count of events having a small probability of occurrence, for example, number of errors at each choice point in a relatively simple multiple T maze. The data can often be normalized for this type of situation by taking the square root of each of the scores. A transformed score X' is given by

$$X' = \sqrt{X}.$$

If any X is less than 10, a more appropriate transformation is given either by

$$X' = \sqrt{X + .5} \quad \text{or} \quad X' = \sqrt{X} + \sqrt{X + 1}.$$

The latter transformation has been recommended by Freeman and Tukey (1950). Tables of $\sqrt{X} + \sqrt{X + 1}$ are reproduced in Mosteller and Bush (1954). The effects of performing a square-root transformation are shown for the data in Table 2.7-1. An examination of the means and variances of the transformed scores shows that they are no longer proportional; additionally, the variances are more homogeneous. These transformed scores are more suitable than the original scores for an analysis of variance.

TABLE 2.7-1 Original and Transformed Scores

Original Scores			*Transformed Scores* $X' = \sqrt{X + .5}$		
b_1	b_2	b_3	b_1	b_2	b_3
3	6	12	1.87	2.55	3.54
0	4	6	.71	2.12	2.55
4	2	6	2.12	1.58	2.55
2	4	10	1.58	2.12	3.24
2	7	6	1.58	2.74	2.55
$\bar{X} = 2.2$	4.6	8.0	1.57	2.22	2.89
$S^2 = 2.2$	3.4	8.0	.28	.20	.22

LOGARITHMIC TRANSFORMATION

If treatment means and standard deviations tend to be proportional, a logarithmic transformation may be appropriate. A transformed score X' is given by

$$X' = \log_{10} X \quad \text{or} \quad X' = \log_{10}(X + 1).$$

The latter formula is used when some scores are zero or very small. Logarithmic transformations have been found to be useful when the dependent variable is some measure of reaction time and the data are positively skewed.