

## Bidirectional Synonym Ratings of 464 Noun Pairs

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Each of 464 noun pairs was rated for synonymy on a 7-point scale by 100 college students. The purpose of this study was twofold. First, it was designed to provide memory and psycholinguistic researchers with extensive synonym norms. Second, it was designed to evaluate the effects of encoding order on perceived synonymy. The hypothesis that limited semantic-memory access can cause synonym pairs to be rated as more synonymous in one word-order than in the other was tested by presenting each noun pair to 50 judges in one order and to another 50 judges in the reverse order. Mean synonym ratings (averaged across word orders) ranged from 6.79 to 2.24, thus demonstrating the need for normative data on synonyms. A significant number of noun pairs showed strong directional effects such that perceived synonymy was significantly changed by word encoding order. The practical and theoretical importance of these directional effects are discussed.

In order to attack certain problems within the domains of memory and psycholinguistic research, psychologists have found it necessary to scale verbal and conceptual materials along dimensions such as meaningfulness, imagery, and frequency. Occasionally, as research questions change and are refined, the need arises for additional normative scaling studies. Currently, there is a need for an extensive set of scaled synonyms. A search through the 1975 and 1976 issues of *Journal of Verbal Learning and Verbal Behavior*, *Memory and Cognition*, and *Journal of Experimental Psychology: Human Learning and Memory* produced more than 20 articles in which synonyms were used as stimulus materials in experiments. To select these stimuli, the experimenters had to rely on dictionaries, Roget (1962), and subjective judgments, or they had to produce limited norms by asking a few judges to rate synonym pairs. On first con-

sideration, these procedures may seem adequate. However, a synonym is "one of two or more words or expressions of the same language that have the same or nearly the same meaning in some or all senses" (Webster's Seventh New Collegiate Dictionary, 1972). Thus, synonymy is not a simple all-or-none relationship, but is a complex mapping of shared denotation and connotation. Consequently, selection of "good synonyms" for experimental stimuli should make use of normatively defined opinions.

Unfortunately, extensive and adequate synonym norms have not been available. A search of Brown's "Catalog of Scaled Verbal Material" (1976) revealed just four studies that involved some type of similarity ratings. Haagen (1949) had subjects rate 400 re-paired adjectives (80 unique pairs) on several dimensions, including synonymy, but only a sample of the resulting norms was published. Richardson and Erlebacher (1958) studied the relation between meaning similarity and estimated learning difficulty, but their study was not designed to provide norms. Flavell (1961) studied the correlations of meaning similarity scores, semantic differential scores, and co-occurrence probability scores for several types

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of word pairs, but only about 10 words in the experiment were highly synonymous. An unpublished study by Melton and Safier, tabled by Hilgard (1951), provides the only extensive array of scaled synonyms. In that study, 96 subjects rated the synonymy of 300 pairs of two-syllable adjectives on a 4-point scale and the mean ratings ranged from a high of 2.85 to a low of .01. These norms are useful, but they are limited to adjectives, do not include an index of variability, and provide relatively few excellent synonyms. The primary purpose of the present study was to fill the need for additional synonym norms by collecting ratings for a large number of common-noun pairs.

In addition to the primary goal, the present study was designed to evaluate the extent to which the order of word encoding can affect perceived synonymy. Ideally, a synonym judgment should be based upon a comprehensive comparison of all attributes of both words. If all of a word's attributes are always accessed, then the order of word encoding should not affect synonym ratings. However, it is not likely, and perhaps it is not possible, that semantic memory searches can be so complete. If access is incomplete, the encoded representation of the first word may serve as context to direct and restrict the encoding of the second word. It is predicted that this sort of contextual effect would produce directional differences in perceived synonymy that would cause some pairs of synonyms to receive significantly higher ratings in one encoding order than in the other. Such "unidirectional synonyms" would be poor stimuli in experiments where maximal synonymy is essential, and could actually produce aberrant experimental results. In addition, if directional encoding effects are found in the "minimal context" situation of a synonym rating task, numerous interesting theoretical questions regarding the storage, retrieval, and comparison of semantic memory attributes would be posed. Because of these considerations, then, the present study was designed with two

goals in mind: (1) to provide an extensive set of synonym pairs for use as stimuli in experiments, and (2) to evaluate the effects of word encoding order on perceived synonymy.

## METHOD

*Subjects.* The 200 subjects were 100 male and 100 females who chose to participate in this particular experiment in order to fulfill a requirement of an introductory psychology course at the State University of New York at Albany.

*Materials.* Initially, all two-syllable noun with occurrence frequencies of 10 or more per million were extracted from the Kučera and Francis (1967) norms. Roget's Thesaurus (1962) and standard dictionaries were used to select synonyms for as many of these words as possible. [All selected synonyms are common nouns, but some do not meet the 10 or more per million criterion in the Kučera and Francis (1967) norms and many are not two-syllable words.] Finally, a computer sorting routine was used to eliminate word duplications from the list. This procedure produced a set of 464 unique pairs of words. Word pairs were computer printed on cards so that the first word of a pair began in Column 1 and the second word of a pair began in Column 50. Two hundred decks of 232 cards were created as described below. Card decks were presented in specially constructed wooden boxes which concealed all but the blank lower left corners of the cards. The 7-point rating scale used by subjects was displayed on the top of each box.

*Design.* Each of the 200 subjects rated 232 of the 464 pairs of synonyms. The 200 decks of cards were prepared by repeating the following procedure 50 times: (a) the 464 synonym pairs were randomly ordered; (b) this list was divided in half to create two decks of 232 pairs each; (c) two additional decks were formed by reversing the left-right order of the words of the first two decks. Thus, each word-pair appeared in 50 decks in one left-right order

and in another 50 decks in the reverse left-right order. Card decks were assigned to subjects on a random basis.

*Procedure.* Subjects were assembled in small groups, most of which ranged from six to nine persons. The purpose of the study and the usefulness of the data were fully explained. Then, subjects were instructed to use the following procedure to judge the synonymy of the words in each pair: (a) Draw the top card about one-third from the wooden box to expose only the left-hand word. (b) Read the word and think of its meaning for about 2 sec. (c) Remove the card from the box so that the right-hand word is exposed. (d) Using a 7-point scale, indicate the degree to which the two words have the same meaning by writing a digit from 1 to 7 in the upper right corner of the card. (e) Place the card on the table and repeat this procedure until all cards have been drawn. The 7-point rating scale was defined such that a 1 indicated very poor synonymy, a 7 indicated excellent synonymy, and intermediate digits indicated intermediate degrees of synonymy. Following all instructions, each subject was given a box containing a deck of cards and was seated alone in a cubicle to make the ratings. Subjects were allowed to work at their own rates, but were told that one judgment every 8 or 10 sec would be optimal. Since the task was self-paced, there was no control over the exact rate of reading. However, the specially constructed card boxes guaranteed that subjects always saw the left-hand word first. After rating all word-pairs in their decks, subjects were asked to sort their cards into numbered bins according to their previously assigned ratings.

## RESULTS

The two-syllable nouns taken from Kučera and Francis (1967) are listed in the first column of Table 1 and the corresponding synonyms are listed in the second column. This left-right ordering will be referred to as

the "forward order" and the reverse ordering of words within pairs will be referred to as the "backward order."

The mean and variance for the forward order ratings, the mean and variance for the backward order ratings, and the grand mean (disregarding word order) were calculated for each word pair. In general, each forward order mean and each backward order mean included data from 50 subjects, but due to mechanical errors 28 of the 46,400 stimulus cards were not processed. The missing data are noted by superscript letters next to the appropriate forward or backward order means in Table 1.

For maximum utility, the ranking of synonyms in Table 1 is by their grand means. Although all pairs in the table are nominally synonyms (i.e., are listed as synonyms in standard references), the rated degree of synonymy ranged from 6.79 to 2.24. This wide range demonstrates the need for norms when selecting maximally synonymous stimulus materials for experiments.

