	-46.583	-40.116	
INSTANCE	-37.584	-31.030	0.9880	CHARLATAN	-43.507	-36.923	
INTEREST	-35.608	-28.628	1.0000	CHRISTMAS	-44.703	-41.019	1.0000
INTIMATE	-37.375	-29.751	1.0000	CLEANNESS	-42.188	-40.554	0.0000
ISLANDER	-38.694	-32.963		COMPORTER	-45.059	-41.610	0.0000
JEALOUSY	-46.527	-37.840	1.0000	COMMITTEE	-43.404	-40.906	0.8571
JEOPARDY	-47.088	-44.042	1.0000	COURTSHIP	-46.381	-43.371	1.0000
KEPCHIEF	-43.026	-39.511	1.0000	CRITERION	-41.986	-36.073	1.0000
KROSENE	-39.079	-33.516	1.0000	DALLIANCE	-44.251	-38.325	
KINDNESS	-41.551	-33.817	1.0000	DEDUCTION	-44.826	-38.099	0.2105
LECTURER	-39.478	-34.761	0.2609	DEMOCRACY	-47.690	-45.125	1.0000
LEGGINGS	-43.501	-39.999	1.0000	DIFFUSION	-47.231	-40.773	1.0000
LEMONADE	-39.009	-35.428	1.0000	DIRECTION	-42.680	-37.724	1.0000
MACARONI	-40.076	-37.119		DISCOVERY	-48.098	-36.933	0.9574
MAGAZINE	-46.138	-39.076	1.0000	DISPARITY	-46.225	-38.597	1.0000
MAJORITY	-46.278	-37.152	1.0000	DISTURBER	-45.603	-40.451	0.0370
MARRIAGE	-40.312	-37.730	0.8962	EMERGENCY	-46.201	-42.590	0.9286
MATERIAL	-38.621	-33.362	0.9613	EXCLUSION	-49.417	-42.517	1.0000
MISCHIEF	-41.610	-37.877	1.0000	FFSTIVITY	-46.743	-37.302	
MOISTURE	-39.587	-33.176	1.0000	FEUDALISM	-47.065	-49.566	1.0000
MOLFCULE	-41.644	-35.329	1.0000	FIREPLACE	-45.504	-39.484	1.0000
MOSQUITO	-46.095	-39.763	1.0000	FIRMAMENT	-45.162	-39.504	
MOUNTAIN	-39.923	-33.249	0.6471	FISHERMAN	-44.613	-34.644	0.4167
MUSICIAN	-41.614	-35.950	1.0000	FORMATION	-44.301	-34.797	1.0000
NAMPSAKE	-40.923	-38.561	1.0000	FRANCHISE	-44.288	-35.076	0.6250
NONSENSE	-36.232	-34.751	1.0000	FURNITURE	-45.384	-40.149	1.0000
OCCASION	-39.737	-36.475	1.0000	GENTLEMAN	-43.826	-39.345	0.5714
OFFSHOOT	-40.810	-43.547		GRATITUDE	-44.427	-39.760	1.0000
OUTSIDER	-38.999	-34.495	1.0000	HANKERING	-46.906	-34.252	
PACIFISH	-43.587	-40.504	0.6000	HAPPINESS	-45.009	-38.877	1.0000
PANORAMA	-40.577	-34.847	1.0000	HEADLIGHT	-44.886	-43.255	
PLEASURE	-40.225	-32.196	1.0000	HIERARCHY	-45.298	-40.959	1.0000
PORTRAIT	-38.830	-36.116	1.0000	HINDRANCE	-43.474	-35.109	
POSITION	-38.956	-33.355	1.0000	HONEYCOMB	-48.195	-48.673	
