MAGEST: A FORTRAN program for analyzing magnitude estimation data

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The method of magnitude estimation has been used extensively in perceptual psychophysics (Stevens, 1975), attitude scaling (Welch, 1971), and, more recently, in psychophysical research on memory for perceptual continua (Moyer, Bradley, Sorensen, Whiting, & Mansfield, 1978; Kerst & Howard, 1978). Since the analysis of magnitude estimation data requires a log transformation of the geometric means of subjects' estimates, and since additional statistics and transformations may be desirable, it is difficult to find one packaged program that handles all aspects of this type of data analysis.

This abstract describes a computer program, MAGEST, which analyzes data from magnitude estimation experiments.

Description. The program computes the exponent (n) and the scaling factor (K) of the power function:

$$\psi = K\phi^n. \quad (1)$$

It also provides an indication of its goodness of fit (Pearson r), and calculates other statistics used for data plotting and further analysis. The parameters and the fit of the power function are computed for each individual subject, as well as for overall group data. This is done by the usual means of applying the method of least squares to determine the slope and intercept of the linear equation relating log stimulus values and log geometric mean estimates. In this equation, the slope is equal to the exponent (n) of the power function and the intercept is equal to the scaling factor (K) (Stevens, 1975).

To allow a test for the significance of a difference between exponents from different experimental groups, the residuals of the regression equation and the sum of the squared deviations about the mean of the physical magnitudes are calculated. So that the variability of estimates can be compared for each stimulus, the relative error (the standard deviation divided by the mean) is computed (Baird, 1970). To allow the analysis of estimate variability even when a different modulus is used for each subject or trial block, or when no stan-

dard is given, the program yields transformed estimates which correspond to a common modulus (Stevens, 1975). Modulus equalization is done by making the mean of the log estimates for each trial block equal to the grand mean of the log estimates. This is accomplished by adding the difference between this grand mean and the trial block mean to each log estimate within a particular trial block. These transformed estimates can then be treated as input data on a second run for inspection of the variability of the magnitude estimates. For data plotting purposes, the geometric mean and log geometric mean of subjects' estimates are printed out for each stimulus for each individual and for the overall group data.

Input. MAGEST requires the user to specify: (1) whether the program is to be used interactively, (2) the title of the run, (3) the format of the input data, (4) the number of stimuli, (5) the number of trial blocks, and (6) the actual values of the stimuli.

Output. The statistics listed in the program description noted above are output to the device selected by the user at run time. The transformed estimates are also output in a separate file without labels or headings, so that they can be used as input data on a later run.

User Options. MAGEST may be used interactively or in batch processing. When multiple trial blocks are used, data from a single trial block may be analyzed by specifying in the format statement that certain lines (trial blocks) of data are to be skipped; that is, (6F///) causes only data from the first of four trial blocks to be analyzed. The use of the transformed scores is optional.

Limitations. Data from as many as 30 subjects, 15 stimuli, and 10 blocks of trials can be analyzed. These limits can easily be altered by changing the dimension statements.

Computer and Language. The program MAGEST is written in standard FORTRAN IV to provide as much machine independence as possible. It has been run on a DECsystem-1090 computer.

Time Requirements. CPU time for processing the data from 10 subjects, four trial blocks, and six stimuli is .94 sec. Twenty thousand words of core (36 bits/word) are required with the limits specified above.

Availability. A listing of the program, documentation, and a sample of the output are available at no cost from Stephen M. Kerst, Boys Town Center, Catholic University, Washington, D.C. 20064.

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