Directionality of synonymy was assessed in two ways. First, an independent-samples *t*-test was performed on the forward and backward order ratings for each word pair. The results of these tests are shown in the last column of Table 1 where a positive *t* score indicates that the mean rating for the forward order was greater, and a negative *t* score indicates that the mean rating for the backward order was greater. Since a number of *t* values would be expected to exceed a standard criterion (e.g.  $p < 0.05$ ) by chance, we suggest that the *t* tests not be used to select those synonyms that exhibit significant directionality from those that do not. On the other hand, the *t* scores provide a convenient device for rank ordering word pairs in terms of directionality of synonymy. To the extent that interchanging the order of word encoding directs access to different attributes in semantic memory, absolute *t* values should tend to increase. Consequently, when interchangeable words are required in an experiment, it would be

TABLE 1  
BIDIRECTIONAL RATINGS OF SYNONYMS

| Rank | Word pair | Grand mean | Forward mean      | Forward variance | Backward mean     | Backward variance | <i>t</i> |
|------|-----------|------------|-------------------|------------------|-------------------|-------------------|----------|
| 1    | Purchase  | 6.79       | 6.72              | .98              | 6.86              | .12               | -.094    |
| 2    | Lawyer    | 6.78       | 6.76              | .27              | 6.80              | .20               | -.041    |
| 3    | Autumn    | 6.72       | 6.84              | .30              | 6.60              | .78               | 1.64     |
| 4    | Penny     | 6.71       | 6.70              | .54              | 6.72              | 1.06              | -.011    |
| 5    | Taxi      | 6.71       | 6.74              | .89              | 6.68              | 1.00              | .31      |
| 6    | Auto      | 6.68       | 6.68              | .79              | 6.68              | .51               | .00      |
| 7    | Error     | 6.66       | 6.66              | 1.00             | 6.66              | .52               | .00      |
| 8    | Pupil     | 6.63       | 6.68              | .30              | 6.58              | .78               | .68      |
| 9    | Victor    | 6.60       | 6.54              | 1.03             | 6.66              | .35               | -.072    |
| 10   | Answer    | 6.58       | 6.47 <sup>a</sup> | .46              | 6.68              | .67               | -.139    |
| 11   | Present   | 6.56       | 6.46              | .87              | 6.66              | .47               | -.122    |
| 12   | Teacher   | 6.56       | 6.54              | .42              | 6.57 <sup>a</sup> | .88               | -.019    |
| 13   | Result    | 6.47       | 6.34              | 1.13             | 6.60              | .53               | -.143    |
| 14   | Triumph   | 6.45       | 6.50              | .74              | 6.40              | .57               | .62      |
| 15   | Basement  | 6.44       | 6.50              | .95              | 6.38              | 1.67              | .52      |
| 16   | Excess    | 6.43       | 6.34              | 1.17             | 6.52              | .83               | -.090    |
| 17   | Display   | 6.41       | 6.34              | .68              | 6.48              | .66               | -.085    |
| 18   | Consent   | 6.41       | 6.22              | 1.40             | 6.60              | .37               | -.202    |
| 19   | Comment   | 6.40       | 6.28              | .61              | 6.52              | .62               | -.153    |
| 20   | Clothing  | 6.39       | 6.24              | 1.12             | 6.54              | .58               | -.162    |
| 21   | Center    | 6.37       | 6.32              | 1.24             | 6.42              | .49               | -.054    |
| 22   | Command   | 6.37       | 6.46              | .62              | 6.28              | .86               | 1.05     |
| 23   | Streetcar | 6.37       | 6.50              | .74              | 6.24              | 1.74              | 1.17     |
| 24   | Prison    | 6.36       | 6.26              | 1.05             | 6.46              | .95               | -.100    |
| 25   | Custom    | 6.35       | 6.24              | .92              | 6.46              | .99               | -.113    |
| 26   | Courage   | 6.34       | 6.22              | 1.03             | 6.47 <sup>a</sup> | .80               | -.129    |
| 27   | Balance   | 6.34       | 6.00              | 1.10             | 6.68              | .47               | -.384    |
| 28   | Singer    | 6.34       | 6.38              | .85              | 6.30              | 1.85              | .34      |
| 29   | Plenty    | 6.33       | 6.24              | 1.04             | 6.42              | .45               | -.104    |
| 30   | Worker    | 6.32       | 6.28              | 1.10             | 6.36              | .89               | -.040    |
| 31   | Rabbit    | 6.30       | 6.22              | 1.32             | 6.38              | .93               | -.075    |

Table 1—Continued

|    |           |               |      |                   |      |                   |      |       |
|----|-----------|---------------|------|-------------------|------|-------------------|------|-------|
| 32 | Slaughter | Massacre      | 6.29 | 6.22              | 1.24 | 6.36              | 1.09 | −0.65 |
| 33 | Murder    | Homicide      | 6.29 | 6.02              | 2.75 | 6.56              | 1.03 | −1.96 |
| 34 | Inside    | Interior      | 6.29 | 6.10              | 1.03 | 6.48              | .66  | −2.06 |
| 35 | Defect    | Flaw          | 6.29 | 6.18              | 1.25 | 6.40              | 1.06 | −1.02 |
| 36 | Speaker   | Orator        | 6.28 | 6.28              | .90  | 6.28              | 1.19 | .00   |
| 37 | Total     | Sum           | 6.28 | 6.18              | 1.58 | 6.38              | 1.42 | −0.82 |
| 38 | Pilot     | Aviator       | 6.25 | 6.10              | 1.40 | 6.40              | .78  | −1.44 |
| 39 | Builder   | Constructor   | 6.25 | 6.28              | .82  | 6.22              | 1.36 | .29   |
| 40 | Couple    | Pair          | 6.24 | 6.30              | 1.19 | 6.18              | 1.13 | .56   |
| 41 | Dinner    | Supper        | 6.23 | 6.24              | 1.29 | 6.22              | 1.60 | .08   |
| 42 | Liquid    | Fluid         | 6.23 | 6.24              | 1.41 | 6.22              | 1.64 | .08   |
| 43 | Motion    | Movement      | 6.22 | 6.40              | .57  | 6.04              | 1.18 | 1.92  |
| 44 | Freedom   | Liberty       | 6.22 | 6.08              | .93  | 6.36              | .64  | −1.58 |
| 45 | Applause  | Clapping      | 6.22 | 6.18 <sup>a</sup> | .99  | 6.26              | 1.09 | −0.37 |
| 46 | Value     | Worth         | 6.22 | 6.08              | 1.22 | 6.36              | .68  | −1.44 |
| 47 | Vision    | Sight         | 6.21 | 6.18              | 1.82 | 6.24              | 1.17 | −0.25 |
| 48 | Subject   | Topic         | 6.21 | 6.02              | 1.33 | 6.40              | .69  | −1.89 |
| 49 | Promise   | Vow           | 6.21 | 6.24              | .88  | 6.18              | 1.46 | .28   |
| 50 | Baby      | Infant        | 6.19 | 6.10              | 1.15 | 6.28              | 1.06 | −0.86 |
| 51 | Complaint | Grievance     | 6.18 | 6.04              | 1.10 | 6.32              | .63  | −1.51 |
| 52 | Duty      | Obligation    | 6.17 | 6.08              | 1.67 | 6.26 <sup>a</sup> | .99  | −0.80 |
| 53 | Region    | Area          | 6.16 | 6.36              | 1.09 | 5.96              | .90  | 2.01  |
| 54 | Movie     | Film          | 6.16 | 6.30              | 1.07 | 6.02              | 1.65 | 1.20  |
| 55 | Vital     | Important     | 6.14 | 6.16              | .91  | 6.12              | 1.25 | .19   |
| 56 | Fatigue   | Tiredness     | 6.13 | 6.10              | 1.44 | 6.16              | 1.08 | −0.27 |
| 57 | Odor      | Smell         | 6.11 | 6.36              | 1.05 | 5.86              | 2.12 | 1.98  |
| 58 | Owner     | Proprietor    | 6.09 | 5.76              | 1.45 | 6.42              | 1.60 | −2.67 |
| 59 | Journey   | Trip          | 6.09 | 6.16              | 1.12 | 6.02              | 1.04 | .67   |
| 60 | Saloon    | Barroom       | 6.09 | 6.14              | 1.51 | 6.04              | 1.75 | .39   |
| 61 | Crying    | Weeping       | 6.09 | 6.00              | 1.31 | 6.18              | 1.29 | −0.79 |
| 62 | Forecast  | Prediction    | 6.08 | 6.28              | .94  | 5.88              | 2.03 | 1.64  |
| 63 | Quarrel   | Argument      | 6.08 | 6.20              | 1.27 | 5.96              | 1.26 | 1.07  |
| 64 | Method    | Procedure     | 6.08 | 6.12              | 1.25 | 6.04              | 1.51 | .34   |
| 65 | Forest    | Woodland      | 6.05 | 5.84              | 1.36 | 6.26              | .81  | −2.02 |
| 66 | Blindness | Sightlessness | 6.05 | 6.12              | 1.33 | 5.98              | 2.43 | .51   |

