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Reliability of the O'Connor Block Test

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PROBLEM

The O'Connor Block test is widely known and is manufactured and sold without any very definite information as to its reliability and validity. In fact it seems to be used without great uniformity in method of administration. Whenever mechanical ability is discussed one is likely to hear of this test along with several others. No published studies of the O'Connor Block test of any great importance have been made on its relative merits and its reliability and validity.

Several years ago exploratory studies on this test, along with others designed to measure mechanical aptitude and ingenuity, were conducted in the Driving Laboratory at Iowa State College. Various mechanical tests were used to ascertain their possible relation to driving. Although the O'Connor Block Test seems to be looked upon with some askance in some quarters, it did seem to screen out persons who would require considerable extra attention while learning to drive. This cue was followed up still further and a study using the O'Connor test was reported by Miller and Lauer (1946). A low positive correlation with driving performance was obtained but the subjects were largely Orientals and their driving performance rather irregular. Also there was some question as to the reliability of the test.

It also seemed that the method of administration, as an amount limit test, would render it unsatisfactory for general use. Some subjects would assemble the blocks in twenty seconds while others would take up to an hour or more. This resulted in a highly skewed distribution which made the establishment of satisfactory norms very difficult.

In some preliminary studies it was also found that the reliability as an amount-limit test was highly unsatisfactory. Consequently, a time-limit method of administration was tried with much more satisfactory results. By giving two two-minute trials and using the number of seconds required for the assembly as a score, the reliability obtained from relatively small numbers of cases seemed to be reasonably substantial. Until the present time the test has not been used in our laboratory for research purposes but merely as a screening device for use in evaluating driver trainees.

The present study was undertaken to obtain data on two fundamental problems:

1. How many trials of two minutes each are necessary to secure a reliable index of the subject's ability in this particular function? This part will be designated as Series A.

2. To what extent is the function improved by practice? This is designated as Series B.

Because of lack of time only details of the first study will be discussed in this paper. Only incidental mention will be made of certain results obtained on the second problem mentioned.

METHOD AND PROCEDURE

The method used for Series A experiments was essentially that of giving the O'Connor Block test, motility and strength tests to a sufficient number of subjects of both sexes under standard conditions to obtain statistically dependable results. Eighty subjects, 48 men and 32 women, ranging in age from 14 to 66 were given four trials of two minutes each. The trials were intercorrelated, correlations also being run between the sum of four trials and each trial separately to determine the order of contribution to the total.

Some comparisons between the sexes, age levels and the relation to certain other variables were determined as secondary data but will not be reported in this paper.

In Series B a regular learning experiment was set up using 9 subjects. Each was given 45 practice trials—five each day and three times a week for three weeks. The method of scoring and general conduct of the experiment was essentially the same as in Series A. The scores for individual trials for all subjects were plotted and graphed to determine the rate and nature of the learning function.

APPARATUS AND PROCEDURE

The apparatus consisted primarily of the standard O'Connor Blocks, stop-watch and a table 24' x 30' about 28 inches high. Each subject was asked to assemble the blocks as quickly as possible while standing at the table. The blocks were laid out in random fashion on the opposite side of the table top and the following directions were read with the experimenter holding the assembled block:

"You will please notice this large block carefully and how it is made up of nine pieces assembled. Now you will please assemble them as quickly as possible as you are working against time. Remember that if you get any two or more pieces to fit, leave them

together as tearing apart perfectly fitting sections wastes time. Work as fast as you can. Ready — Begin."

A limit of two minutes was placed on each trial. Upon calling time the pieces assembled were counted according to the formula given. If the number of piles of two or more pieces assembled resulted they were scored as follows:

$$\frac{\text{Time (Sec.)}}{(\text{Number of blocks assembled}) - (\text{Number of piles}) - 1} = \frac{T}{B - (P - 1)} = \text{Score}$$

In scoring it should be noted that in case a subject failed to follow directions and finished with two or more incomplete piles the formulae blocks assembled = number which fit in each pile summed less the number of extra piles assembled was used to determine the score, thus correcting for this irregularity. When the entire set of nine were completed in less than two minutes the scoring formula was:

$$\text{Score} = \frac{\text{Time}}{9}$$

RESULTS

The results of Series A are briefly summarized in the following tables. The first, Table 1, shows the correlations between the four tests and with the composite score.

Table 1

Intercorrelations of Trials on the O'Connor Block Test

Trial	1	2	3	4
Composite Score	+ .665	+ .553	+ .553	+ .538
4	+ .403	+ .546	+ .432	
3	+ .473	+ .516		
2	+ .461			

The correlations are significant to the 1 per cent level and above.

Since the mean of all intercorrelations calculated was +.514 and there was no great variation in r's obtained between trials, simple calculation by the Spearman-Brown formula using a rounded figure of +.50 as the estimated correlation between single trials gave the following table of estimated reliabilities:

Table 2
 Estimated Reliabilities of the O'Connor Block Test

Two Minute Trials (score calculated as described)	Working Time (in minutes)	Reliability (by formula)
1	2	.50
2	4	.66
3	6	.75
4	8	.80
5	10	.83
6	12	.85
7	14	.87
8	16	.88
9	18	.90
10	20	.91

It is therefore necessary to determine the degree of reliability desired then use the length of test accordingly. Further studies of the validity and correlated variables of the O'Connor Block test are being made. The learning study showed that learning takes place very early in the practice period and reaches a relative plateau at from 4 — 10 trials.

CONCLUSIONS

It would seem that within the limitations of the number of subjects used the following tentative conclusions may be offered concerning the reliability of the O'Connor Block test.

1. At least four two-minute trials and perhaps five or six are necessary to give a reliability usually demanded of a test.
2. The functions involved in the O'Connor Block test are highly amenable to training altho the curve seems to become almost asymptotic to the base after the first ten trials.
3. Wide individual differences exist although there is a tendency for those slow at the beginning to remain relatively slow at the end of the learning period used in this study.

Reference

1. Miller, Charles and Lauer, A. R., The Mechanical Aptitude of Drivers in Relation to Performance at the Wheel. Proc. Iowa Academy of Science, 1946, 53, 273-275.

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