TABLE FOR DETERMINING PHI COEFFICIENTS

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A table is presented which directly gives phi coefficients accurate to three places when entered by the proportion of one sub-group responding in a specified manner and the proportion of a second sub-group responding in the same manner. The table gives coefficients identical with those obtained by formula if the sub-groups are equal in number. The phi coefficients can readily be expressed, if desired, in terms of critical ratio or chi square. The table is more accurate than the use of abacs and eliminates the use of time-consuming formulas. Accurate determination of item validity on the basis of statistically rigorous techniques can be made more quickly by means of the table than validity determined by less efficient methods which have previously been used to save time.

Increasing emphasis on item analyses is being found in test construction and development, particularly with regard to item validity as estimated by means of internal consistency or an outside criterion. Long and Sandiford (5) have summarized the methods which were most popular a decade ago, and test construction since that time seems to have continued to follow those methods in the main.

Methods for determining whether individual items should be retained or rejected (or the closely allied problem of determining what weights should be assigned each item) vary from a simple determination of the difference in per cent of persons in contrasted groups who respond similarly to a given item, to the more rigorous correlational techniques or levels of significance. Because of the great amount of computational time necessary to determine item validities on the basis of correlational techniques, the simpler and less efficient techniques have too often been used. This is particularly unfortunate in those cases where the number of cases is small and has often resulted in retaining items purely on the basis of chance differences. In an effort to reduce the time required for the more accurate types of item validation, various tables, nomographs, and abacs have been developed.

One of the earliest of these techniques was a table developed by Edgerton and Paterson (1) which gives standard errors from .001 to .100 by successive steps of .001 for all possible combinations of differences between percentages. For a maximum percentage difference of 50, this table covers a maximum standard error for 25 cases
and a minimum standard error for one million cases. These data do not give item validity, but do permit necessary computations to be made more readily than otherwise.

Votaw (8) has published the formulas necessary to construct an abac based on the probable error of differences between two groups as well as an abac based on a critical ratio of 2 (in terms of probable error) when the N of each subgroup equals 45. Mosier and McQuitty (7) have published a more detailed abac giving critical ratios of 2, 3, 5, 7 and 10 (in terms of standard error) based on the highest and lowest fifty cases of a group having a total N of 200. Mosier and McQuitty also published correlational abacs based on upper-lower halves and upper-lower quarters. Guilford (4) has published an abac based on phi coefficients ranging from 0 to ±.90 in steps of .10 and another giving 1% and 5% levels of significance when the total N equals 50, 100, 200, and 400.

Lord (6) has given an alignment chart for calculating the four-fold point correlation coefficient, the chart being entered on three values: per cent of cases successful with respect to the first variable, the similar per cent for the second variable, and the per cent of cases successful with respect to both variables.

Fiske and Dunlap (2) have published a formula for constructing an ellipse on the assumption that the two sub-groups are random samples from the same parent population and that the best estimate of the true proportion is the weighted mean proportion of the two samples. Fiske and Dunlap's abac is based on a critical ratio of 2 with one hundred persons in each sub-group.

Numerous other abacs and nomographs have been constructed. Although they all possess the advantage of reducing statistical computations, other objections are inherent in their use. Abacs and nomographs based on critical ratios, level of significance, or chi square are necessarily constructed for use in situations having a specified number of cases in each sub-group. As the N is changed, so must the abac be changed also. Inasmuch as construction of an abac requires computing numerous points by means of formula and careful drawing of a curved line to fit these points, and because the number of abacs which can be drawn is unlimited, this procedure becomes impractical.

Rather than constructing an abac for each possible N, it is also possible to devise abacs for various selected N's, and in any single study the abac can be used which most closely approximates the available data. Although such approximations are sufficiently accurate for most practical purposes, many research workers are reluctant to state in the literature that their work is based on approximations