| Rank | Word pair | Grand mean | Forward mean      | Forward variance | Backward mean | Backward variance | t     |
|------|-----------|------------|-------------------|------------------|---------------|-------------------|-------|
| 67   | Author    | 6.05       | 6.08              | 1.30             | 6.02          | 1.53              | .25   |
| 68   | Money     | 6.04       | 5.88              | 2.07             | 6.20          | 1.22              | -1.25 |
| 69   | Rival     | 6.04       | 6.12              | .97              | 5.96          | 1.75              | .69   |
| 70   | Unknown   | 6.04       | 5.74              | 2.52             | 6.34          | 2.19              | -1.95 |
| 71   | Country   | 6.03       | 6.02              | 1.08             | 6.04          | 1.47              | -0.09 |
| 72   | Children  | 5.99       | 5.92              | 1.14             | 6.06          | 1.44              | -0.62 |
| 73   | Event     | 5.99       | 5.94              | 1.08             | 6.04          | 1.51              | -0.44 |
| 74   | Walker    | 5.99       | 5.76              | 2.55             | 6.22          | .95               | -1.74 |
| 75   | Sunrise   | 5.98       | 6.10              | 1.89             | 5.86          | 2.69              | .79   |
| 76   | Label     | 5.98       | 5.64              | 1.95             | 6.32          | .79               | -2.90 |
| 77   | Column    | 5.96       | 5.82              | 1.50             | 6.10          | .95               | -1.27 |
| 78   | Decrease  | 5.94       | 5.96              | 1.55             | 5.92          | 1.83              | .15   |
| 79   | Profit    | 5.94       | 6.06              | 1.28             | 5.82          | 1.09              | 1.10  |
| 80   | Motive    | 5.92*      | 6.28              | .74              | 5.56          | 1.88              | 3.15  |
| 81   | Fabric    | 5.92       | 5.84              | 1.44             | 6.00          | 1.80              | -0.63 |
| 82   | Engine    | 5.91       | 6.00              | 1.22             | 5.82          | 2.23              | .68   |
| 83   | Feeling   | 5.90       | 5.60              | 1.75             | 6.20          | .94               | -2.58 |
| 84   | Concept   | 5.90       | 6.20              | .94              | 5.60          | 2.16              | 2.41  |
| 85   | Carpet    | 5.90       | 6.00              | 1.63             | 5.80          | 1.75              | .77   |
| 86   | Protest   | 5.90       | 5.82              | 1.70             | 5.98          | 1.12              | -0.67 |
| 87   | Commerce  | 5.89       | 6.00              | 1.27             | 5.78          | 1.16              | 1.00  |
| 88   | Poultry   | 5.88       | 6.04              | 1.63             | 5.72          | 2.00              | 1.19  |
| 89   | Question  | 5.88       | 5.86              | 1.72             | 5.90*         | 1.68              | -0.15 |
| 90   | Shortage  | 5.88       | 5.86 <sup>a</sup> | 2.33             | 5.90          | 1.89              | -0.15 |
| 91   | Income    | 5.88       | 5.80              | 1.31             | 5.96          | 1.71              | -0.65 |
| 92   | Insect    | 5.87       | 5.76              | 2.68             | 5.98          | 2.35              | -0.69 |
| 93   | Story     | 5.87       | 5.78              | 1.85             | 5.96          | 1.34              | -0.71 |
| 94   | Delay     | 5.87       | 5.86              | 2.08             | 5.88          | 2.52              | -0.07 |
| 95   | Expense   | 5.84       | 6.12              | 1.05             | 5.56          | 2.46              | 2.12  |
| 96   | Labor     | 5.84       | 5.94              | 1.28             | 5.74          | 1.99              | .78   |
| 97   | Hazard    | 5.79       | 5.84              | 1.48             | 5.74          | 1.26              | .43   |
| 98   | Summit    | 5.79       | 6.14              | 1.47             | 5.44          | 3.52              | 2.22  |
| 99   | Tremble   | 5.79       | 6.12              | 1.13             | 5.46          | 1.93              | 2.67  |
| 100  | Survey    | 5.78       | 5.54              | 1.93             | 6.02          | .80               | -2.06 |
| 101  | Driver    | 5.78       | 5.60              | 1.96             | 5.96          | 1.79              | -1.31 |

|     |          |               |        |      |      |                   |      |       |
|-----|----------|---------------|--------|------|------|-------------------|------|-------|
| 102 | Adult    | Grownup       | 5.78   | 5.50 | 1.89 | 6.06              | 1.65 | -2.11 |
| 103 | Status   | Rank          | 5.77   | 5.70 | 2.05 | 5.84              | 1.24 | -0.55 |
| 104 | Savage   | Barbarian     | 5.77   | 5.74 | 2.12 | 5.80              | 1.63 | -0.22 |
| 105 | Poison   | Venom         | 5.77   | 5.62 | 2.00 | 5.92              | 2.16 | -1.04 |
| 106 | Purpose  | Intention     | 5.74   | 5.76 | 2.02 | 5.72              | 2.37 | .13   |
| 107 | Echo     | Reverberation | 5.74   | 5.84 | 1.73 | 5.64              | 2.40 | .70   |
| 108 | Ethics   | Morals        | 5.74   | 5.76 | 2.02 | 5.72              | 1.88 | .14   |
| 109 | Delight  | Pleasure      | 5.72   | 5.60 | 1.55 | 5.84              | 1.08 | -1.05 |
| 110 | Moisture | Dampness      | 5.72   | 5.94 | 1.04 | 5.50              | 1.81 | 1.85  |
| 111 | Vigor    | Energy        | 5.72   | 5.94 | 1.24 | 5.50              | 2.05 | 1.71  |
| 112 | Human    | Person        | 5.71   | 5.76 | 1.78 | 5.66              | 2.80 | .33   |
| 113 | Logic    | Reasoning     | 5.71   | 5.72 | 1.19 | 5.70              | 2.25 | .08   |
| 114 | Desire   | Wish          | 5.71   | 5.66 | 1.45 | 5.76              | 1.94 | -0.38 |
| 115 | Curtain  | Drape         | 5.69   | 5.62 | 1.75 | 5.76              | 1.90 | -0.52 |
| 116 | Justice  | Fairness      | 5.68   | 5.56 | 1.97 | 5.80              | 1.43 | -0.92 |
| 117 | Number   | Quantity      | 5.67   | 5.44 | 1.92 | 5.90              | 1.44 | -1.77 |
| 118 | Sequence | Series        | 5.67   | 5.56 | 1.60 | 5.78              | 1.48 | -0.89 |
| 119 | Player   | Contestant    | 5.66   | 5.72 | 2.16 | 5.60              | 2.37 | .40   |
| 120 | Fraction | Part          | 5.66   | 5.88 | 1.82 | 5.44              | 1.72 | 1.65  |
| 121 | Trouble  | Difficulty    | 5.66   | 5.80 | 1.27 | 5.52              | 1.85 | 1.12  |
| 122 | Witness  | Observer      | 5.65   | 5.88 | 1.86 | 5.42              | 2.17 | 1.62  |
| 123 | Rancher  | Cattleman     | 5.65   | 5.36 | 1.95 | 5.94              | 1.73 | -2.14 |
| 124 | Ration   | Allowance     | 5.64   | 5.82 | 2.35 | 5.46              | 2.13 | 1.20  |
| 125 | Crossing | Intersection  | 5.64   | 5.42 | 2.17 | 5.86 <sup>a</sup> | 2.29 | -1.46 |
| 126 | Union    | Joining       | 5.63   | 5.64 | 2.52 | 5.62              | 1.87 | .07   |
| 127 | Verdict  | Decision      | 5.62   | 5.92 | 2.16 | 5.32              | 2.83 | 1.90  |
| 128 | Fashion  | Style         | 5.62   | 5.86 | 1.67 | 5.38              | 2.24 | 1.72  |
| 129 | Quiet    | Silence       | 5.62   | 5.42 | 2.45 | 5.82              | 1.95 | -1.35 |
| 130 | Quarter  | Fourth        | 5.62** | 6.24 | 2.27 | 5.00              | 4.33 | 3.41  |
| 131 | Statute  | Law           | 5.61   | 5.82 | 1.86 | 5.40 <sup>b</sup> | 1.61 | 1.59  |
| 132 | Instant  | Moment        | 5.61   | 5.50 | 2.17 | 5.72              | 2.04 | -0.76 |
| 133 | Impulse  | Urge          | 5.60   | 5.72 | 1.55 | 5.48              | 2.13 | .88   |
| 134 | Pastor   | Minister      | 5.60   | 5.66 | 1.86 | 5.54              | 2.87 | .39   |
| 135 | Design   | Pattern       | 5.60   | 5.54 | 1.52 | 5.66              | 1.78 | -0.47 |
| 136 | Canyon   | Gorge         | 5.60   | 5.62 | 1.59 | 5.58              | 1.23 | .17   |

