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BRIDGES THE GAP BETWEEN CORRELATION COEFFICIENT AND CLIENT GENERAL EXPECTANCY TABLES

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ABSTRACT

Readers are reminded of a "universal expectancy table" developed by Schrader from properties of the bivariate normal distribution. The authors point out some practical utilities of this table in training clinical practitioners — specifically, in developing probability statements about criteria given degree of relationship and place on predictor. Also presented is a modification of Schrader's table based on five levels of *z* rather than on three levels of precentile rank.

HISTORY

Numerous tables have been developed over the years to provide practitioners with ready-made description of the relations between variables, given certain conditions. We are thinking of such productions as the tables of the bivariate normal distribution function by R. A. Fisher (National Bureau of Standards, 1959), the Taylor-Russell tables (Taylor and Russell, 1939), and more recently, a "universal expectancy table" developed by Schrader (1965).

It is the latter that is a point-of-departure for the present article. Schrader presents several model expectancy tables and certain issues, advantages and disadvantages which accompany them. The one of particular interest here, with which the authors have had considerable experience, both pedagogical and practical, translates position on a predictor into chances of being at certain levels on a criterion for nine levels of correlation between predictor and criterion. Figure 1 presents, an illustration of this approach, the details of Schrader's table for one such correlation (0.50) between pedictor and criterion.

UTILITIES

The authors have used this table in both teaching and professional practice and have found it greatly useful. In teaching, particularly if the students are in applied programs, it provides concrete illustrations of correlations which give students an intuitive grasp of the topic and provide them with an immediately usable tool. It fits well with the traditional 2 x 2 table of outcomes for professional decision-making as outlined by Schuerger and Watterson (1977), Wiggins (1973), and others. With a bit of ingenuity, it can be used to liven up presentations of reliability, give alternate illustrations for SEM and SEE, and help students envision both more concretely and more precisely than is usually possible such

Figure 1[1]

Correlation coefficient	Standing on predictor	Percent of students standing in each criterion group		
		Bottom fifth	Middle three-fifths	Top fifth
	Top fifth	4	52	44
.50	Middle three-fifths	17	66	17
	Bottom fifth	44	52	4

[1]Given such a table and even general knowledge of the degree of relationship between predictor and criterion, a practitioner need only know the standing of a client on the predictor in general terms to give the client's probabilities of various standings on the criterion.

test-interpretation statements as "has a tendency toward." The table, in short, has proven itself eminently useful in bridging the gap between the precision, conciseness and sparseness of a correlation coefficient and the concrete exigencies of clinical practice.

AN ADDITIONAL DEVELOPMENT

In addition to their enthusiasms, the authors thought it worthwhile to pass on an additional table developed to satisfy the same exigencies in a slightly different way. Students particularly, but also field practitioners to whom this table has been presented, have sometimes pointed out the greater precision that could be obtained if the predictor were split into five levels instead of three. Further, it was argued that splitting by SD units would be easier for users who frequently find test scores available as standard scores. The results of these modifications[1] are presented in Table 1, for nine levels of the correlation coefficient.

After minimal effort toward familiarization, the user can read the relevant information at a glance from this type of table.[2] One simply rounds the standardized deviation (z-score) of the client on the predictor to the nearest whole number, and enters the table with the correlation between the predictor and criterion. The results are the percentages of such clients in the different criterion groups. The nominal z-score categories of -2 and 2 are used for any given z-score more extreme than -1.5 and 1.5. For example, assume that the correlation between predictor and criterion is 0.5. If a client has a z-score of 1.7 on the predictor, one would round this to 2 and find from the table that the approximate percentage in the z=2 criterion group is 27.4. This client is more likely to be in the z=1 criterion group, since the given percentage is 42.7. These percentages can also be added across rows to combine some of the criterion groups. For example, one could say that this client has about a 95% chance (25.0 + 42.7 + 27.4) of being in the top half (actually z = -0.5) on the criterion.

