A compilation of 800 word neighborhoods by frequency

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A number of inconsistencies are evident in the literature examining word-neighborhood size and frequency effects. One reason for the inconsistency may be that there are no standardized materials and criteria used in the different studies. Each experimenter has devised his or her word neighborhoods using different criteria for neighborhood size and frequency. The purpose of the present study was to develop a standardized set of word neighborhoods. Eight hundred orthographic neighborhoods were constructed with 4- and 5-letter words. The word lists were devised relative to the key elements that have been identified in the literature: (1) target-word frequency, (2) number of words in the neighborhood, (3) number of words higher in frequency than the target word, (4) number of letter positions contributing to the neighborhood, and (5) summation of the frequency of all neighbors (providing a standard metric for high- vs. low-frequency neighborhoods).

The average adult reader of English has at least 50,000 words in his or her vocabulary (Monsell, Doyle, & Haggard, 1989). These 50,000 words are constructed from the set of 26 letters in the alphabet. Furthermore, all of the 26 letters are constructed from a small set of features (Andrews, 1992; Gibson, 1969). Logically, many words must share features and letters with other words. Yet, amazingly, the reader selects the correct word (i.e., lexical entry) from the many possible candidates in memory.

Selection of the correct lexical entry from all other possible candidates is one of the most fundamental issues in models of word recognition. The selection process provides an insight into how lexical memory (i.e., the lexicon) is structured and organized. All models or theories of the recognition process speculate on the way that the lexicon is organized (typically, by visual or phonological features) and, in turn, suggest a method of finding a specific item that has been "filed" in the lexicon. Such theoretical frameworks provide hypothetical points in the selection process that may be tested experimentally. For example, if the mental lexicon is organized by the visual or phonological features of the lexical entries, then an experimenter should be able to influence a subject's response to a stimulus word that has features similar to those of many lexical entries in memory.

This logic was applied in an experiment by Coltheart, Davelaar, Jonasson, and Besner (1977, Experiment 2). Coltheart et al. controlled the similarity of the features of a series of word and nonword stimuli that varied by what they

called "N," or "orthographic neighborhood" size. "N" was defined as the number of English words that could be produced by replacing one letter while preserving letter position for all other letters. The final stimulus list consisted of words and nonwords with either a high or a low value of N.

Coltheart et al. (1977) used a lexical decision task (LDT); in this task, the subject is required to decide if a stimulus item, shown on a computer screen, is a word or a nonword. The authors found an effect of N only for nonword trials; that is, having many similar (word) neighbors considerably slowed the "nonword" response. There was no effect for words, which led Coltheart et al. to conclude that the number of items physically similar to a given word is not related to the response time (RT) to recognize it as a word.

However, new evidence suggests that other properties of a neighborhood do affect visual word recognition, and recent work has found that the effect of the size of a word's neighborhood on RT is not quite as clear as it initially appeared in Coltheart et al.'s (1977) study.¹ A number of experiments (e.g., Stadlander, 1990, 1995) have supported Coltheart et al.'s finding that there is no effect of neighborhood size. However, others (Andrews, 1989, Experiments 1 and 2; Forster & Shen, 1996; Sears, Hino, & Lupker, 1995) have reported a significant difference for word stimuli, with large neighborhoods showing a faster RT than small neighborhoods.

Results such as those of Andrews (1989), Forster and Shen (1996), and Sears et al. (1995) suggest that the process of recognizing a word and making a lexical decision may be affected by specific attributes of the target word and/or the word's neighbors. Researchers have examined a number of possible attributes in a neighborhood context, including frequency of the target word, frequency of neighbors of the target word, and number of letter positions contributing to the neighborhood.

Since the first use of the LDT, RT has been shown to be a sensitive measure of frequency (Forster & Chambers,

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1973; Rubenstein, Garfield, & Millikan, 1970; Taft, 1979; Whaley, 1978). Thus, common words (i.e., ones of high-frequency in a language), such as *door*, are responded to more quickly in the LDT than are uncommon words (i.e., ones of low frequency in a language), such as *cask*. Virtually all research on neighborhood effects in which the target word's frequency has varied within the experiment report a target-word frequency effect. High-frequency target words are responded to faster than low-frequency words.

The evidence is conflicting on whether the frequency of the target word's neighbors affects RT. Grainger (1990), using large neighborhoods with low- and medium-frequency target words in a LDT, developed four classes of words: (1) words with zero neighbors, (2) words with neighbors of only lower frequencies, (3) words with one neighbor of higher frequency, and (4) words with more than one neighbor of higher frequency. Grainger found that when the target had one or more neighbors of higher frequency, RT was slowed. A similar finding for low-frequency target words was reported by Stadtlander (1990). However, Forster and Shen (1996) found no consistent inhibitory effect of high-frequency neighbors, and, to complicate the issue further, Sears et al. (1995) found high-frequency neighbors to facilitate processing of the target words.

Johnson and Pugh (1994) have recently reported that the number of letter positions contributing to the neighborhood (or word cohort) also has an effect. The authors report that as the number of letter positions yielding neighbors increases, an increase in interference is evident. It is Johnson and Pugh's opinion that it is not the size of a word's neighborhood that is the critical factor, but rather the number of letter positions contributing to the neighborhood.

Why are such inconsistencies present across experiments? One obvious reason is that thus far there has been no recognized standard of measuring neighborhoods used in these different studies. Each experimenter has devised his or her own word neighborhoods, using a variety of databases and criteria for neighborhood size and frequency.