Table 1—Continued

| Rank | Word pair | Grand mean | Forward mean | Forward variance | Backward mean     | Backward variance | <i>t</i> |
|------|-----------|------------|--------------|------------------|-------------------|-------------------|----------|
| 137  | Tension   | 5.60       | 5.46         | 2.13             | 5.74              | 1.58              | -1.03    |
| 138  | Feature   | 5.59       | 5.64         | 1.58             | 5.54              | 2.62              | .34      |
| 139  | Lumber    | 5.59       | 5.88         | 1.21             | 5.30              | 2.38              | 2.17     |
| 140  | Program   | 5.59       | 5.58         | 1.96             | 5.60              | 1.75              | -0.07    |
| 141  | Candy     | 5.58       | 5.70         | 1.97             | 5.46              | 2.46              | .81      |
| 142  | Crisis    | 5.57       | 5.34         | 2.03             | 5.80              | 1.39              | -1.76    |
| 143  | Founder   | 5.57       | 5.38         | 2.32             | 5.76              | 2.31              | -1.25    |
| 144  | Excuse    | 5.57       | 5.52         | 2.13             | 5.62              | 2.93              | -0.31    |
| 145  | Repair    | 5.57       | 5.50         | 2.05             | 5.64              | 1.34              | -0.54    |
| 146  | Meadow    | 5.57       | 5.52         | 1.72             | 5.61 <sup>a</sup> | 2.74              | -0.31    |
| 147  | Normal    | 5.57       | 5.84         | 1.57             | 5.30              | 2.87              | 1.81     |
| 148  | Warfare   | 5.57       | 5.78         | 1.85             | 5.36              | 2.15              | 1.48     |
| 149  | Worship   | 5.55       | 5.64         | .05              | 5.46              | 2.42              | .81      |
| 150  | Insane    | 5.55       | 5.40         | 2.94             | 5.70              | 2.75              | -0.89    |
| 151  | Surprise  | 5.55       | 5.16         | 2.22             | 5.94              | 1.49              | -2.87    |
| 152  | Vessel    | 5.54       | 5.58         | 2.13             | 5.50              | 2.13              | .27      |
| 153  | Control   | 5.53       | 5.56         | 1.72             | 5.50              | 1.93              | .22      |
| 154  | Capture   | 5.52       | 5.52         | 2.42             | 5.52              | 2.50              | .00      |
| 155  | Pistol    | 5.52       | 5.78         | 2.34             | 5.26              | 2.16              | 1.73     |
| 156  | Posture   | 5.51       | 5.66         | 1.45             | 5.36              | 2.97              | 1.01     |
| 157  | Damage    | 5.51       | 5.38         | 2.32             | 5.64              | 1.70              | -0.92    |
| 158  | Preserves | 5.48       | 5.26         | 2.60             | 5.70              | 1.48              | -1.54    |
| 159  | Picture   | 5.48       | 5.30         | 2.70             | 5.66              | 2.27              | -1.14    |
| 160  | Daring    | 5.47       | 5.62         | 1.34             | 5.32              | 1.94              | 1.17     |
| 161  | Advice    | 5.47       | 5.10         | 2.01             | 5.84              | 1.77              | -2.69    |
| 162  | Terror    | 5.47       | 5.68         | 2.22             | 5.26              | 1.91              | 1.46     |
| 163  | Double    | 5.46       | 5.42         | 2.04             | 5.50              | 3.15              | -0.25    |
| 164  | Challenge | 5.45       | 5.14         | 2.74             | 5.76              | 2.39              | -1.94    |
| 165  | Safety    | 5.45       | 5.44         | 1.52             | 5.46              | 1.76              | -0.08    |
| 166  | Prairie   | 5.44       | 5.54         | 2.46             | 5.34              | 2.43              | .64      |
| 167  | Contest   | 5.44       | 5.70         | 1.64             | 5.18              | 2.68              | 1.77     |
| 168  | Talent    | 5.43       | 5.30         | 2.75             | 5.57 <sup>a</sup> | 2.17              | -0.86    |
| 169  | Highway   | 5.43       | 5.30         | 2.05             | 5.56              | 2.29              | -0.88    |
| 170  | Wagon     | 5.43       | 5.36         | 1.30             | 5.50              | 1.60              | -0.58    |
| 171  | Palace    | 5.42       | 5.54         | 1.80             | 5.30              | 2.09              | .86      |



|     |          |               |       |                   |      |                   |      |       |
|-----|----------|---------------|-------|-------------------|------|-------------------|------|-------|
| 172 | Scholar  | Academician   | 5.42  | 5.24              | 2.59 | 5.60              | 1.31 | -1.29 |
| 173 | Review   | Critique      | 5.41  | 5.32              | 2.47 | 5.51 <sup>a</sup> | 1.67 | -0.66 |
| 174 | Refund   | Reimbursement | 5.41* | 5.86              | 2.29 | 4.96              | 4.73 | 2.40  |
| 175 | Haven    | Refuge        | 5.41  | 5.44              | 2.29 | 5.38              | 2.57 | .19   |
| 176 | Rebel    | Revolutionary | 5.40  | 5.34              | 3.13 | 5.46              | 2.05 | -0.37 |
| 177 | Soil     | Dirt          | 5.40  | 5.52              | 2.83 | 5.28              | 2.16 | .76   |
| 178 | Empire   | Kingdom       | 5.40  | 5.48              | 2.01 | 5.32              | 2.02 | .56   |
| 179 | Actor    | Performer     | 5.40  | 5.52              | 2.21 | 5.28              | 3.27 | .72   |
| 180 | Tribute  | Praise        | 5.40  | 5.42              | 1.43 | 5.38              | 1.87 | .16   |
| 181 | Version  | Rendition     | 5.39  | 5.40              | 2.00 | 5.38              | 2.40 | .07   |
| 182 | Belly    | Stomach       | 5.38  | 5.68              | 1.86 | 5.08              | 3.42 | 1.85  |
| 183 | Offer    | Bid           | 5.37  | 5.10              | 2.21 | 5.64              | 1.34 | -2.03 |
| 184 | Humor    | Wit           | 5.36  | 5.22              | 1.89 | 5.50              | 1.81 | -1.03 |
| 185 | Matter   | Substance     | 5.36  | 5.46              | 1.72 | 5.26              | 2.07 | .73   |
| 186 | Despair  | Hopelessness  | 5.36  | 5.32              | 2.75 | 5.40              | 2.45 | -0.25 |
| 187 | Meeting  | Assembly      | 5.35  | 5.18              | 1.82 | 5.52              | 1.23 | -1.37 |
| 188 | Holder   | Receptacle    | 5.35  | 5.12              | 2.11 | 5.58              | 2.00 | -1.60 |
| 189 | Target   | Goal          | 5.34  | 5.48              | 1.52 | 5.20              | 1.96 | 1.06  |
| 190 | Cruelty  | Brutality     | 5.34  | 5.04              | 2.16 | 5.64              | 2.03 | -2.07 |
| 191 | Index    | Listing       | 5.33  | 5.38              | 1.47 | 5.28              | 2.29 | .37   |
| 192 | Progress | Improvement   | 5.32  | 5.30              | 2.54 | 5.34              | 1.70 | -0.14 |
| 193 | Symbol   | Emblem        | 5.31  | 4.96              | 2.32 | 5.67 <sup>a</sup> | 1.43 | -2.58 |
| 194 | Stockade | Fort          | 5.31  | 5.42              | 1.96 | 5.20              | 3.02 | .70   |
| 195 | Legend   | Myth          | 5.31  | 5.06              | 2.83 | 5.56              | 1.80 | -1.64 |
| 196 | Senior   | Elder         | 5.30  | 5.32              | 1.65 | 5.28              | 2.74 | .14   |
| 197 | Razor    | Shaver        | 5.30  | 5.16              | 2.91 | 5.44              | 2.82 | -0.83 |
| 198 | Burden   | Load          | 5.29  | 5.48              | 1.72 | 5.10              | 2.46 | 1.31  |
| 199 | Anger    | Wrath         | 5.29  | 5.18 <sup>a</sup> | 2.78 | 5.40              | 2.37 | -0.67 |
| 200 | Parade   | Procession    | 5.28  | 5.32              | 2.06 | 5.24              | 3.00 | .25   |
| 201 | Increase | Enlargement   | 5.27  | 5.36              | 1.70 | 5.18              | 2.31 | .63   |
| 202 | Pressure | Force         | 5.27  | 5.24              | 3.08 | 5.30              | 2.66 | -0.18 |
| 203 | Bureau   | Department    | 5.27  | 5.42              | 1.39 | 5.12              | 3.13 | 1.00  |
| 204 | Comfort  | Consolation   | 5.26  | 4.86              | 2.69 | 5.66              | 1.98 | -2.62 |
| 205 | Manner   | Mode          | 5.26  | 5.22              | 2.18 | 5.30              | 1.68 | -0.29 |
| 206 | Mission  | Task          | 5.25* | 5.66              | 1.49 | 4.84              | 2.95 | 2.75  |

