CC/NUMBER 28
JULY 12, 1982

This Week's Citation Classic

Greenhouse S W & Geisser S. On methods in the analysis of profile data. *Psychometrika* **24**:95-112, 1959.
[Biometry Branch, Natl. Institute of Mental Health, NIH, Bethesda, MD]

Methods are presented for analyzing repeated measurements on a variable, or a battery of tests, given to subjects in one or more groups. Approximate procedures based on classical analysis of variance are presented and exact, generalized multivariate methods are also discussed. [The *Science Citation Index*® (*SCI*®) and the *Social Sciences Citation Index*® (*SSCI*®) indicate that this paper has been cited in over 295 publications since 1961.]

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February 2, 1982

"Seymour Geisser joins me in expressing our pleasure in learning that our 1959 paper is now a Citation Classic. Each of us was aware that our procedures were being applied because of the many letters and calls we received over the years. In preparing for this statement, I reread the paper. I must say it reads very well and is quite lucid in its exposition. I believe we have the then-editors of Psychometrika to thank for this in that, contrary to editorial strictures currently imposed, they did not demand that we shorten the paper. The pace of the exposition and the examples presented made it possible for any interested reader to apply the methods we were describing.

"Geisser and I were in a statistical research and consulting section of the Biometry Branch of the National Institute of Mental Health. We were confronted with a number of repeated measurement problems brought to us by psychologists, psychiatrists, and other social scientists in the intramural program of the institute. Being unhappy with the lack of rigor and the too specialized methods then available in the literature, we attacked the problem from scratch. Since both Geisser and I had received some special training in multivariate analysis, it was not too difficult to solve the theoretical issues which we published[1] a year prior to the publication of the paper in Psychometrika. I am sure familiarity with our procedures was greatly facilitated and enhanced when shortly thereafter our work was included in several statistical textbooks, put into a number of computer programs, and reprinted in a book of readings[2] in educational research.

"It is interesting to note that many designs of a similar nature have appeared in research fields other than the social sciences, particularly in biomedical research. Our proposed techniques for analyzing these data would clearly be applicable. Indeed, such uses have already been made in these other fields. Recently, I reviewed a paper generalizing our techniques to multifactors observed on the same individual. (This paper has not been published as yet.) Actually, Geisser published a paper wherein he considered two factors each observed a repeated number of times on each individual[3] and wrote another paper involving Latin square designs.[4]

"As far as I am aware, these methods have not been superseded by any better procedure and are as applicable today, given that the assumptions hold, as they were 20 years ago."

1. **Geisser S & Greenhouse S W.** An extension of Box's results on the use of the F distribution in multivariate analysis. *Ann. Math. Statist.* **29**:885-91, 1958. [The *SCI* and the *SSCI* indicate that this paper has been cited in over 145 publications since 1961.]
2. **Collier R O & Hummel T J**, eds. *Experimental design and interpretation, readings in educational research.* Berkeley, CA: McCutchan, 1977. p. 211-33.
3. **McHugh R, Sivanich G & Geisser S.** On the evaluation of personality changes as measured by psychometric test profiles. *Psychol. Rep.* **9**:335-44, 1961.
4. **Geisser S.** The Latin square as a repeated measurements design. (Neyman J, ed.) *Proceedings of the Fourth Berkeley Symposium on Mathematical Statistics and Probability, 20 June-30 July I960, Berkeley, CA.* Berkeley, CA: University of California Press, 1961. Vol. 4. p. 241-50.