The development of stimulus lists in this area has tended to be a laborious and complex process. The typical procedure has involved selecting a large number of words on the basis of their frequency (e.g., Forster & Shen, 1996), compiling their neighborhoods, and selecting the final list on the basis of their target frequency and neighborhood size (e.g., Andrews, 1992). Other characteristics of the neighborhood (such as letter position, number of high-frequency neighbors, total neighborhood frequency), if not of specific interest in the study, tend to be ignored because of the complexity involved in compiling a balanced stimulus list. The purpose of the present study was to develop a large set of word neighborhoods which would specify the size, frequency, and number of positions contributing to the neighborhoods.

An additional area of concern is that researchers have varied, for no obvious reason, in using either 4- or 5-letter stimuli. Those using 5-letter target words have tended to report an inhibitory effect of neighborhood frequency (e.g.,

Grainger, O'Regan, Jacobs, & Segui, 1989; Stadtlander, 1990; though see Sears et al., 1995, for a contrary finding). In contrast, those using 4-letter stimuli have indicated no inhibitory effect (Sears et al., 1995). Therefore, words of both 4 and 5 letters are included in the present study.

METHOD OF COMPILATION OF WORD NEIGHBORHOODS

In the present study, Coltheart et al.'s (1977) "N" definition is utilized. Thus, an orthographic neighborhood is defined as the number of English words produced by replacing one letter while preserving letter positions for all other letters. This definition of a neighborhood should be considered a rough metric of orthographic similarity and not necessarily a realistic portrayal of lexical processing.

All of the target words came from the stimulus lists of Andrews (1989, 1992), Coltheart et al. (1977), Johnson and Pugh (1994), Sears et al. (1995), and Stadtlander (1990, 1995). All of the 800 words contained 4 or 5 letters. The word lists were devised relative to the key elements that have been identified in the above literature: (1) target-word frequency (based upon Kučera and Francis, 1967), (2) number of words in the neighborhood, (3) number of words higher in frequency than the target word (per Grainger, 1990, and Grainger et al., 1989), (4) number of letter positions contributing to the neighborhood (per Johnson & Pugh, 1994), and (5) summation of the frequency of all neighbors (providing a standard metric for high- vs. low-frequency neighborhoods). In the present compilation, an effort was made to be impartial in selecting words for neighborhoods by selecting all words found in the relevant databases. Thus, included in neighborhoods are personal names (e.g., *Mark*, *Mary*). Note that many of these names have high Kučera and Francis (1967) frequency counts (e.g., *Mary* has a frequency of 88 per million); the author leaves it to individual researchers to choose whether to include such items in the neighborhood counts.

The neighborhoods were constructed primarily through the use of the WordPerfect (Version 5.0) and Word for Windows (Version 2.0) spell checkers. Documentation for WordPerfect 5.0 reports that it contains 115,000 words in its lexicon. The technical support for Word for Windows reports that its lexicon contains 104,000 words from the Standard English Dictionary. Counts of 4- and 5-letter words contained in these packages are not available. In these word-processing packages, a "wild card" character can be used to replace a letter in a word. The spell-check program then lists all words from its word lexicon whose letters are positionally consistent within the word. The total number of consistent words across all positions constitutes the neighborhood for a particular word, as defined in this study. For example, the target word *blank* would generate a neighborhood consisting of *clank*, *flank*, *plank*, *blink*, *black*, and *bland*.

Additionally, for each neighborhood, a summary neighborhood metric was devised with the format [A-B-C-D], whereby A = number of neighbors present in the neighbor-

Table 1
Summary of Neighborhood Metrics for 4-Letter Words

Target Frequency	Mean No. of Neighbors	Mean No. of Higher Frequency Neighbors	Mean No. of Positions Used	Mean Neighborhood Frequency	<i>n</i>
1,000+	6.16	0.16	2.16	1,877	6
500-999	11.00	0.66	2.93	2,072	15
300-499	6.61	0.33	2.22	1,112	18
200-299	9.00	0.39	2.73	766	23
100-199	9.24	1.08	2.64	720	50
50-99	9.32	1.68	2.92	665	25
20-49	8.56	1.94	2.67	420	48
10-19	8.16	2.89	2.48	492	69
5-9	7.32	3.12	2.36	434	50
1-4	7.29	4.11	2.36	366	46
0	3.60	2.05	1.18	183	21
Overall Mean	7.84	1.67	2.42	827	<i>N</i> = 371

hood (excluding the target word), B = number of neighbors higher in frequency than the target word, C = number of letter positions contributing neighbors to the neighborhood, and D = summed frequency of the neighborhood (including the target word). As an example, the target word *blank* leads to the generation of 6 neighbors (*A* = 6). *Blank*, with a Kučera and Francis (1967) frequency of 14 per million, has one neighbor higher in frequency (*black*, with a frequency of 203), thus *B* = 1. Four letter positions contributed to constructing the neighborhood, thus *C* = 4. For the final portion of the metric, all of the frequencies are summed, *D* = 233. The entry for this orthographic neighborhood in the present compilation would be:

blank (14) [6-1-4-233]

- a. flank (2)
- b. clank (4)
- c. blink (4)
- d. black (203)
- e. plank (7)
- f. bland (3)

RESULTS AND DISCUSSION

Tables 1 and 2 summarize the neighborhood metrics for the 4- and 5-letter words. Appendix A lists the 4-letter target words in alphabetical order, with their frequency per

million in parentheses and their summary metric in brackets. Appendix B lists the 5-letter words in alphabetical order. A copy of the detailed computerized listing of all word neighborhoods is available on disk from the author.