Table 1—Continued

| Rank | Word pair      | Grand mean | Forward mean | Forward variance | Backward mean     | Backward variance | <i>t</i> |
|------|----------------|------------|--------------|------------------|-------------------|-------------------|----------|
| 207  | Research       | 5.25       | 5.48         | 1.93             | 5.02              | 1.98              | 1.65     |
| 208  | Color          | 5.24       | 4.96         | 3.18             | 5.52              | 2.46              | -1.67    |
| 209  | Margin         | 5.23       | 5.04         | 1.79             | 5.42              | 2.17              | -1.35    |
| 210  | Muscle         | 5.22       | 4.88         | 2.64             | 5.56              | 2.37              | -2.15    |
| 211  | Marshal        | 5.21       | 5.34         | 2.56             | 5.08              | 2.65              | .81      |
| 212  | Contempt       | 5.20       | 4.96         | 2.94             | 5.44              | 2.33              | -1.48    |
| 213  | Defense        | 5.20       | 5.40         | 2.78             | 5.00              | 2.69              | 1.21     |
| 214  | Era            | 5.20*      | 5.80         | 1.92             | 4.60              | 2.37              | 4.10     |
| 215  | Magic          | 5.19*      | 4.64         | 2.52             | 5.74              | 2.28              | -3.55    |
| 216  | Hotel          | 5.19       | 5.18         | 2.35             | 5.20              | 3.10              | -0.06    |
| 217  | Sidewalk       | 5.19       | 5.12         | 2.60             | 5.26              | 2.52              | -0.44    |
| 218  | Heaven         | 5.18       | 4.96         | 3.26             | 5.40              | 3.14              | -1.23    |
| 219  | Gossip         | 5.16       | 5.02         | 2.63             | 5.30              | 2.58              | -0.87    |
| 220  | Lady           | 5.16       | 5.42         | 2.78             | 4.90              | 3.85              | 1.43     |
| 221  | Folly          | 5.16       | 5.12         | 2.31             | 5.20              | 2.82              | -0.25    |
| 222  | Minor          | 5.15       | 4.76         | 2.96             | 5.54              | 2.25              | -2.42    |
| 223  | Party          | 5.15       | 5.24         | 1.78             | 5.06              | 2.59              | .61      |
| 224  | Habit          | 5.14       | 4.92         | 3.42             | 5.36              | 2.15              | -1.32    |
| 225  | Reverse        | 5.14       | 4.90         | 3.52             | 5.38              | 2.24              | -1.41    |
| 226  | Reward         | 5.13       | 5.00         | 1.43             | 5.26              | 2.73              | -0.90    |
| 227  | College        | 5.12       | 5.12         | 2.60             | 5.12              | 3.74              | .00      |
| 228  | Spirit         | 5.11       | 4.86         | 1.96             | 5.36              | 2.72              | -1.63    |
| 229  | Output         | 5.10       | 5.34         | 3.21             | 4.86              | 3.76              | 1.29     |
| 230  | Savings        | 5.09       | 5.16         | 1.65             | 5.02              | 3.00              | .46      |
| 231  | Expert         | 5.09       | 5.18         | 2.19             | 5.00              | 3.02              | .56      |
| 232  | Effort         | 5.08       | 5.08         | 2.44             | 5.08              | 3.50              | .00      |
| 233  | Servant        | 5.08       | 4.88         | 2.60             | 5.28              | 2.74              | -1.22    |
| 234  | Soldier        | 5.07       | 5.20         | 2.20             | 4.94              | 3.04              | .80      |
| 235  | Jacket         | 5.07       | 5.16         | 2.63             | 4.98              | 2.51              | .56      |
| 236  | Lesson         | 5.07       | 5.04         | 1.71             | 5.10              | 2.46              | -0.21    |
| 237  | Disease        | 5.07*      | 5.58         | 1.84             | 4.56              | 1.84              | 3.76     |
| 238  | Fortune        | 5.07       | 5.28         | 1.84             | 4.86 <sup>c</sup> | 2.67              | 1.40     |
| 239  | Cluster        | 5.07       | 5.22         | 2.34             | 4.92              | 2.20              | 1.00     |
| 240  | Alarm          | 5.06       | 5.30         | 2.21             | 4.82              | 2.93              | 1.50     |
| 241  | Success        | 5.06       | 5.19         | 1.79             | 4.94              | 3.33              | .77      |
|      | Accomplishment |            |              |                  |                   |                   |          |

|     |          |                |       |                   |      |                   |      |       |
|-----|----------|----------------|-------|-------------------|------|-------------------|------|-------|
| 242 | Prospect | Likelihood     | 505   | 508               | 1.95 | 5.02              | 2.22 | .21   |
| 243 | Province | Territory      | 505   | 5.28              | 1.55 | 4.82              | 2.07 | 1.71  |
| 244 | Passage  | Corridor       | 503   | 502               | 1.94 | 5.04 <sup>a</sup> | 2.12 | -.007 |
| 245 | Patent   | Copyright      | 503   | 504               | 3.18 | 5.02              | 2.96 | .06   |
| 246 | Congress | Legislature    | 503   | 4.96              | 3.79 | 5.10              | 3.24 | -.037 |
| 247 | Power    | Strength       | 502   | 5.18              | 2.23 | 4.86              | 2.82 | 1.01  |
| 248 | Supply   | Provision      | 502   | 4.66              | 2.60 | 5.39 <sup>a</sup> | 1.66 | -.248 |
| 249 | Product  | Commodity      | 501   | 4.84              | 2.26 | 5.18              | 2.23 | -.113 |
| 250 | Puzzle   | Perplexity     | 500   | 4.76              | 2.80 | 5.24              | 1.70 | -.160 |
| 251 | Missile  | Projectile     | 500   | 5.28              | 2.00 | 4.72              | 3.80 | 1.64  |
| 252 | Mainland | Continent      | 500   | 4.88              | 2.97 | 5.12              | 2.88 | -.070 |
| 253 | Mirror   | Reflector      | 4.99  | 5.38              | 3.30 | 4.60              | 2.86 | 2.22  |
| 254 | Signal   | Sign           | 4.99  | 504               | 2.98 | 4.94              | 2.26 | .31   |
| 255 | Blanket  | Cover          | 4.99  | 5.28              | 1.47 | 4.70              | 2.83 | 1.98  |
| 256 | Village  | Hamlet         | 4.99  | 4.96 <sup>a</sup> | 2.41 | 5.02              | 3.28 | -.018 |
| 257 | Vapor    | Gas            | 4.98  | 5.12              | 3.05 | 4.84              | 2.79 | .82   |
| 258 | Token    | Memento        | 4.98  | 4.80              | 2.69 | 5.16              | 2.75 | -.109 |
| 259 | Merchant | Trader         | 4.98  | 4.86              | 2.65 | 5.10              | 2.05 | -.078 |
| 260 | Meaning  | Interpretation | 4.98  | 500               | 3.26 | 4.96              | 3.02 | .11   |
| 261 | Estate   | Property       | 4.97  | 5.34              | 2.23 | 4.60              | 3.71 | 2.15  |
| 262 | Elite    | Select         | 4.96* | 5.49 <sup>a</sup> | 1.80 | 4.44              | 2.70 | 3.48  |
| 263 | Virtue   | Merit          | 4.96  | 4.92              | 2.77 | 5.00              | 1.75 | -.027 |
| 264 | Device   | Tool           | 4.95  | 4.74              | 2.40 | 5.16              | 1.89 | -.143 |
| 265 | Notice   | Announcement   | 4.95  | 4.80              | 1.59 | 5.10              | 2.25 | -.108 |
| 266 | Partner  | Comrade        | 4.95  | 5.32              | 1.86 | 4.58              | 2.21 | 2.60  |
| 267 | Noble    | Aristocrat     | 4.94  | 4.92              | 2.28 | 4.96              | 3.06 | -.012 |
| 268 | Neglect  | Inattention    | 4.94  | 5.00              | 3.51 | 4.88              | 2.68 | .34   |
| 269 | Hollow   | Cavity         | 4.93  | 4.60              | 2.82 | 5.26              | 1.87 | -.216 |
| 270 | Sponsor  | Patron         | 4.92  | 5.02              | 3.28 | 4.82              | 3.54 | .54   |
| 271 | Bundle   | Package        | 4.92  | 4.88              | 2.11 | 4.96              | 2.69 | -.026 |
| 272 | Closet   | Cloakroom      | 4.92  | 4.86              | 3.14 | 4.98              | 3.73 | -.032 |
| 273 | Welcome  | Reception      | 4.92  | 4.78              | 2.62 | 5.06              | 1.81 | -.094 |
| 274 | Cafe     | Restaurant     | 4.91  | 4.90              | 2.25 | 4.92              | 1.87 | -.007 |
| 275 | Marriage | Wedding        | 4.91  | 4.56              | 5.03 | 5.26              | 3.54 | -.169 |
| 276 | Patrol   | Sentry         | 4.90  | 4.92 <sup>a</sup> | 2.91 | 4.88              | 1.98 | .12   |

