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Magnitude estimation of imagery

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Magnitude estimates of imagery for 47 nouns correlated highly (r = .948) with the rating scale values of Paivio, Yuille, and Madigan (1968).

One important aspect of contemporary cognitive psychology involves a determination of the ways in which information is coded in memory (e.g., Paivio, 1975a, b). A large amount of current evidence demonstrates the importance of imaginal codes in a variety of cognitive tasks (for summaries of this work, see Paivio, 1971, 1975a, b). Paivio, Yuille, and Madigan (1968) provided some of the normative data necessary for examining the role of imagery in cognition by determining the imagery values of 925 nouns. Paivio et al. used a seven-point rating scale procedure to assess imagery, and they report that their values correlate highly with the imagery values obtained in earlier work that also used the rating technique. In the study reported below, we scaled imagery by another psychophysical procedure, magnitude estimation, and correlated the resulting values with those reported by Paivio et al. (1968).

METHOD

Subjects

Fourteen male students at Washington and Lee University participated as part of a class project in introductory psychology.

Stimuli

The 47 nouns chosen from the Paivio et al. (1968) norms appear in Table 1 along with their imagery values determined by the rating scale procedure. The words were selected so that they represented the entire range of rating scale values. Whenever a choice was possible, words with the smallest SDs were chosen for the current sample.

Procedure

Following practice on estimating the magnitude of lines of different length, the students received a mimeographed form that contained the description of imagery used by Paivio et al. (1968). Also on the form were the following instructions for the magnitude estimation of imagery: "You will be read a list of nouns, and your task is to assign a number proportional to the ease or difficulty with which a word arouses imagery. Use any number you find necessary–fraction, whole number, or decimal–but try to keep the numbers proportional to imagery. If one word arouses imagery twice as easily as another, the number you assign to one should be twice as large as the number you assign to the other. The words that arouse mental images most readily should be given high numbers; words that arouse images with difficulty should be given low numbers; words that are intermediate in ease or difficulty of imagery should, of course, be rated approximately between the two extremes. Feel free to use a wide range of numbers; at the same time, however, don't be concerned about how often you use a particular number as long as it is your true judgment of the ease or difficulty of arousing a mental image.

"As the words are read, write the number in the appropriate blank space that is your best estimate of the ease or difficulty with which that word arouses a mental image."

Two different random orders of the words were prepared, and each order was presented to half the students. Testing occurred in groups, and the words were read at a 5-sec rate.

Table 1
Mean Imagery Values by Rating and Magnitude Estimation

Noun	Paivio Rating	Magnitude Estimate	Noun	Paivio Rating	Magnitude Estimate	Noun	Paivio Rating	Magnitude Estimate
elephant	6.83	8.83	victory	4.93	4.63	knowledge	2.97	2.53
lemon	6.83	7.66	infection	4.87	4.91	gender	2.90	3.38
cigar	6.80	8.43	fortune	4.57	4.50	belief	2.73	2.10
acrobat	6.53	6.85	humor	4.57	4.53	elaboration	2.63	1.94
palace	6.50	7.81	code	4.53	4.99	situation	2.53	3.05
spray	6.17	5.25	kindness	4.20	3.30	fate	2.37	2.44
troops	6.13	6.98	research	4.13	3.17	tendency	2.20	1.45
nursery	6.10	6.83	madness	4.03	4.54	context	2.13	2.13
hamlet	5.87	5.42	vanity	3.83	2.60	instance	2.00	2.10
industry	5.77	4.96	recognition	3.60	2.18	gist	1.97	1.43
weapon	5.70	6.35	tribute	3.57	3.09	concept	1.93	1.82
bloom	5.63	6.10	greed	3.53	2.52	impropriety	1.87	1.26
agony	5.43	5.56	pact	3.50	3.42	criterion	1.83	1.66
destruction	5.27	5.75	welfare	3.17	3.50	functionary	1.77	1.18
harness	5.10	6.41	upkeep	3.07	2.60	surtax	1.63	2.34
victim	5.07	5.37	jeopardy	3.03	2.59			

RESULTS AND DISCUSSION

The geometric mean of the magnitude estimations for each of the words was computed by the procedure outlined by Engen (1971). To facilitate comparison with the rating scale values from Paivio et al. (1968), these geometric means were multiplied by a constant to equate the overall mean magnitude estimation to the overall mean rating for these words (M = 4.09). Table 1 shows the adjusted mean magnitude estimation for the 47 nouns in our sample.

The two measures of imagery shown in Table 1, magnitude estimation and ratings from Paivio et al. (1968) are strongly related [$r(45) = .948$, $p < .0001$]. The high correlation between these two measures of imagery is important for at least two reasons. In the first place, the close correspondence in imagery obtained under the two psychophysical methods suggests the existence of a common underlying psychological metric (e.g., Calfee, 1975). In the second place, the present results provide some generality for the normative data collected by Paivio et al. (1968) and, therefore, lend further support for the extensive use of these norms.

The size of the obtained correlation is particularly impressive since our data were collected from different subjects than were used to provide the rating data, at a different time, and in a different location. Furthermore, our subjects had had extensive practice using imagery/rhyme mnemonic devices prior to making their magnitude estimations of imagery.

In spite of the overall high agreement, there are some systematic differences between the two measures. The mean magnitude estimation of words above the mean Paivio et al. (1968) rating tend to be higher than the values derived from rating. This was true for 15 of 23 nouns, and the discrepancies were among the largest for four of the five most highly rated words: *elephant, lemon, cigar,* and *palace.* Apparently, the rating procedure tends to compress the upper end of the imagery scale, resulting in an underestimation of both the imagery value of words capable of evoking strong images and the differences in imagery value among those words. Conversely, for words that do not evoke strong images, mean magnitude estimations tend to be lower than mean ratings. This held true 16 out of 24 times, suggesting that subjects in the rating task were unable to assign low enough imagery values to words that do not evoke strong mental images.

In addition to systematic differences between the two scales, the differences between scores of a few words were unexpectedly large. For example, the words *vanity, recognition,* and *greed,* which all had rating values near the mean, received considerably lower magnitude estimates. This indicates that caution may be required when using the original norms, and that it may be desirable to have a local sample rerate some portion of the original list.

Notwithstanding the previous caution, we would like to suggest two things: (1) There is a measurable imagery metric; and (2) additional work on imagery (such as local rescaling) may as well use the rating technique since, compared to magnitude estimation, the rating task is less demanding on the subjects and easier to work with mathematically. Of course, our data do indicate that the magnitude estimation procedure may be more sensitive than the rating technique; therefore, magnitude estimation probably should be used when a small range of imagery values is examined.

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