Differences are evident between 4- and 5-letter word stimuli, with 4-letter target words having a slightly higher mean frequency ($M = 107.29$) than 5-letter target words ($M = 92.96$). Additionally, as shown in Tables 1 and 2, 4-letter words have a higher mean number of neighbors ($M = 7.84$) than do 5-letter words ($M = 4.57$).

The neighborhood metrics generated in the present study suggest that the contrary findings reported in the literature may be due, at least in part, to differences in the frequency of the overall neighborhoods for 4- and 5-letter words. Shown in Table 3 are comparisons of overall neighborhood frequency and number of neighbors for 4- and 5-letter stimuli. The table shows quite clearly that, for the samples in the present study (taken from studies in this area), the 4-letter words tend to have much higher total neighborhood frequency for the larger neighborhoods (i.e., larger neighborhood = more neighbors). Consequently, in a given experiment using 4-letter words, neighborhood size would tend to be confounded with neighborhood frequency: "large neighborhoods" would tend to have high neighborhood frequency, while "small neighborhoods" would tend to have low neighborhood frequency. On the

Table 2
Summary of Neighborhood Metrics for 5-Letter Words

Target Frequency	Mean No. of Neighbors	Mean No. of Higher Frequency Neighbors	Mean No. of Positions Used	Mean Neighborhood Frequency	<i>n</i>
1,000+	1.60	0.20	1.20	2,512	5
500-999	3.50	0.25	1.63	1,322	8
300-499	5.11	0.38	1.78	742	18
200-299	3.56	0.08	1.91	346	23
100-199	5.72	0.29	2.47	296	51
50-99	5.13	0.82	2.15	254	39
20-49	4.46	0.82	1.84	194	45
10-19	4.95	2.58	2.06	159	62
5-9	4.62	1.38	2.18	89	91
1-4	4.96	2.79	2.24	181	77
0	6.73	4.46	3.06	245	15
Overall Mean	4.57	1.27	2.05	576	<i>N</i> = 434

Table 3
4- and 5-Letter Words by Number of Neighbors
and Total Neighborhood Frequency

Number of Neighbors	4-Letter Words	5-Letter Words
15-28	1,577	358
10-14	855	287
7-9	328	214
6	369	190
5	654	222
4	266	122
3	486	264
2	189	231
1	198	269
0	74	45

other hand, an experiment with 5-letter words would tend to have similar total neighborhood frequency for both the large and small neighborhoods. Thus far, only three experimenters have controlled neighborhood size and frequency in the same experiment (Forster & Shen, 1996; Sears et al., 1995; Stadtländer, 1990). However, no resolution can be drawn from these studies on the issue of 4- versus 5-letter words and neighborhood size and frequency. Forster and Shen (1996) and Sears et al. (1995) used only low-frequency target words; Stadtländer (1990) used both low- and high-frequency target words, but only for 5-letter words. It remains to be seen whether this confound of neighborhood size and neighborhood frequency, which is present for 4-letter words but not for 5-letter words, contributes to the discrepant findings reported in the literature.

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NOTE

1. Neighborhood effects have also been reported in studies of accuracy of identification of masked words (Luce, 1986), children's naming (Laxon, Coltheart, & Keating, 1988), and naming latency for German words (Gunther & Greese, 1985; Scheerer, 1987).

APPENDIX A

4-Letter Target Words

Kučera and Francis (1967) frequency per million in parentheses. Neighborhood metric [A–B–C–D], whereby A = number of neighbors present in the neighborhood (excluding the target word), B = number of neighbors higher in frequency than the target word, C = number of letter positions contributing neighbors to the neighborhood, and D = summed frequency of the neighborhood (including the target word).