Table 1—Continued

| Rank | Word pair | Grand mean | Forward mean      | Forward variance | Backward mean     | Backward variance | t     |
|------|-----------|------------|-------------------|------------------|-------------------|-------------------|-------|
| 277  | Beauty    | 4.89       | 4.94              | 2.10             | 4.84              | 2.18              | .34   |
| 278  | License   | 4.88       | 4.92              | 2.73             | 4.84              | 2.99              | .24   |
| 279  | Insight   | 4.87       | 4.50              | 2.62             | 5.24              | 3.00              | -2.21 |
| 280  | Random    | 4.87       | 4.70              | 3.72             | 5.04              | 2.86              | -0.94 |
| 281  | Weakness  | 4.87       | 4.48              | 3.52             | 5.26              | 2.20              | -2.31 |
| 282  | Factor    | 4.86       | 4.94              | 2.79             | 4.78              | 2.13              | .51   |
| 283  | Racial    | 4.85       | 4.66              | 4.19             | 5.04              | 3.59              | -0.96 |
| 284  | Liquor    | 4.85       | 5.04              | 2.49             | 4.66              | 3.66              | 1.08  |
| 285  | Circle    | 4.82       | 4.78              | 1.93             | 4.86 <sup>a</sup> | 2.12              | -0.27 |
| 286  | Baton     | 4.81       | 4.80              | 2.65             | 4.82              | 2.64              | -0.06 |
| 287  | Effect    | 4.81       | 4.62              | 3.10             | 5.00              | 2.98              | -1.09 |
| 288  | Symptom   | 4.81*      | 5.32              | 1.49             | 4.30              | 1.97              | 3.88  |
| 289  | Judgment  | 4.80       | 4.62              | 2.44             | 4.98              | 2.35              | -1.16 |
| 290  | Campaign  | 4.80       | 4.78              | 2.05             | 4.82              | 2.44              | -0.13 |
| 291  | Tourist   | 4.80       | 4.88              | 2.23             | 4.72              | 2.16              | .54   |
| 292  | Decay     | 4.79       | 4.66              | 2.19             | 4.92              | 1.99              | -0.90 |
| 293  | Journal   | 4.78       | 4.94              | 2.34             | 4.62              | 2.36              | 1.04  |
| 294  | Limit     | 4.78       | 4.86              | 3.39             | 4.70              | 3.60              | .43   |
| 295  | Report    | 4.78       | 4.90              | 2.21             | 4.66              | 2.51              | .78   |
| 296  | Victim    | 4.78       | 4.46              | 3.19             | 5.10              | 3.48              | -1.75 |
| 297  | Spectrum  | 4.77       | 4.76              | 3.25             | 4.78              | 2.87              | -0.06 |
| 298  | Distress  | 4.77       | 4.70              | 3.19             | 4.84              | 3.69              | -0.38 |
| 299  | Market    | 4.76       | 4.72              | 1.55             | 4.80              | 1.96              | -0.30 |
| 300  | Placement | 4.76       | 4.90              | 1.81             | 4.62              | 2.28              | .98   |
| 301  | Voyage    | 4.76       | 4.40              | 2.90             | 5.12              | 2.43              | -2.20 |
| 302  | Statement | 4.75       | 4.64              | 2.77             | 4.86              | 2.37              | -0.69 |
| 303  | Doctrine  | 4.75       | 5.10              | 2.01             | 4.39 <sup>a</sup> | 3.41              | 2.15  |
| 304  | Static    | 4.74       | 4.78              | 3.11             | 4.70              | 2.62              | .24   |
| 305  | Model     | 4.73       | 4.60              | 3.43             | 4.86              | 2.49              | -0.76 |
| 306  | Pension   | 4.72       | 4.53 <sup>a</sup> | 2.13             | 4.92 <sup>a</sup> | 1.91              | -1.35 |
| 307  | Harvest   | 4.72       | 4.54              | 3.27             | 4.90              | 2.54              | -1.06 |
| 308  | Hunger    | 4.71*      | 4.24              | 3.00             | 5.18              | 3.25              | -2.66 |
| 309  | Object    | 4.71       | 4.78              | 2.79             | 4.64              | 1.70              | .47   |
| 310  | Rhythm    | 4.71       | 4.58              | 2.53             | 4.84              | 3.40              | -0.75 |
| 311  | Warrant   | 4.71       | 4.68              | 2.14             | 4.74 <sup>a</sup> | 3.41              | -0.16 |

|     |           |               |       |      |                   |      |       |
|-----|-----------|---------------|-------|------|-------------------|------|-------|
| 312 | Thickness | Density       | 4.46  | 3.97 | 4.94              | 4.87 | -1.14 |
| 313 | Sample    | Example       | 4.70  | 3.10 | 5.00              | 2.20 | -1.84 |
| 314 | Fiber     | Thread        | 4.70  | 1.99 | 4.48              | 2.38 | 1.49  |
| 315 | Dwelling  | Shelter       | 4.68  | 1.44 | 4.92              | 1.91 | -1.86 |
| 316 | Practice  | Training      | 4.68  | 2.87 | 4.84              | 2.87 | -0.94 |
| 317 | Handle    | Grip          | 4.67  | 2.61 | 4.74              | 3.05 | -0.42 |
| 318 | Sculpture | Statue        | 4.66  | 2.79 | 4.64              | 2.89 | .12   |
| 319 | Serum     | Antitoxin     | 4.66  | 2.91 | 4.53 <sup>a</sup> | 3.88 | .67   |
| 320 | Concert   | Recital       | 4.66* | 2.35 | 5.08              | 2.69 | -2.65 |
| 321 | Whisper   | Murmur        | 4.66  | 2.82 | 4.92              | 2.24 | -1.64 |
| 322 | Figure    | Form          | 4.65  | 2.38 | 4.36              | 2.24 | 1.91  |
| 323 | Prestige  | Importance    | 4.65  | 2.25 | 4.20              | 2.86 | 2.81  |
| 324 | Regard    | Respect       | 4.64  | 3.55 | 4.88              | 1.98 | -1.44 |
| 325 | Sanction  | Authorization | 4.64  | 2.03 | 4.64              | 2.77 | .00   |
| 326 | Paper     | Stationery    | 4.64  | 3.27 | 4.82              | 2.60 | -1.05 |
| 327 | Award     | Trophy        | 4.64  | 2.76 | 5.04              | 2.69 | -2.42 |
| 328 | Artist    | Craftsman     | 4.64  | 2.74 | 4.82              | 3.46 | -1.02 |
| 329 | Cabin     | Cottage       | 4.61  | 2.61 | 4.60              | 2.37 | .06   |
| 330 | Profile   | Outline       | 4.61  | 3.03 | 4.76              | 2.06 | -0.94 |
| 331 | Knowledge | Information   | 4.59  | 2.36 | 4.92              | 2.73 | -2.07 |
| 332 | Creature  | Animal        | 4.59  | 2.37 | 4.46              | 3.03 | .79   |
| 333 | Address   | Speech        | 4.59  | 2.67 | 4.50              | 3.11 | .53   |
| 334 | Bearing   | Direction     | 4.58  | 2.66 | 4.62              | 2.69 | -0.24 |
| 335 | Platform  | Rostrum       | 4.58  | 2.78 | 4.62              | 1.87 | -0.26 |
| 336 | Species   | Type          | 4.57* | 2.45 | 4.10              | 2.42 | 3.01  |
| 337 | Threshold | Doorsill      | 4.56  | 3.05 | 4.94              | 3.16 | -2.16 |
| 338 | Relief    | Help          | 4.54  | 2.11 | 4.26              | 2.40 | 1.86  |
| 339 | Request   | Petition      | 4.54  | 2.03 | 4.82              | 3.25 | -1.72 |
| 340 | Poem      | Verse         | 4.54  | 1.75 | 4.34              | 2.84 | 1.32  |
| 341 | Lightning | Thunderbolt   | 4.52  | 6.04 | 4.90              | 5.32 | -1.59 |
| 342 | Presence  | Existence     | 4.52  | 3.06 | 4.32              | 3.69 | 1.09  |
| 343 | Laughter  | Chuckle       | 4.51  | 2.30 | 4.80              | 2.37 | -1.90 |
| 344 | Project   | Enterprise    | 4.50  | 2.90 | 4.58              | 1.96 | -0.51 |
| 345 | Window    | Porthole      | 4.49  | 3.44 | 4.88              | 2.43 | -2.28 |
| 346 | Venture   | Speculation   | 4.49  | 2.78 | 4.46              | 2.38 | .19   |