Table 1

RELATION BETWEEN STANDING ON PREDICTOR AND STANDING ON CRITERION FOR VARIOUS VALUES OF THE CORRELATION COEFFICIENT

Correlation	Predictor	Criterion z				
	z	-2	-1	0	1	2
0.1	2	4.4	19.8	37.8	28.4	9.5
	1	5.5	22.1	38.3	26.2	7.9
	0	6.6	24.2	38.5	24.2	6.6
0.2	2	2.7	15.6	36.2	32.6	12.9
	1	4.3	20.0	38.3	28.4	9.0
	0	6.3	24.2	39.0	24.2	6.3
03.	2	1.5	11.5	33.6	36.4	17.0
	1	3.2	17.7	38.4	30.7	10.1
	0	5.9	24.2	39.8	24.2	5.9
0.4	2	0.7	7.8	29.9	39.9	21.8
	1	2.1	15.2	38.3	33.3	11.0
	0	5.2	24.2	41.2	24.2	5.2
	-1	11.0	33.3	38.3	15.2	2.1
	-2	21.8	39.8	29.9	7.8	0.7
0.5	2	0.3	4.6	25.0	42.7	27.4
	1	1.3	12.4	38.1	36.4	11.8
	0	4.4	24.1	43.1	24.1	4.4
	-1	11.8	36.4	38.1	12.4	1.3
	-2	27.4	42.7	25.0	4.6	0.3
0.6	2	0.1	2.2	19.1	44.6	34.1
	1	0.6	9.3	37.6	40.2	12.3
	0	3.3	23.7	45.9	23.7	3.3
0.7	2	0.0	0.7	12.3	44.9	42.2
	1	0.2	5.9	36.2	45.3	12.4
	0	2.1	22.9	50.0	22.9	2.1
0.8	2	0.0	0.1	5.5	42.3	52.2
	1	0.0	2.6	33.1	52.6	11.7
	0	1.0	20.9	56.3	20.9	1.0
0.9	2	0.0	0.0	0.7	33.5	65.8
	1	0.0	0.3	25.6	64.8	9.3
	0	0.1	16.2	67.4	16.2	0.1

Note: Since each correlation-level block is symmetrical, we have presented all five rows only for correlation levels 0.4 and 0.5, the two levels which we have found most useful. For use with beginning students, we advise expanding the rest of the blocks to present a complete pattern.

Table 2

EXAMPLES OF THE RELATION BETWEEN STANDINGS ON PREDICTOR AND CRITERION FOR A SMALL SAMPLE

Sample Size: 10, Correlation: 0.5

Predictor	Criterion t				
t	-2	-1	0	1	2
2	3.4	8.6	21.6	30.4	36.0
1	5.1	14.6	31.8	30.6	17.9
0	9.1	22.9	35.9	22.9	9.1

Finally, we note as a precaution that the percentages in Table 1 assume no sampling error in the estimates of the means, standard deviations, and correlation coefficient. If these statistics are based on a small sample, then the given percentages provide only a fair approximation to those that should be expected. Compare the entries of Table 2 with those of Table 1 for a correlation of 0.5. For a sample size of 10, Table 2 takes account of the sampling errors of the mean and the regression coefficient in predicting the criterion *t*, given a value of the predictor (Hays, 1973, pg 649), and also the sampling errors of the mean and standard deviation in calculating the predictor *t* from the predictor raw score. For small samples, the percentages in adjacent equal intervals become more uniform than those of Table 1, and this tendency increases with more extreme values of the predictor. In practice, if the estimate of relationship is based on a large number of studies (as, for example, the *r* between traditional measures of IQ and school achievement), this precaution is unnecessary.

FOOTNOTES

[1] Table 1 was constructed generally by Schrader's method, i.e., by evaluating the incomplete double integral of the bivariate normal distribution. The evaluations were obtained by a FORTRAN program available from the authors, but may also be taken from the published tables cited in the text.

[2] With somewhat greater effort, one can construct one's own criterion-group distribution for a given value of the predictor, from a table of the normal distribution, with mean equal to r times the predictor *z*-score and SD equal to $1\text{-}r^2$.

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