In this table variances appear along the main diagonal, and covariances appear on either side of the main diagonal. The homogeneity of variance-covariance assumption means that the variances and covariances in the population sampled are as follows:

	1	2	3	4
1	σ^2	$\rho\sigma^2$	$\rho\sigma^2$	$\rho\sigma^2$
2	$\rho\sigma^2$	σ^2	$\rho\sigma^2$	$\rho\sigma^2$
3	$\rho\sigma^2$	$\rho\sigma^2$	σ^2	$\rho\sigma^2$
4	$\rho\sigma^2$	$\rho\sigma^2$	$\rho\sigma^2$	σ^2

Here ρ is the value of the population correlation coefficient, and $\rho\sigma^2$ is the population covariance. If the homogeneity of variance-covariance assumption is not satisfied in repeated measurement designs, the F test is positively biased. This means that more significant differences will be found, and more null hypotheses rejected, than would have been the case had the F test not been biased.

A method exists for testing the homogeneity of variance-covariance assumption. This method is due to Box (1953), and a description of it is found in more advanced texts such as Winer (1971). Application of the procedure involves considerable arithmetical labor, and the computation required is best done on a computer.

If the homogeneity of variance-covariance assumption is not satisfied, Box (1954) has suggested a procedure which for a one-factor experiment with repeated measurements uses the same F ratio, $F_c = s_c^2/s_{rc}^2$, that would be appropriate if the assumption had been satisfied. Different degrees of freedom are, however, used on entering the F table. Instead of $(C-1)$ and $(R-1)(C-1)$, the Box procedure uses 1 and $(R-1)$. Since in this design R is the number of subjects, $(R-1) = (N-1)$. This is a conservative procedure and is based on a maximal departure of the observed covariance matrix from the homogeneity assumption. This procedure in most situations will be negatively biased and will lead to too few significant differences. Since the investigator will usually wish to proceed without applying a proper test of the homogeneity of the variance-covariance assumption, the following has been suggested. Test for column effects by using the F test with 1 degree of freedom associated with the numerator and $(R-1)$ with the denominator. If the result is significant at the desired level, no further test is required, because this is a conservative test that works against obtaining a significant difference. If the result is not significant, test the F ratio by using $(C-1)$ and $(R-1)(C-1)$ degrees of freedom. If this is not significant, no further test is required, because this is a liberal procedure that works in the direction of too many significant differences. If the conservative procedure indicates that the F ratio is not significant, and the liberal procedure indicates that it is significant, then a test of the homogeneity of variance-covariance assumption is required.

When the Box procedure as described above is applied to tests used in