Table 1—Continued

| Rank | Word pair | Grand mean | Forward mean | Forward variance | Backward mean | Backward variance | <i>t</i> |
|------|-----------|------------|--------------|------------------|---------------|-------------------|----------|
| 347  | Rescue    | 4.48       | 4.52         | 3.15             | 4.44          | 2.58              | .24      |
| 348  | Harbor    | 4.47       | 4.46         | 2.70             | 4.48          | 2.83              | −0.06    |
| 349  | Temple    | 4.46       | 4.76         | 3.66             | 4.16          | 3.81              | 1.55     |
| 350  | Costume   | 4.45       | 4.36         | 3.58             | 4.54          | 2.50              | −0.52    |
| 351  | Mixture   | 4.44       | 4.44         | 4.09             | 4.44          | 3.60              | .00      |
| 352  | Stature   | 4.44       | 4.36         | 2.52             | 4.52          | 2.34              | −0.51    |
| 353  | Premier   | 4.43       | 4.18         | 2.88             | 4.68          | 3.45              | −1.41    |
| 354  | Trial     | 4.43       | 4.32         | 3.98             | 4.54          | 2.87              | −0.59    |
| 355  | Wonder    | 4.42       | 4.06         | 2.83             | 4.78          | 2.79              | −2.15    |
| 356  | Message   | 4.42       | 4.38         | 1.91             | 4.46          | 2.25              | −0.28    |
| 357  | Critic    | 4.41       | 4.28         | 2.66             | 4.54          | 1.93              | −0.86    |
| 358  | Charter   | 4.41       | 4.12         | 2.60             | 4.70          | 1.89              | −1.94    |
| 359  | Demand    | 4.41       | 4.72         | 2.41             | 4.10          | 3.19              | 1.85     |
| 360  | Treatment | 4.40*      | 3.86         | 3.88             | 4.94          | 1.94              | −3.17    |
| 361  | Recruit   | 4.39       | 4.66         | 3.21             | 4.12          | 5.13              | 1.32     |
| 362  | Suspect   | 4.39       | 4.04         | 3.88             | 4.74          | 3.01              | −1.89    |
| 363  | Drama     | 4.38       | 4.54         | 3.19             | 4.22          | 3.20              | .90      |
| 364  | Swimming  | 4.36       | 4.30         | 3.36             | 4.42          | 2.66              | −0.35    |
| 365  | Glory     | 4.36       | 4.16         | 3.44             | 4.56          | 3.80              | −1.05    |
| 366  | Secret    | 4.35       | 4.28         | 2.98             | 4.42          | 2.62              | −0.42    |
| 367  | Vacuum    | 4.35       | 4.16         | 4.18             | 4.54          | 4.21              | −0.93    |
| 368  | Temper    | 4.34       | 4.52         | 3.93             | 4.16          | 2.83              | .98      |
| 369  | Panic     | 4.33       | 4.48         | 3.11             | 4.18          | 3.33              | .84      |
| 370  | Flavor    | 4.33       | 4.08         | 3.10             | 4.58          | 4.04              | −1.32    |
| 371  | Exchange  | 4.32       | 4.32         | 3.32             | 4.32          | 3.24              | .00      |
| 372  | Structure | 4.32       | 4.20         | 3.63             | 4.44          | 2.78              | −0.67    |
| 373  | Shower    | 4.31       | 4.52         | 3.07             | 4.10          | 2.79              | 1.23     |
| 374  | Honey     | 4.31**     | 3.68         | 2.55             | 4.94          | 3.16              | −3.73    |
| 375  | Transit   | 4.31*      | 4.82         | 2.35             | 3.80          | 2.74              | 3.20     |
| 376  | Weapon    | 4.31       | 4.30         | 4.58             | 4.32          | 3.00              | −0.05    |
| 377  | Leather   | 4.30       | 4.46         | 2.99             | 4.14          | 3.55              | .88      |
| 378  | Stranger  | 4.30*      | 3.90         | 4.09             | 4.70          | 2.87              | −2.14    |
| 379  | Agent     | 4.29       | 4.10         | 2.38             | 4.48          | 3.64              | −1.10    |
| 380  | Distance  | 4.28*      | 3.84         | 3.36             | 4.72          | 2.94              | −2.48    |
| 381  | Stable    | 4.28       | 4.62         | 3.06             | 3.94          | 2.51              | 2.04     |

|     |          |               |       |      |      |      |      |       |
|-----|----------|---------------|-------|------|------|------|------|-------|
| 382 | Retreat  | Recoil        | 4.27  | 4.52 | 2.25 | 4.02 | 3.45 | 1.48  |
| 383 | Concrete | Pavement      | 4.27  | 4.32 | 3.37 | 4.22 | 3.52 | .27   |
| 384 | Finance  | Economics     | 4.26  | 4.20 | 2.74 | 4.32 | 3.61 | -.034 |
| 385 | Pity     | Compassion    | 4.25  | 4.48 | 2.17 | 4.02 | 3.12 | 1.41  |
| 386 | Weather  | Climate       | 4.25* | 3.82 | 3.95 | 4.68 | 3.49 | -.223 |
| 387 | Valley   | Ravine        | 4.24  | 4.18 | 3.05 | 4.30 | 2.95 | -.035 |
| 388 | Letter   | Note          | 4.24  | 4.22 | 2.30 | 4.26 | 2.32 | -.013 |
| 389 | Timber   | Tree          | 4.21  | 4.34 | 2.92 | 4.08 | 2.32 | .80   |
| 390 | Salesman | Clerk         | 4.20  | 4.16 | 2.18 | 4.24 | 4.14 | -.022 |
| 391 | Collar   | Neckband      | 4.19  | 4.48 | 4.17 | 3.90 | 4.01 | 1.43  |
| 392 | Sewer    | Drain         | 4.18  | 4.44 | 2.13 | 3.92 | 2.48 | 1.71  |
| 393 | Impact   | Collision     | 4.18  | 4.22 | 2.87 | 4.14 | 3.35 | .23   |
| 394 | Fury     | Frenzy        | 4.15  | 3.94 | 3.12 | 4.36 | 2.93 | -.121 |
| 395 | Tenure   | Term          | 4.15  | 4.20 | 3.14 | 4.10 | 3.32 | .28   |
| 396 | Pollen   | Spore         | 4.14  | 3.98 | 3.53 | 4.30 | 3.28 | -.087 |
| 397 | Defeat   | Failure       | 4.13  | 3.76 | 3.00 | 4.50 | 3.72 | -.202 |
| 398 | Wisdom   | Intelligence  | 4.12  | 3.94 | 3.08 | 4.30 | 3.64 | -.098 |
| 399 | Unit     | One           | 4.11  | 4.12 | 3.78 | 4.10 | 4.13 | .05   |
| 400 | Desert   | Wasteland     | 4.11  | 4.26 | 3.22 | 3.96 | 4.00 | .79   |
| 401 | Virus    | Infection     | 4.10  | 4.04 | 3.47 | 4.16 | 2.99 | -.033 |
| 402 | Novel    | Book          | 4.09  | 4.00 | 4.53 | 4.18 | 3.70 | -.044 |
| 403 | Routine  | System        | 4.08  | 4.08 | 3.50 | 4.08 | 3.54 | .00   |
| 404 | Problem  | Issue         | 4.08  | 4.08 | 3.75 | 4.08 | 2.85 | .00   |
| 405 | Recall   | Retraction    | 4.07  | 3.74 | 3.71 | 4.40 | 3.14 | -.178 |
| 406 | Romance  | Affair        | 4.05  | 3.84 | 2.83 | 4.26 | 2.48 | -.129 |
| 407 | Resolve  | Determination | 4.03  | 4.26 | 3.67 | 3.80 | 3.92 | 1.18  |
| 408 | Music    | Melody        | 4.03  | 3.82 | 2.44 | 4.24 | 2.76 | -.130 |
| 409 | Tower    | Turret        | 4.03  | 3.96 | 2.81 | 4.10 | 3.32 | -.040 |
| 410 | Plastic  | Synthetic     | 4.02  | 4.36 | 3.46 | 3.68 | 3.32 | 1.85  |
| 411 | Garbage  | Sewage        | 4.02  | 3.80 | 2.98 | 4.24 | 3.82 | -.119 |
| 412 | Rally    | Gathering     | 4.01  | 4.34 | 2.88 | 3.68 | 3.08 | 1.91  |
| 413 | Debate   | Discussion    | 4.00  | 4.12 | 2.43 | 3.88 | 3.41 | .70   |
| 414 | Mayor    | Magistrate    | 3.97  | 4.04 | 2.86 | 3.90 | 3.40 | .40   |
| 415 | Tackle   | Gear          | 3.96  | 4.22 | 4.62 | 3.70 | 3.28 | 1.31  |
| 416 | Waiter   | Attendant     | 3.96  | 4.12 | 3.25 | 3.80 | 2.08 | .98   |