able (216) [2-0-2-223]	coin (10) [8-3-4-145]	fuel (17) [4-2-3-468]
acid (13) [4-1-2-30]	cold (171) [12-1-3-951]	full (230) [14-0-3-642]
acre (9) [3-0-1-13]	colt (18) [13-3-4-487]	fury (19) [4-1-2-97]
adds (10) [3-2-2-51]	come (630) [17-1-4-3621]	fuse (19) [4-0-2-29]
also (1069) [2-0-1-1073]	core (37) [26-5-4-3353]	gaff (0) [0-0-0-0]
anew (6) [1-1-1-401]	corn (34) [14-2-3-301]	gala (7) [3-0-2-9]
area (323) [2-0-2-324]	cove (2) [15-11-2-1168]	game (123) [14-4-2-2098]
army (132) [2-0-1-254]	cult (11) [4-2-3-61]	gang (22) [9-2-2-109]
aunt (22) [4-0-1-36]	curb (13) [4-1-1-49]	gash (1) [12-7-3-104]
away (456) [2-0-2-463]	cuspid (2) [1-0-1-2]	gasp (3) [5-0-2-8]
bank (83) [17-1-4-1223]	cute (9) [7-2-4-73]	gene (9) [2-1-2-204]
bard (3) [16-12-3-516]	dame (7) [19-11-4-1994]	germ (0) [2-1-1-79]
bark (14) [12-6-3-1466]	dare (21) [19-6-4-617]	gill (2) [17-13-4-2908]
barn (29) [11-2-3-284]	dark (185) [10-0-3-406]	girl (220) [2-0-2-223]
bash (0) [15-14-3-241]	data (173) [3-0-2-279]	glib (1) [1-0-1-1]
bass (16) [15-5-4-389]	days (384) [15-0-2-770]	glow (16) [7-4-2-251]
bats (6) [20-9-3-182]	deaf (12) [5-4-2-434]	golf (34) [4-1-4-114]
bear (57) [21-5-4-1517]	deal (142) [17-2-4-755]	gown (16) [6-2-1-1126]
beta (2) [4-2-2-10]	dear (64) [17-6-3-1776]	grew (64) [5-0-3-261]
bill (143) [18-1-3-2811]	debt (13) [2-0-1-17]	grey (12) [5-2-3-137]
bite (10) [12-2-3-110]	deed (8) [14-6-3-829]	grim (14) [8-2-2-83]
blue (143) [5-0-2-169]	deep (109) [9-1-2-433]	gulp (2) [3-2-2-30]
boat (72) [10-0-4-220]	deny (47) [4-0-2-57]	gyms (0) [3-2-1-6]
body (276) [4-0-2-286]	desk (65) [3-0-2-122]	gyro (26) [0-0-0-26]
bold (21) [13-6-4-1044]	dine (2) [22-12-4-1060]	hair (148) [4-0-2-285]
bomb (36) [4-0-2-48]	disc (6) [2-2-1-47]	half (275) [5-0-2-452]
boot (13) [18-4-4-387]	doff (0) [0-0-0-0]	halt (10) [10-3-4-244]
born (113) [10-0-4-297]	dome (17) [15-5-2-3230]	hand (431) [8-0-3-981]
both (730) [3-0-2-762]	done (320) [20-0-4-808]	hang (26) [12-3-3-634]
brag (2) [8-1-3-21]	down (895) [6-0-3-1152]	hawk (14) [5-1-3-37]
buck (20) [10-2-3-1089]	dual (9) [4-2-2-184]	heap (14) [8-4-3-1018]
buff (5) [6-1-1-18]	dumb (13) [2-0-2-21]	high (497) [3-0-2-518]
bulb (7) [2-2-1-37]	easy (125) [2-1-1-350]	hill (72) [16-3-3-2929]
bulk (16) [7-2-4-77]	echo (10) [0-0-0-10]	hint (9) [8-2-4-53]
bump (5) [9-4-3-57]	envy (7) [0-0-0-7]	hire (15) [11-5-3-1051]
bunk (18) [16-2-3-170]	epic (18) [1-0-1-21]	hobo (1) [3-0-3-3]
buoy (0) [2-2-1-64]	ever (345) [4-2-3-2752]	hold (169) [12-2-4-1134]
busy (58) [5-0-2-86]	fact (447) [5-0-2-907]	holy (49) [2-2-1-276]
buzz (13) [1-0-1-16]	fair (77) [5-2-2-362]	home (547) [10-2-2-3128]
cage (9) [13-10-2-1373]	farm (125) [5-0-3-335]	hook (5) [13-6-3-1089]
calf (11) [3-3-2-509]	fear (127) [11-3-2-1359]	hoot (9) [13-4-3-183]
call (188) [13-0-3-967]	fend (0) [14-11-4-758]	horn (31) [6-2-1-226]
came (622) [19-2-4-2963]	feud (1) [2-1-1-128]	hour (144) [5-2-1-1464]
cape (20) [18-5-4-1296]	film (96) [3-1-2-336]	huge (54) [2-0-1-63]
care (162) [24-2-4-1647]	firm (109) [6-2-4-530]	hull (13) [15-7-4-675]
cart (5) [14-10-3-957]	fish (35) [3-1-2-187]	hymn (9) [0-0-0-9]
case (362) [13-1-3-1397]	fizz (0) [1-1-1-3]	idea (195) [1-0-1-195]
cave (9) [17-12-3-5598]	flag (16) [7-1-3-87]	idol (7) [0-0-0-7]
cell (65) [13-5-3-1658]	flax (3) [8-3-1-121]	itch (5) [2-1-2-45]
cent (158) [11-1-3-903]	flea (2) [5-3-2-71]	jinx (1) [2-0-2-1]
chef (9) [2-0-2-11]	flew (27) [9-2-3-142]	jury (67) [4-0-2-165]
chug (0) [2-2-2-2]	flux (30) [4-0-2-32]	kept (186) [1-0-1-195]
chum (1) [1-0-1-1]	foal (2) [7-6-3-193]	kick (16) [10-4-2-176]
city (0) [2-2-2-15]	foil (20) [11-3-3-174]	knee (35) [1-1-1-430]
clay (100) [9-0-4-112]	folk (34) [3-0-3-56]	knew (395) [3-1-3-1119]
club (145) [2-0-2-160]	food (147) [10-1-3-984]	knit (10) [3-1-2-121]
clue (15) [5-2-2-311]	form (370) [11-0-4-755]	know (683) [4-0-3-1147]
coax (1) [3-2-2-76]	free (260) [4-0-3-348]	lamb (7) [5-0-3-32]