PPESSURE	-39.906	-31.040	1.0000	HORSEHAIR	-42.079	-45.201	1.0000
PPESTIGE	-39.677	-30.940	1.0000	HOSTILITY	-44.288	-38.388	1.0000
PRISONER	-39.063	-32.067	1.0000	HURRICANE	-44.185	-39.996	1.0000
PROPERTY	-42.477	-34.644	0.7393	IGNORANCE	-43.952	-38.793	1.0000
QUANTITY	-46.225	-34.345	1.0000	IMPOTENCY	-46.975	-41.169	0.3333
RAILROAD	-39.325	-45.271	1.0000	INCREMENT	-42.600	-36.106	0.0000
REACTION	-37.578	-33.415	1.0000	INEBRIETY	-44.225	-45.205	
REMINDER	-38.830	-33.316	0.2162	INFECTION	-43.192	-39.152	0.5333
RESEARCH	-38.036	-36.594	1.0000	INFIRMARY	-47.102	-40.787	1.0000
RETAILER	-36.701	-36.654	1.0000	INSOLENCE	-42.112	-36.538	0.8571
REVOLVER	-42.820	-38.069	0.7368	INSTITUTE	-41.285	-35.216	1.0000
RHAPSODY	-42.959	-47.607		INTELLECT	-42.132	-36.066	1.0000
SCORPION	-40.733	-37.348		INTERVIEW	-44.720	-41.873	1.0000
SEMESTER	-36.810	-32.193	1.0000	JOVIALITY	-52.244	-40.773	1.0000
SICKNESS	-41.919	-35.525	1.0000	KNOWLEDGE	-49.254	-48.513	1.0000
SOBRIETY	-41.006	-41.215	1.0000	LABYRINTH	-46.955	-41.328	1.0000
SOVERIGN	-41.800	-45.897		LANDSCAPE	-45.391	-40.361	1.0000
STEERAGE	-36.960	-34.322		LIMELIGHT	-45.952	-42.046	1.0000
STRENGTH	-38.813	-34.807	1.0000	LOQUACITY	-52.543	-47.404	1.0000
TEMERITY	-39.056	-33.668	1.0000	LUBRICANT	-46.995	-40.617	1.0000
TENDENCY	-39.853	-32.787	1.0000	MAGNITUDE	-46.092	-43.401	1.0000
TOMAHAWK	-44.391	-47.377		MEDALLION	-44.653	-35.325	
TRACTION	-38.006	-32.761	0.0000	NECESSITY	-43.215	-40.700	1.0000
TWEEZERS	-43.434	-41.594		NEWSPAPER	-45.882	-46.773	1.0000
TWILIGHT	-43.012	-34.521	1.0000	NIGHTFALL	-46.756	-50.274	1.0000
UMBRELLA	-43.647	-39.999	1.0000	NORTHWEST	-42.886	-43.032	1.0000
VELOCITY	-43.232	-38.215	1.0000	OBEDIENCE	-43.517	-38.634	1.0000
VOCATION	-40.903	-37.010	0.0265	OBSSESSION	-43.318	-41.750	1.0000
				ONSLAUGHT	-45.826	-45.580	1.0000
				ORCHESTRA	-42.454	-37.970	0.9836
				OWNERSHIP	-45.384	-45.022	1.0000
				PERFORMER	-45.550	-38.833	0.1667
				PHYSICIAN	-47.115	-44.796	1.0000
				POLICEMAN	-45.902	-36.535	0.5588
9 LETTER WORDS							
ABASEMENT	-43.285	-37.790	1.0000				
ABDUCTION	-46.799	-46.039	1.0000				
ACCORDION	-44.803	-38.172	1.0000				