Table 1—Continued

| Rank | Word pair | Grand mean | Forward mean | Forward variance | Backward mean     | Backward variance | t     |
|------|-----------|------------|--------------|------------------|-------------------|-------------------|-------|
| 417  | Leader    | 3.95       | 3.68         | 3.12             | 4.22              | 5.07              | -1.33 |
| 418  | Porter    | 3.95       | 4.16         | 2.50             | 3.74              | 2.20              | 1.37  |
| 419  | Button    | 3.95       | 4.08         | 3.54             | 3.82              | 2.27              | .76   |
| 420  | Support   | 3.94       | 3.62         | 2.28             | 4.26              | 2.32              | -2.11 |
| 421  | Native    | 3.87**     | 3.22         | 3.24             | 4.52              | 3.76              | -3.47 |
| 422  | Nature    | 3.87       | 3.88         | 3.54             | 3.86              | 3.63              | .05   |
| 423  | Ticket    | 3.87       | 4.02         | 3.12             | 3.72              | 3.19              | .84   |
| 424  | Pony      | 3.85       | 3.96         | 3.26             | 3.74              | 3.30              | .61   |
| 425  | Shadow    | 3.84       | 3.90         | 3.52             | 3.78              | 3.24              | .33   |
| 426  | Record    | 3.84       | 3.84         | 3.40             | 3.84              | 3.20              | .00   |
| 427  | Neighbor  | 3.83       | 3.64         | 2.93             | 4.02              | 4.18              | -1.01 |
| 428  | Title     | 3.83       | 3.70         | 3.89             | 3.96              | 3.75              | -0.67 |
| 429  | Panel     | 3.81       | 3.80         | 2.16             | 3.82              | 3.46              | -0.06 |
| 430  | Equal     | 3.81       | 3.78         | 2.58             | 3.84              | 3.97              | -0.17 |
| 431  | Essay     | 3.79       | 3.48         | 2.58             | 4.10              | 2.75              | -1.90 |
| 432  | Cement    | 3.74       | 3.52         | 3.32             | 3.96              | 3.06              | -1.23 |
| 433  | Perfume   | 3.74       | 3.70         | 3.19             | 3.78              | 2.30              | -0.24 |
| 434  | Powder    | 3.73       | 3.86         | 3.31             | 3.60              | 3.55              | .70   |
| 435  | Counter   | 3.73       | 3.82         | 3.29             | 3.64              | 2.72              | .52   |
| 436  | River     | 3.67       | 3.82         | 2.27             | 3.52              | 3.36              | .89   |
| 437  | Portrait  | 3.64       | 3.88         | 3.50             | 3.40              | 2.57              | 1.38  |
| 438  | Context   | 3.62       | 3.94         | 2.91             | 3.30              | 2.99              | 1.86  |
| 439  | Anchor    | 3.61*      | 4.10         | 3.44             | 3.12              | 2.72              | 2.79  |
| 440  | Entrance  | 3.58       | 3.26         | 2.69             | 3.90              | 3.85              | -1.77 |
| 441  | Volume    | 3.56       | 3.34         | 3.00             | 3.78              | 2.95              | -1.27 |
| 442  | Sentence  | 3.55       | 3.46         | 3.23             | 3.64              | 3.01              | -0.51 |
| 443  | Solid     | 3.53       | 3.22         | 3.64             | 3.84              | 4.42              | -1.54 |
| 444  | Mountain  | 3.52       | 3.38         | 3.79             | 3.66              | 3.58              | -0.73 |
| 445  | Worry     | 3.50       | 3.62         | 2.53             | 3.38              | 2.81              | .73   |
| 446  | Veto      | 3.49       | 3.54         | 3.07             | 3.44              | 3.27              | .28   |
| 447  | City      | 3.40*      | 3.04         | 3.59             | 3.76              | 3.08              | -1.97 |
| 448  | Saddle    | 3.39       | 3.68         | 3.57             | 3.10 <sup>a</sup> | 2.68              | 1.63  |
| 449  | Ribbon    | 3.39       | 3.18         | 2.76             | 3.60              | 2.53              | -1.29 |
| 450  | Member    | 3.35       | 3.08         | 2.85             | 3.62              | 2.65              | -1.63 |
| 451  | Trustee   | 3.34       | 3.24         | 2.68             | 3.44              | 2.29              | -0.63 |



$${}^a N = 49.$$

conservative to select a set of synonym pairs that have small  $t$  scores.

The  $t$  scores also can be used to determine whether a significant number of the synonym pairs exhibit directional effects. Using the criterion of  $p < 0.05$ , we would expect 23.2 of the  $t$  scores to exceed an absolute value of 1.99 by chance alone, but 65 such  $t$  scores were observed. This difference is significant ( $X^2 = 79.27$ ,  $df = 1$ ,  $p < \sim 0.001$ ), and confirms the hypothesis that perceived synonymy can be affected by word order.

To select those word pairs that showed significant directional effects, a linear regression of the forward order means on the backward order means was computed. Forward and backward order means were highly correlated ( $r = .894$ ) and the resulting least squares regression line was described by:  $\hat{y} = .892X + .508$  where  $\hat{y}$  = the forward mean and  $X$  = the backward mean. The standard error of estimate of this line was .400. Predictions for the 21 word pairs whose grand means are marked with asterisks in Table 1 showed significant deviations from this regression line. A deviation of two to three standard error of estimate units is demarked by a single asterisk and a deviation that exceeds three units is indicated by two asterisks.

#### DISCUSSION

Each of the word pairs in Table 1 is listed as a synonym pair by standard references, but the wide range of mean synonym ratings shows clearly that some pairs are much better synonyms than others. The low ratings assigned to the worst synonyms in Table 1 do not indicate that these pairs are not synonyms, but mean that these pairs are poor synonyms relative to other synonyms in the study. It is likely that these poor synonyms would receive higher ratings if judged within the context of nonsynonym pairs.

The finding that perceived synonymy can be affected by word encoding order in the minimal context situation of a synonym rating

task raises a number of interesting questions about the cause of these directional effects as they relate to storage, retrieval, and comparison processes in semantic memory. Ideally, a judgment of synonymy would be based upon a comprehensive comparison of all attributes of both words. The existence of encoding-order effects demonstrates that this is not always the case, however. Given that semantic memory access is incomplete we can ask, what factors determine the direction and extent of semantic memory access? Exactly how do the encoding-order effects arise? Although the present study was not designed to answer these questions, research directed toward such questions should help clarify our conceptualizations of semantic memory processes.

At this time the major theoretical implication of encoding-order effects is that access to the mental lexicon is limited such that access to one sense of a word short-circuits the search for alternative encodings. An interesting question is, to what extent is this short-circuiting avoidable? For ordinary language processing, it may be optimal or economical to stop lexical access after the initial encoding. However, the synonym rating task requires subjects to search extensively in order to evaluate the synonymy of two words, and effects of encoding order were still found. At this point, two alternatives seem equally likely. On the one hand, some amount of short-circuiting may be unavoidable. Once a particular sense of a word is encoded the person may be trapped by a sort of "functional fixedness" where alternative senses of the word are blocked from consciousness. On the other hand, subjects may be choosing to stop lexical search after some particular amount of effort or time has been expended.

The major practical implication of encoding-order effects is that the poor choice of stimulus materials may lead to confusing experimental results. The norms presented here should be extensive enough to guide the selection of highly rated bidirectional syn-

onyms for a wide variety of studies of human memory and language comprehension.

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