APPENDIX A (Continued)

lamp (18) [9-1-3-139]	once (499) [0-0-0-499]	sigh (11) [3-1-2-106]
lard (2) [10-8-3-644]	only (1747) [1-0-1-1757]	sign (94) [1-0-1-105]
lark (2) [10-7-4-496]	open (319) [3-0-1-338]	sink (23) [14-2-4-251]
lash (6) [13-4-3-581]	over (1236) [3-0-2-1588]	sire (0) [17-13-4-1131]
late (179) [19-1-2-739]	pant (0) [10-7-4-806]	size (138) [4-1-1-586]
lazy (9) [4-1-3-99]	park (94) [11-2-4-919]	skin (47) [8-0-2-74]
lead (129) [13-3-4-994]	part (500) [16-0-4-946]	slab (9) [11-0-3-24]
lean (20) [12-5-3-472]	past (281) [12-2-4-2007]	slim (20) [9-1-4-96]
legs (67) [12-1-3-638]	path (44) [8-0-3-85]	slow (60) [14-2-3-546]
lend (14) [13-5-3-524]	peak (16) [11-2-3-87]	slum (8) [10-2-4-45]
levy (7) [2-0-2-10]	peer (8) [12-2-3-70]	snag (3) [6-2-3-26]
lewd (3) [2-2-1-146]	pelt (0) [10-5-2-396]	snob (9) [5-1-4-80]
lift (23) [10-4-4-1393]	pica (0) [3-2-3-56]	soak (7) [3-1-2-33]
like (1290) [14-0-3-2688]	pill (15) [16-8-3-2757]	soft (61) [6-1-4-234]
limb (5) [4-3-2-37]	pink (48) [13-1-3-195]	soon (199) [8-0-3-293]
line (298) [20-2-4-2950]	pint (13) [13-2-4-104]	sort (164) [7-0-3-312]
list (133) [12-2-4-1063]	pity (14) [4-1-3-410]	soup (16) [4-2-2-92]
loft (2) [7-5-3-742]	pixy (0) [1-1-1-14]	span (19) [11-0-3-62]
look (399) [12-1-3-1125]	plan (205) [5-0-2-412]	spat (9) [11-4-3-152]
loom (6) [9-4-3-825]	plot (37) [8-0-3-65]	spit (11) [7-2-3-137]
loon (2) [14-11-3-787]	poem (48) [1-1-1-147]	stem (29) [4-3-3-448]
loot (3) [15-8-3-633]	pole (18) [18-5-4-356]	stir (7) [1-1-1-32]
loss (86) [15-2-4-810]	pond (25) [4-1-2-148]	stop (120) [5-1-4-322]
love (232) [16-0-3-669]	pool (111) [7-1-3-380]	stow (0) [6-5-3-531]
lump (7) [9-4-2-85]	poor (113) [7-1-3-554]	such (1303) [3-0-2-2248]
lung (16) [5-3-2-289]	pose (11) [13-6-3-391]	suck (8) [14-5-3-1458]
lust (5) [12-9-3-2999]	pulp (5) [4-2-3-69]	sung (18) [11-3-3-214]
magi (1) [3-0-1-2]	pump (11) [11-1-3-64]	sunk (9) [15-4-4-115]
mail (47) [18-1-3-340]	quit (15) [4-0-2-25]	sure (264) [6-0-3-366]
main (119) [9-3-2-465]	race (103) [13-1-3-299]	swam (1) [12-5-3-31]
make (974) [21-1-3-3078]	raft (4) [6-0-3-10]	take (611) [13-1-3-1601]
mane (0) [21-16-3-3180]	rage (16) [13-6-3-743]	talk (154) [8-0-3-406]
mare (16) [28-13-4-4729]	rake (11) [16-20-2-1913]	tang (4) [11-7-3-134]
mask (9) [9-3-4-271]	rare (41) [16-3-2-624]	taut (8) [4-0-2-23]
mass (110) [15-1-4-537]	rash (1) [13-7-3-119]	tent (20) [16-8-4-1127]
mate (21) [26-10-4-2716]	rasp (2) [6-2-3-14]	term (79) [5-1-3-165]
mean (199) [10-0-3-367]	rate (209) [21-0-3-1057]	test (119) [12-3-2-998]
melt (4) [11-4-4-587]	real (260) [15-0-3-694]	thud (3) [2-1-1-316]
memo (1) [1-0-1-1]	rely (13) [0-0-0-13]	thus (312) [3-1-2-5462]
mesh (4) [4-1-2-28]	rest (163) [12-2-2-950]	tide (11) [13-7-3-2236]
mine (59) [20-5-4-1182]	rich (0) [2-1-1-33]	tile (16) [16-7-4-1889]
mink (5) [14-9-3-591]	ride (49) [18-3-4-804]	tomb (11) [4-1-2-54]
mire (0) [17-14-3-2807]	rind (0) [8-8-2-1159]	town (212) [7-1-2-1151]
miss (258) [8-0-3-432]	rink (2) [12-9-4-283]	trap (20) [5-1-3-127]
mist (14) [10-5-4-2626]	ripe (14) [13-5-4-275]	tree (59) [4-2-4-567]
mite (1) [16-9-4-317]	rise (102) [13-0-4-435]	trim (20) [7-1-3-139]
mole (4) [21-11-4-2753]	road (194) [8-0-3-436]	trio (9) [3-3-1-120]
monk (16) [5-0-3-29]	role (104) [16-0-3-425]	trot (12) [4-0-2-18]
mope (0) [14-12-2-2672]	rope (15) [16-6-3-517]	true (231) [1-0-1-290]
much (937) [5-1-3-2241]	rosy (9) [2-1-2-95]	tube (31) [5-0-3-48]
must (1013) [14-1-4-1903]	ruin (14) [2-1-1-87]	turn (233) [5-0-3-281]
name (294) [10-2-3-1757]	rush (20) [10-2-4-117]	type (200) [4-0-3-235]
navy (37) [3-0-3-40]	same (686) [16-1-3-3574]	unit (103) [2-0-1-113]
neck (81) [5-0-2-136]	sari (1) [1-1-1-5]	upon (495) [0-0-0-495]
neon (14) [3-1-2-44]	says (200) [17-1-2-772]	urge (21) [0-0-0-21]
next (394) [4-0-2-503]	scar (10) [9-1-2-42]	used (612) [2-0-1-675]
norm (10) [4-1-1-384]	seam (9) [14-6-3-440]	vein (25) [3-0-3-46]
nude (20) [4-0-3-26]	seat (54) [13-2-4-412]	verb (4) [2-1-2-807]
numb (4) [1-1-1-17]	seem (229) [10-0-4-615]	very (796) [1-0-1-830]
obey (8) [0-0-0-8]	sexy (2) [0-0-0-2]	veto (10) [1-0-1-10]
odor (14) [0-0-0-14]	shot (112) [11-1-3-589]	view (186) [2-0-1-188]
okay (20) [1-0-1-20]	show (287) [9-0-3-540]	void (10) [0-0-0-10]
omen (2) [4-4-2-357]	side (380) [11-0-2-804]	vote (75) [6-1-2-203]