WORD	FOA	SOA	ONR	WORD	FOA	SOA	ONR
POLLUTION	-45.975	-37.431	1.0000	UNDERWORLD	-51.364	-47.374	1.0000
PROFESSOR	-44.803	-37.621	0.9344	UNIVERSITY	-51.214	-42.703	1.0000
PROMOTION	-44.560	-36.282	1.0000	WHOLESALER	-48.341	-40.265	
RACKETEER	-43.949	-41.295	1.0000				
SENSATION	-40.528	-36.661	1.0000	11 LETTER WORDS			
SENTIMENT	-40.976	-35.229	1.0000	BEREAVEMENT	-52.905	-40.723	1.0000
SHEEPSKIN	-46.158	-43.883	1.0000	BLUNDERBUSS	-58.539	-46.723	
SITUATION	-42.208	-37.887	1.0000	CATERPILLAR	-53.324	-46.936	1.0000
SOCIALIST	-43.238	-40.547	0.5122	COBBLESTONE	-54.303	-46.387	1.0000
SPEAKEASY	-47.494	-42.607		COMPETITION	-52.546	-42.531	1.0000
STOREROOM	-42.318	-36.398	1.0000	COMRADESHIP	-54.915	-52.782	1.0000
TIMEPIECE	-43.328	-40.172	1.0000	CONNOISSEUR	-51.912	-54.692	1.0000
UNFEELITY	-44.883	-43.986	1.0000	COOPERATION	-51.423	-43.055	1.0000
VEGETABLE	-46.570	-42.570	1.0000	DESTRUCTION	-52.028	-46.527	1.0000
VESTIBULE	-47.112	-37.508	1.0000	DEVELOPMENT	-54.835	-48.945	1.0000
VIGILANCE	-47.407	-40.062	1.0000	DISPOSITION	-52.164	-45.746	1.0000
VIOLATION	-44.584	-37.916	1.0000	DISTINCTION	-51.144	-41.268	1.0000
WHALBONE	-45.384	-38.179		DISTRACTION	-51.214	-44.510	1.0000
WORKHOUSE	-48.527	-41.145		ELABORATION	-51.433	-45.421	1.0000
				EXAMINATION	-54.835	-46.939	1.0000
10 LETTER WORDS				EXPLANATION	-55.978	-44.099	1.0000
ABDICATION	-49.261	-46.165		FLEXIBILITY	-61.240	-52.347	1.0000
ABERRATION	-46.846	-39.714	1.0000	FORETHOUGHT	-54.217	-44.434	1.0000
AMBASSADOR	-50.297	-47.062	1.0000	FUNCTIONARY	-55.725	-45.836	1.0000
APPEARANCE	-48.680	-40.611	1.0000	GRANDMOTHER	-53.642	-44.713	1.0000
ATMOSPHERE	-47.640	-43.288	1.0000	IMPROPRIETY	-56.121	-48.703	1.0000
AUTOMOBILE	-50.208	-45.298	1.0000	INGRATITUDE	-52.553	-42.883	1.0000
BACKGROUND	-56.984	-45.378	1.0000	LEGISLATION	-52.041	-49.224	1.0000
BELONGINGS	-51.895	-38.896	1.0000	MATHEMATICS	-52.686	-41.810	1.0000
BLACKSMITH	-55.074	-44.889	1.0000	OPPORTUNITY	-56.230	-48.892	1.0000
CAMOUFLAG	-52.991	-47.872	1.0000	PREDICAMENT	-53.270	-41.667	1.0000
CENTENNIAL	-45.633	-45.291	1.0000	RECOGNITION	-51.772	-48.484	1.0000
COMBUSTION	-51.656	-38.727	1.0000	REPLACEMENT	-52.410	-46.603	1.0000
COMPARISON	-50.211	-38.933	1.0000	SUBTRACTION	-54.001	-51.108	1.0000
COMPETENCE	-48.563	-40.444	0.9474	SUPPRESSION	-54.523	-44.773	1.0000
CONFIDENCE	-48.939	-42.238	1.0000	THISTLEDOWN	-52.500	-44.986	
CONVENTION	-48.437	-37.903	0.7179	UNIFICATION	-53.360	-46.457	1.0000
