PROGRAM ABSTRACTS/ALGORITHMS

SCHUBRAD: The comparison of the sensitivities of similar experiments

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In an elegant but seldom cited series of papers, Schumann and Bradley (Bradley & Schumann, 1957a, 1957b; Schumann & Bradley, 1959) developed a statistical test for comparing the sensitivities of similar experiments. The test applies null-hypothesis testing logic to the question of whether two F-ratios from separate experiments may be regarded as equal in magnitude. Thus, the test measures strength of effect in a comparative sense. The basic statistic is the ratio of the F-ratios, whose expected value is one if the null hypothesis is true. Bradley and Schumann (1957b) derived the distribution of this test statistic.

The Schumann-Bradley procedure is not subject to the incisive criticisms (O'Grady, 1982) of the better known strength-of-effect measures, which are based upon proportion of variance accounted for (Hays, 1963). The major limitation of the procedure is that it requires the experiments to be similar in structure; that is, they should have the same number of factors, levels per factor, and observations per cell. A typical behavioral application is to have a set of judges rate the same set of stimuli several times using two response modes. Each response mode is regarded as a separate experiment. The F-ratio for stimuli then measures the sensitivity (i.e., discriminating power) of the response mode, and the Schumann-Bradley procedure determines whether one response mode is significantly more sensitive than the other.

Alternately, the Schumann-Bradley procedure may be used to compare the multiple correlation coefficients (R^2) in two similar regression experiments. This is useful because R^2 is often used as a measure of the proportion of variation in the dependent variable associated with regression on the independent variables.

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Schumann and Bradley (1959) furnished a table of the critical values of their test statistic, which is called W_o . The table has been expanded by Meeker and Hahn (1980), whose values are used for SCHUBRAD, along with an interpolation routine. Standard hypothesis-testing terminology regarding alpha level and one-tailed versus two-tailed tests is employed. One simply compares W_o from the table with W_{obs} (the ratio of the F-ratios or R^2 s) from the data; if W_{obs} is larger, the null hypothesis is rejected.

For the F-ratio comparison, the program user inputs the two F-ratios and the associated dfs, and indicates whether the F-ratios were based on independent groups or repeated measures. For the comparison of multiple correlation coefficients, the two values of R^2 and the two sets of dfs (which need not be exactly the same, although they should be close in value) are the inputs. In either case, the output consists of W_{obs} and the appropriate W_o .

Limitations. The program is limited to one- and two-tailed tests at the $p < .05$ level. It is written in a neutral version of BASIC, and should run on most interactive machines. On an Apple IIe, the program occupies 32 sectors on a diskette and is about 250 lines in length.

Availability. A listing of the program may be obtained without charge from the author. If a formatted Apple IIe diskette is submitted, the program will be added at no charge.

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