APPENDIX A (Continued)

walk (100) [5-2-2-415]	well (897) [15-1-4-3899]	word (274) [10-1-3-1320]
wall (160) [14-4-3-4169]	went (507) [17-0-4-1477]	yelp (2) [3-2-2-324]
wand (1) [10-7-3-1169]	whip (19) [7-1-2-133]	yoke (3) [5-3-2-46]
ward (15) [14-6-4-655]	wide (125) [14-2-3-988]	zero (24) [1-1-1-76]
weep (14) [8-4-2-687]	wolf (6) [2-1-2-40]	

APPENDIX B
5-Letter Target Words

Kučera and Francis (1967) frequency per million in parentheses. Neighborhood metric [A-B-C-D], whereby A = number of neighbors present in the neighborhood (excluding the target word), B = number of neighbors higher in frequency than the target word, C = number of letter positions contributing neighbors to the neighborhood, and D = summed frequency of the neighborhood (including the target word).

about (1815) [1-0-1-1815]	burst (33) [1-0-1-39]	creak (1) [6-5-4-136]
above (296) [1-0-1-300]	cabin (23) [0-0-0-23]	creep (10) [2-1-1-32]
adapt (5) [2-1-1-22]	cases (148) [15-0-4-223]	crime (34) [6-1-4-81]
after (1070) [3-0-1-1085]	cater (4) [8-3-3-852]	crisp (8) [1-0-1-8]
again (578) [0-0-0-578]	cause (130) [1-0-1-151]	crock (0) [7-5-4-4-47]
alien (16) [1-0-1-18]	cedar (1) [0-0-0-1]	cross (55) [6-1-3-147]
alone (195) [2-1-2-550]	chain (50) [1-1-1-116]	crown (19) [8-3-4-300]
angel (18) [1-1-1-66]	chick (3) [5-4-2-312]	crude (15) [2-0-2-15]
ankle (8) [1-1-1-59]	chief (119) [1-0-1-127]	cured (7) [6-1-4-29]
apart (57) [1-0-1-57]	child (213) [2-0-1-228]	cycle (24) [0-0-0-24]
apron (7) [2-0-1-15]	chili (6) [2-2-1-233]	dense (9) [2-2-1-335]
areas (236) [1-0-1-236]	chill (14) [3-1-1-234]	depth (53) [1-1-1-330]
aside (65) [1-0-1-72]	chins (2) [5-3-4-83]	devil (25) [0-0-0-25]
awake (20) [2-1-2-113]	choir (8) [1-1-1-74]	digit (1) [0-0-0-1]
bacon (10) [2-0-1-22]	choke (9) [2-1-1-53]	dives (4) [9-4-4-228]
badge (5) [2-1-2-15]	chord (7) [1-0-1-14]	donor (5) [2-1-2-71]
baked (8) [11-2-3-179]	circa (1) [0-0-0-1]	doubt (114) [0-0-0-114]
baker (36) [10-0-4-59]	cites (10) [7-2-2-63]	dozed (5) [10-1-4-69]
bales (4) [21-6-5-235]	civil (91) [1-0-1-114]	drama (43) [1-0-1-43]
based (119) [9-0-4-162]	clamp (0) [6-4-4-9]	drawn (70) [6-0-4-97]
basic (171) [3-1-1-363]	clank (0) [10-6-4-60]	dress (67) [5-1-3-203]
batch (5) [8-4-2-193]	class (207) [10-0-4-321]	drown (3) [5-4-2-312]
beans (9) [12-3-3-361]	clear (219) [2-0-1-290]	dunes (8) [7-0-4-19]
bears (0) [18-13-4-1103]	cleat (1) [5-4-3-295]	dwelt (8) [2-0-2-16]
beats (4) [17-7-3-149]	clerk (34) [1-1-1-69]	eager (27) [4-0-1-30]
begin (84) [2-1-1-447]	cliff (11) [0-0-0-11]	early (366) [1-0-1-366]
being (712) [1-0-1-870]	climb (12) [1-0-1-12]	eight (104) [7-5-1-2345]
bills (47) [18-1-4-172]	clink (0) [9-4-5-14]	elect (8) [2-1-1-22]
bison (1) [0-0-0-1]	clock (20) [8-1-3-104]	enter (78) [3-0-2-80]
bland (3) [7-5-4-143]	clove (1) [3-2-2-244]	every (491) [2-0-2-492]
blank (14) [6-1-4-233]	clown (3) [3-3-2-35]	exact (27) [2-0-2-35]
bleak (10) [2-1-2-99]	coast (61) [3-0-1-98]	faces (72) [13-1-3-251]
bless (9) [1-0-1-13]	coats (10) [8-2-3-255]	false (29) [0-0-0-29]
blimp (1) [0-0-0-1]	coins (9) [7-0-4-22]	feast (3) [3-2-1-356]
bloom (12) [3-2-2-149]	colon (2) [1-1-1-143]	feeds (12) [9-3-3-266]
blows (8) [9-1-4-32]	color (141) [2-0-2-143]	fetch (6) [1-0-1-7]
blunt (9) [2-0-2-10]	comes (137) [12-0-4-312]	flair (8) [2-0-2-11]
bolts (1) [6-4-3-88]	comet (2) [3-1-2-141]	flank (2) [10-4-3-96]
boost (15) [2-0-2-24]	copes (1) [11-7-4-218]	fleet (17) [2-0-2-19]
bored (14) [11-0-3-27]	corps (109) [7-0-3-120]	flesh (52) [3-1-2-166]
brick (18) [5-0-2-45]	costs (176) [7-0-3-201]	flood (19) [2-2-2-298]
brink (3) [7-5-4-272]	couch (12) [6-2-3-132]	floor (158) [1-0-1-177]
broil (2) [0-0-0-2]	could (1599) [1-1-1-4313]	flour (8) [2-1-2-166]
brown (176) [7-0-4-257]	count (49) [3-1-2-498]	fluid (21) [0-0-0-21]
brute (6) [1-0-1-10]	court (230) [1-0-1-279]	force (230) [2-0-2-243]
budge (3) [3-1-1-82]	cover (88) [12-0-3-121]	forms (128) [8-0-4-260]
bugle (2) [0-0-0-2]	cower (0) [7-4-3-564]	forth (71) [5-2-2-417]
built (103) [3-0-2-222]	crack (21) [6-1-3-61]	forts (4) [9-5-3-260]
bully (4) [10-5-5-161]	crank (1) [5-4-4-114]	forum (10) [0-0-0-10]