DECORATION	-46.544	-38.408	1.0000	VACCINATION	-54.191	-48.407	1.0000
DETONATION	-44.813	-40.348	1.0000	WISDFULNESS	-54.862	-56.606	
DISCIPLINE	-49.683	-44.109	1.0000				
DISCLOSURE	-49.606	-44.647	1.0000	12 LETTER WORDS			
DISCRETION	-46.872	-43.285	1.0000	CONTRIBUTION	-58.011	-47.437	1.0000
ENCEPHALON	-48.188	-44.248		ECCENTRICITY	-57.333	-53.526	1.0000
ENGAGEMENT	-48.214	-43.122	1.0000	EMANCIPATION	-56.765	-50.586	1.0000
ENTERPRISE	-45.328	-42.112	1.0000	EMBEZZLEMENT	-68.870	-60.097	1.0000
EVANGELIST	-49.301	-41.534	0.1000	HEADQUARTERS	-60.957	-52.447	1.0000
EYACTITUDE	-51.842	-46.803		REFRIGERATOR	-56.051	-49.753	1.0000
EXHAUSTION	-51.443	-46.746	1.0000	SUPPLICATION	-60.356	-47.327	
EXPRESSION	-51.423	-40.753	1.0000				
GRADUATION	-49.437	-44.291	1.0000	13 LETTER WORDS			
GUARDHOUSE	-51.181	-51.835	1.0000	DETERMINATION	-57.984	-51.546	1.0000
GYMNASTICS	-52.134	-57.436	1.0000	DISCONNECTION	-59.991	-54.705	
HABITATION	-47.278	-41.102		EXTERNINATION	-62.183	-52.845	1.0000
HYPOTHESIS	-49.527	-42.760	0.8182	INVESTIGATION	-61.004	-49.656	1.0000
INCLEMENCY	-50.895	-43.052		MISCONCEPTION	-62.359	-54.240	1.0000
INDUCEMENT	-48.786	-39.674	1.0000				
INHABITANT	-47.374	-45.999		14 LETTER WORDS			
INSTRUCTOR	-48.058	-42.521	1.0000	MULTIPLICATION	-68.485	-57.928	1.0000
INSTRUMENT	-47.474	-41.826	1.0000				
LETTERHEAD	-44.863	-47.719	1.0000				
MANAGEMENT	-48.424	-41.537	1.0000				
METROPOLIS	-48.832	-43.109	1.0000				
MICROSCOPE	-50.726	-45.188	0.6667				
ORIGINATOR	-47.367	-40.142					
OSCULATION	-48.573	-42.896					
PASSAGWAY	-52.546	-46.597	1.0000				
PEACEMAKER	-51.307	-42.557					
PERCEPTION	-48.673	-44.241	1.0000				
PERIODICAL	-49.550	-41.378	1.0000				
PERMISSION	-48.577	-40.863	1.0000				
PHOTOGRAPH	-51.709	-51.623	0.8571				
PROCESSION	-48.201	-41.723	0.1190				
PROFESSION	-48.646	-39.936	0.8810				
PROPRIETOR	-48.626	-43.188	0.8162				
PROSECUTOR	-49.361	-43.165	1.0000				
PROSPERITY	-50.709	-41.846	1.0000				
REFLECTION	-47.504	-44.494	0.9412				
RENDEZVOUS	-55.815	-51.832	1.0000				
RESTAURANT	-45.892	-41.464	1.0000				
RHEUMATISM	-49.603	-53.021	1.0000				
SALUTATION	-46.962	-41.846	1.0000				
SETTLEMENT	-44.710	-46.507	1.0000				
STAGECOACH	-49.035	-47.112	1.0000				
STRAWBERRY	-51.530	-51.879					
SUBSTITUTE	-49.155	-44.716	1.0000				
TABLESPOON	-49.258	-42.514	1.0000				
THEOLOGIAN	-47.447	-44.733	1.0000				
UNBELIEVER	-50.859	-48.969					