APPENDIX B (Continued)

found (411) [8-0-2-812]	lions (6) [2-0-2-7]	plate (22) [8-2-3-737]
fours (2) [6-3-2-215]	lived (115) [7-0-5-290]	plead (5) [2-0-1-8]
freak (4) [2-1-1-93]	liver (16) [11-5-4-629]	plots (7) [6-0-2-15]
freed (12) [8-1-4-62]	lords (3) [5-2-3-292]	poker (6) [6-1-4-355]
frees (2) [6-3-4-121]	louse (3) [6-4-3-671]	polls (10) [9-4-4-80]
front (221) [1-0-1-227]	lover (19) [13-3-4-346]	power (342) [9-0-2-486]
frost (6) [1-1-1-227]	loves (19) [13-3-3-233]	price (108) [5-0-3-225]
froze (5) [0-0-0-5]	lower (123) [11-1-2-500]	prime (45) [7-1-3-257]
fuzzy (7) [1-0-1-7]	loyal (18) [3-2-3-354]	proof (40) [0-0-0-40]
gaily (5) [1-1-1-127]	lunch (33) [6-0-3-66]	props (6) [8-2-4-42]
ghoul (1) [0-0-0-1]	lyric (12) [0-0-0-12]	pulse (9) [1-1-1-23]
girls (142) [2-0-2-142]	major (247) [2-0-1-290]	pumps (5) [11-10-4-14]
gives (112) [8-1-3-617]	makes (172) [14-0-3-316]	pupil (20) [0-0-0-20]
glass (99) [9-1-3-357]	manor (5) [3-3-2-348]	quack (9) [2-1-2-79]
gloom (14) [2-0-2-31]	maple (7) [0-0-0-7]	quail (0) [0-0-0-0]
going (399) [1-0-1-562]	marsh (4) [2-2-2-136]	quake (2) [1-0-1-2]
grabs (3) [5-2-3-77]	mates (10) [15-5-3-377]	quest (2) [1-1-1-41]
grace (40) [7-0-2-130]	mayor (38) [2-1-1-290]	quill (9) [2-0-2-12]
grade (35) [8-2-3-260]	means (310) [9-0-3-454]	radii (4) [2-1-1-124]
grape (3) [10-5-4-141]	meant (100) [2-1-2-413]	raged (8) [10-2-2-51]
graph (17) [1-0-1-20]	mercy (20) [1-0-1-28]	raids (5) [1-1-1-17]
grass (53) [9-2-5-279]	merit (29) [0-0-0-29]	rails (9) [12-2-2-73]
grave (33) [10-2-4-155]	meter (6) [7-1-3-48]	rains (5) [10-5-4-76]
great (665) [2-0-2-698]	miles (173) [15-0-4-248]	rally (10) [2-1-1-27]
greed (3) [6-6-2-224]	mince (1) [2-1-1-619]	ranch (27) [0-0-0-27]
grief (10) [1-1-1-83]	miner (1) [9-6-4-98]	rates (102) [16-0-4-215]
grove (14) [6-3-4-172]	mines (28) [22-3-4-486]	reach (106) [7-0-3-229]
hands (289) [9-0-4-361]	mirth (2) [3-1-1-69]	react (15) [1-1-1-121]
handy (13) [8-4-4-397]	miser (0) [7-2-3-12]	realm (19) [1-0-1-19]
hangs (4) [5-3-2-307]	moist (11) [3-0-1-12]	repay (7) [2-2-2-62]
harsh (12) [1-0-1-16]	money (265) [2-0-1-293]	repel (8) [2-1-1-29]
hatch (5) [8-4-2-198]	month (130) [1-0-1-433]	right (613) [7-1-1-2345]
heads (43) [10-0-4-112]	moods (8) [8-3-4-160]	rings (6) [9-3-3-50]
heart (173) [2-1-1-427]	motor (56) [1-0-1-62]	risks (5) [6-1-5-35]
heave (2) [3-3-2-321]	mouth (103) [2-1-2-315]	rites (4) [7-6-3-170]
heavy (110) [1-0-1-112]	moved (181) [7-0-3-276]	river (165) [8-0-4-203]
hello (10) [1-0-1-10]	muddy (10) [2-1-1-26]	roach (2) [3-2-2-133]
hides (5) [10-1-4-129]	munch (1) [5-5-2-69]	roman (58) [1-1-1-282]
hints (10) [8-0-4-13]	needs (152) [6-0-3-225]	roofs (5) [5-3-2-94]
hitch (5) [6-3-2-53]	nerve (12) [2-1-1-123]	rouge (7) [2-1-2-49]
horns (8) [2-0-1-10]	night (411) [7-2-1-2345]	round (81) [7-2-1-937]
hotel (126) [2-0-2-142]	noose (3) [5-3-2-97]	ruins (8) [2-1-1-22]
hyena (1) [0-0-0-1]	odder (0) [3-2-2-467]	rumor (8) [2-2-1-72]
ideal (61) [1-1-1-204]	often (368) [1-0-1-368]	safer (5) [5-0-2-8]
irons (7) [2-1-2-19]	older (93) [3-1-2-485]	salem (19) [1-1-1-152]
jolly (4) [5-1-2-26]	olive (5) [2-1-1-63]	sales (133) [16-0-5-225]
khaki (1) [0-0-0-1]	order (376) [2-0-1-469]	sauce (20) [1-0-1-21]
known (245) [1-0-1-344]	paced (11) [10-2-3-92]	saves (5) [12-4-3-240]
label (19) [3-0-3-25]	paint (37) [6-1-3-767]	scale (60) [6-0-2-72]
labor (149) [1-0-1-149]	panel (31) [2-0-1-35]	scare (3) [11-7-4-282]
laced (2) [5-3-3-80]	paper (157) [8-0-2-167]	scene (106) [2-0-2-112]
lance (3) [1-1-1-93]	parts (113) [13-1-5-440]	score (66) [10-1-5-251]
large (361) [2-0-1-368]	peach (3) [7-4-4-44]	scout (8) [7-2-3-39]
later (397) [12-1-4-859]	peers (8) [9-0-3-21]	scrap (8) [2-0-1-10]
latin (50) [1-0-1-55]	piano (38) [0-0-0-38]	scrub (9) [1-0-1-10]
learn (84) [1-0-1-85]	piece (129) [1-0-1-137]	seeks (10) [8-3-2-453]
leash (3) [2-2-1-356]	pilot (44) [2-0-1-46]	seems (259) [9-0-4-355]
least (343) [7-0-3-371]	pipes (7) [6-0-4-14]	sense (311) [2-0-1-335]
leave (205) [3-0-2-221]	pitch (22) [5-0-3-52]	serve (107) [2-0-2-124]
light (333) [7-3-1-2345]	pizza (3) [0-0-0-3]	seven (113) [2-0-2-116]
liner (4) [10-3-3-51]	plane (114) [5-2-3-952]	shaft (11) [2-1-2-52]
lines (198) [16-0-5-300]	plank (7) [9-4-4-375]	shale (0) [11-9-4-586]

APPENDIX B (Continued)

shall (267) [6-1-4-853]	spray (16) [3-0-2-28]	trust (52) [3-0-3-103]
shape (85) [7-1-1-255]	stack (9) [10-3-4-245]	twist (18) [0-0-0-18]
share (98) [15-0-4-429]	stale (4) [12-8-4-1208]	tying (5) [3-3-2-408]
shark (0) [7-5-4-191]	stand (148) [2-0-2-149]	under (707) [1-0-1-707]
sharp (72) [3-1-1-170]	stare (14) [14-8-4-1411]	union (182) [1-0-1-197]
shave (6) [10-6-3-291]	stark (7) [8-4-4-225]	value (200) [2-0-2-228]
shine (5) [11-1-5-33]	state (808) [9-0-3-1035]	verbs (7) [1-0-1-10]
shock (31) [6-2-3-236]	stiff (21) [4-2-2-227]	vigil (1) [0-0-0-1]
shore (61) [13-3-5-478]	still (782) [7-0-4-844]	virus (13) [0-0-0-13]
short (212) [8-0-3-356]	stole (10) [7-4-2-259]	vocal (14) [2-1-1-310]
shout (9) [7-2-2-261]	stony (5) [2-2-2-216]	vodka (0) [0-0-0-0]
shows (94) [2-1-1-371]	stoop (4) [7-3-3-233]	voice (225) [1-0-1-225]
sides (101) [10-0-3-153]	store (74) [13-1-3-501]	waken (0) [6-5-4-287]
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sings (10) [9-2-3-110]	stunk (1) [8-3-4-29]	water (442) [9-0-2-849]
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slate (10) [8-3-3-874]	theft (10) [0-0-0-10]	whine (4) [5-4-2-1062]
slept (27) [2-1-2-62]	thief (8) [1-1-1-127]	whisk (0) [1-0-1-0]
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slump (8) [5-0-4-26]	thumb (10) [1-0-1-13]	wiped (19) [5-0-2-32]
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