(1968) nouns. Blanks are listed for the orthographic neighbor ratio when the word and its neighbors have frequencies of zero in Kučera and Francis (1967). The variables listed are of most use when word length is held constant, so the 925 nouns are grouped by length.

Table 2 shows correlations among these variables and the length in letters, imagery, concreteness, and meaningfulness from Paivio et al. (1968), familiarity from Paivio (Note 1), the \log_{10} of the Kučera and Francis (1967) frequency, and the percentage of subjects recalling each word as measured by Christian et al. (1978). Kučera and Francis frequency values of zero were replaced by .5 before taking the logarithm. Correlations for a subset of 125 of these words with a larger set of variables is available in Rubin (1980). Significance figures are not

Table 2
Correlations Among Variables

	L	FOA	SOA	ONR	I	C	M	F	LGFK
L									
FOA	-.970								
SOA	-.917	.935							
ONR	.579	-.578	-.567						
I	-.347	.325	.280	-.222					
C	-.296	.286	.236	-.254	.831				
M	-.327	.318	.293	-.163	.724	.559			
F	-.270	.285	.309	-.024	.337	.105	.483		
LGFK	-.272	.297	.345	.111	.088	-.061	.277	.755	
FRC	-.267	.251	.230	-.206	.444	.396	.311	.128	.088

Note—The correlation of FRC and ONR has an *n* of 825. Other correlations involving FRC and ONR have *n*s of 899 and 851, respectively. All other correlations have an *n* of 925. FOA = first-order approximation to English; SOA = second-order approximation to English; ONR = orthographic neighbor ratio; L = length of letters; I = imagery; C = concreteness; M = meaningfulness; F = familiarity; LGFK = \log_{10} of Kučera-Francis (1967) frequency; FRC = percentage of subjects recalling each word (Christian et al., 1978).

given because the 925 observations are not independent. If the observations were independent, however, the .001 level for the 925 observations would be .11, so that any correlation explaining more than 1% of the variance would be highly significant in the statistical sense.

The correlations for the orthographic neighbor ratio are misleading. As words get longer, they have fewer orthographic neighbors. This effect is large enough to mask any effects of the orthographic neighbor ratio itself. Similarly, the effect of length can mask any value that first- and second-order approximations might have beyond length. For this reason, correlations of first- and second-order approximations and orthographic

neighbor ratios with the other variables are calculated for words of given length in letters and are presented in Table 3. Lengths of four to nine letters are used, because each of these lengths contains at least 100 words. Means, standard deviations, and ranges for first- and second-order approximations and orthographic neighbor ratios are given in Table 4. With length constant, first- and second-order approximations correlate moderately, as do orthographic neighbor ratios and the frequency variables. Other correlations are small, indicating that first- and second-order approximations and orthographic neighbor ratios provide relatively independent measures when length is held constant.

Table 3
Correlations for Words of a Given Length

Length	N	Variables								
		FOA	SOA	ONR	I	C	M	F	LGFK	FRC
First-Order Approximation to English										
4	110		.406	-.107	-.210	-.149	-.108	-.008	-.055	-.207
5	128		.455	-.034	.062	.042	.198	.131	.165	-.020
6	167		.569	-.190	.085	.069	.142	.110	.131	.044
7	146		.348	-.072	-.040	.038	-.042	.060	.081	.047
8	120		.559	-.123	-.192	-.100	-.003	.078	.249	-.010
9	113		.426	-.103	-.067	-.016	-.113	.218	.215	-.112
Second-Order Approximation to English										
4	110	.406		-.134	-.193	-.230	-.101	.035	.188	-.012
5	128	.455		-.159	-.002	-.043	.120	.169	.193	.004
6	167	.569		-.121	.027	-.005	.142	.220	.196	.105
7	146	.348		-.036	-.175	-.159	-.122	.151	.371	-.068
8	120	.559		-.109	-.215	-.211	-.069	.281	.419	-.152
9	113	.426		-.139	-.040	.044	-.054	.002	.053	-.077
Orthographic Neighbor Ratio										
4	110	-.107	-.134		-.095	-.153	-.040	.447	.552	.127
5	127	-.034	-.159		-.116	-.159	-.002	.198	.410	-.011
6	157	-.190	-.121		-.058	-.163	-.002	.133	.324	.028
7	135	-.072	-.036		-.005	-.017	.008	.066	.255	.017
8	101	-.123	-.109		.108	-.015	.035	.091	.236	.073
9	97	-.103	-.139		.062	-.046	.112	.120	.282	.042

Note—The value for *n* for correlations of FOA and SOA with ONR should be read from the ONR section. The value for *n* for correlations with FRC is slightly less than listed, because only 899 of the 925 nouns have values on this variable.

Table 4
Mean, Standard Deviation, and Range of Variables

L	Mean	SD	Minimum	Maximum
First-Order Approximations to English				
4	-23.748	1.842	-30.558	-19.586
5	-28.061	2.007	-34.525	-24.297
6	-32.135	2.443	-39.086	-17.603
7	-36.777	2.239	-44.537	-32.362
8	-40.919	2.597	-48.646	-35.608
9	-45.171	2.199	-52.543	-40.411
All	-36.220	9.411	-68.870	-16.430
Second-Order Approximation to English				
4	-21.276	2.495	-26.805	-15.792
5	-24.851	2.812	-33.435	-19.174
6	-28.831	3.718	-42.517	-14.394
7	-32.960	3.552	-44.507	-25.878
8	-36.484	4.056	-48.281	-28.628
9	-40.063	3.442	-50.274	-33.621
All	-32.263	8.616	-60.097	-14.394
Orthographic Neighbor Ratio				
4	.2251	.2854	.0000	1.0000
5	.5241	.3623	.0000	1.0000
6	.7670	.3382	.0000	1.0000
7	.8404	.3048	.0000	1.0000
8	.8906	.2568	.0000	1.0000
9	.8872	.2686	.0000	1.0000
All	.7053	.3861	.0000	1.0000

Note—L = length.

REFERENCE NOTES

1. Paivio, A. *Imagery ratings and other norms for 2,448 words*. Unpublished manuscript, University of Western Ontario.
2. Olivier, D. *Tables of ngrams*. Unpublished manuscript, Harvard University.

REFERENCES

- CHRISTIAN, J., BICKLEY, W., TARKA, M., & CLAYTON, K. Measures of free recall of 900 English nouns: Correlations with imagery, concreteness, meaningfulness, and frequency. *Memory & Cognition*, 1978, 6, 379-390.
- ENGEL, G. R. On the functional relationship between word identification and letter probability. *Canadian Journal of Psychology*, 1974, 28, 300-309.
- KUČERA, H., & FRANCIS, W. H. *Computational analysis of present-day American English*. Providence, R.I.: Brown University Press, 1967.
- LANDAUER, T. K., & STREETER, L. A. Structural differences between common and rare words: Failure of equivalence assumptions for theories of word recognition. *Journal of Verbal Learning and Verbal Behavior*, 1973, 12, 119-131.
- MANELIS, L. The effects of meaningfulness in tachistoscopic word perception. *Perception & Psychophysics*, 1974, 16, 182-192.
- MASSARO, D. W., VENEZKY, R. L., & TAYLOR, G. A. Orthographic regularity, positional frequency, and visual processing of letter strings. *Journal of Experimental Psychology: General*, 1979, 108, 107-124.
- MILLER, G. A., BRUNER, J. S., & POSTMAN, L. Familiarity of letter sequences and tachistoscopic identification. *Journal of General Psychology*, 1954, 50, 129-139.
- MILLER, G. A., NEWMAN, E. B., & FRIEDMAN, E. A. Length-frequency statistics for written English. *Information and Control*, 1958, 1, 370-389.
- MILLER, G. A., & SELFRIDGE, J. A. Verbal context and the recall of meaningful material. *American Journal of Psychology*, 1950, 63, 176-185.
- PAIVIO, A., YUILLE, J. C., & MADIGAN, S. A. Concreteness, imagery, and meaningfulness values for 925 nouns. *Journal of Experimental Psychology Monograph Supplement*, 1968, 76(1, Pt. 2).
- RICE, G. A., & ROBINSON, D. O. The role of bigram frequency in the perception of words and nonwords. *Memory & Cognition*, 1975, 3, 513-518.
- RICHARDS, L. G., & HELLER, F. P. Recognition thresholds as a function of word length. *American Journal of Psychology*, 1976, 89, 455-466.
- RUBIN, D. C. 51 properties of 125 words: A unit analysis of verbal behavior. *Journal of Verbal Learning and Verbal Behavior*, 1980, 19, 736-755.
- Social Science Citation Index (Pt. 2), Citation Index, 1976 to 1980 Annuals*. Philadelphia: Institute for Scientific Information, 1977-1981.
- SPREEN, O., & SCHULZ, R. W. Parameters of abstraction, meaningfulness, and pronunciability for 329 nouns. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 459-468.
- TRAVERS, J. R., & OLIVIER, D. C. Pronounceability and statistical "Englishness" as determinants of letter identification. *American Journal of Psychology*, 1978, 91, 523-538.

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