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## AN EVALUATION OF A SHORT FORM OF THE RADIO CODE APTITUDE TEST

Bernard Rimland

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AN EVALUATION OF A SHORT FORM OF THE  
RADIO CODE APTITUDE TEST

by

Bernard Rimland

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Submitted by

B. Rimland, Ph.D., Director, Personnel Measurement Research Department

Approved by

E. E. Dudek, Ph.D., Technical Director  
G. W. Watson, Commander, USN  
Officer in Charge

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U.S. Naval Personnel Research Activity  
San Diego, California 92152

## BRIEF

The Radio Code Aptitude Test (RCAT) has been used during and since WWII in the selection of personnel for Morse Code training. As a result of recent criticism that the test was too highly speeded toward the end, and was thus hopelessly outpacing and demotivating the testees, an analysis was made of the feasibility of eliminating most of the fast-paced latter items of the RCAT.

Statistical analysis of a sample of completed RCAT answer sheets showed the final sixty items (40 per cent) of the RCAT could be eliminated with no loss in psychometric efficiency. The short (60 per cent) form correlated .96 with the long form, and each form had a reliability of .95. Since most items unanswered by the testees were found to have occurred in the final, highly-speeded 40 per cent of the test, it may be assumed that testee frustration will be greatly reduced by the shortened RCAT.

It is recommended that items 166 through 225 be omitted from future testing with the Radio Code Aptitude Test. A conversion table for obtaining Navy Standard Scores from the new short form RCAT is provided as an appendix to this report.

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## AN EVALUATION OF A SHORT FORM OF THE RADIO CODE APTITUDE TEST

### A. BACKGROUND

The Radio Code Aptitude Test (RCAT) was developed during World War II for joint service use to provide a quick work sample index of the speed with which potential radio school students could be expected to learn Morse Code (1).

The RCAT is presented on tape or disc recordings. It consists of a training part followed by a testing part. The Code Training part consists of a series of exercises in which the testees are taught to recognize three Morse Code letters: I, N, and T. After the training series of graduated speed Morse Code signals, for each of which the testee marks the I, N, or T on his answer sheet, the actual test begins. The Testing part of the RCAT consists of 225 three-choice items (only the last 150 of which are scored), very similar to the earlier practice items, except that the test items are more highly speeded. The training items simulate code receiving speeds starting at 4 wpm, and increase stepwise to 7 wpm. The test items start at 11 wpm and end at 15 wpm.

A number of studies conducted during and since WWII have established the RCAT to have substantial validity as a predictor of performance in the code learning phase of radioman training (2). Since the RCAT takes only about 35 minutes to administer and demonstrates both face and predictive validity, there has been little interest in attempting to revise or improve it.

However, in a memorandum to the Naval Reserve Policy Board dated 2 Feb 1965, a naval reserve officer concerned with testing<sup>1</sup> noted that the RCAT was creating a sense of defeat in many recruits, who tended to feel they had failed the high speed portion of the test, even after they were told that they had passed. As a result of this memorandum, the Chief of Naval Personnel (Pers A322) requested the U. S. Naval Personnel Research Activity, San Diego, to investigate the possibility that the RCAT might in fact be too highly speeded in its latter portion, and thus might be having the demotivating effect which had been reported.

### B. ANALYSIS OF THE RCAT

To check on the speededness of the RCAT, a sample of recently completed RCAT answer sheets was obtained from the testing office files of the

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<sup>1</sup>LCDR R. A. Lindquist, of the Rockford, Illinois Reserve Training Center.

U.S. Naval Training Center, San Diego. The sample was found to have an NSS mean of 56.30 and a standard deviation of 9.64, and thus appeared to be reasonably representative of the several million Navy recruits who had taken the RCAT since WWII.

The answer sheets for a sample of recruits (N=390) were then rescored (scored test portion only), by fifths. Separate scores were obtained for the first one fifth of the test (scored items 76-105), the second fifth (items 106-135), third fifth (items 136-165), fourth fifth (166-195), and last fifth (196-225). To determine the effect of reducing the length of the RCAT, the total RCAT score was correlated successively with the cumulated sums of its parts. These correlations are presented in Table 1, for both raw scores and scores corrected for guessing ( $R-1/2W$ ).

TABLE 1

Correlations Between RCAT Total Scores and the  
Cumulated Sum of RCAT Successive Fifth Scores<sup>a</sup>  
(N=390)

Correlation Between RCAT Total and Its:	Raw Score	Corrected Score ( $R-1/2W$ )
1st fifth	.75	.74
1st + 2nd fifths	.92	.93
1st + 2nd + 3rd fifths	.96	.96
1st+2nd+3rd+4th fifths	.99	.99

<sup>a</sup>Each fifth consists of 30 items.

Upon inspection of the data in Table 1, it was tentatively decided that a 60 per cent RCAT version--the dropping out of the last two fifths of the items--would represent a desirable balance between shortening the RCAT yet maintaining its intrinsic validity.

Since part of the high correlation of .96 between the shortened (sixty per cent) and full length RCAT was spurious, resulting from inclusion of chance errors of measurement in both the short and total scores, estimates of short and long form reliability were needed. The odd-even reliability

estimation procedure was used. Answer sheets from a sample of 208 recruits were scored to obtain the reliability values presented in Table 2.

TABLE 2

Odd-Even Reliabilities for Short (60 Per Cent) and Standard Forms of RCAT (N=208)

Form	Reliability
Short (90 items)	.948
Standard (150 items)	.951

Note:—Corrections for guessing and corrections for double test length (Spearman-Brown) not applied.

The reliability analysis thus supported the previous conclusion that the RCAT could be substantially shortened with little or no loss in psychometric effectiveness.

Inspection of the mean raw scores for the fifths of the RCAT (Table 3) shows only about 10 of the 30 items in each of the last two fifths of the RCAT to have been answered correctly. Since the RCAT consists of 3-choice items, it would appear that the testees were responding essentially at random to the last two-fifths of the test. This would also seem to lend support to the decision to drop the final two-fifths of the RCAT. However, inspection of the answer sheets showed a substantial number of omissions toward the end of the test, so although the mean scores suggested random responses, it appeared that the testees were in fact trying--albeit not very successfully--to keep up with the fast pace of the test.

As a final check on the decision to shorten the RCAT, an analysis was made of the number of items omitted from each fifth of the test. This, of course, would permit a more direct evaluation of the original criticism that the latter parts of the RCAT were so speeded as to demoralize the recruits tested. Table 4 presents the results of a tally of the 1,690 items omitted from a random sample of thirty answer sheets.

If the omissions may be considered a sign of excessive test speeding, the sharp rise in omissions between the third and fourth segments of the test supports the decision to drop the last 40 per cent of the RCAT.

TABLE 3  
 Mean Raw Scores for Successive RCAT Fifths<sup>a</sup>

Fifth of Test	Mean	S.D.
First	21.52	7.29
Second	18.05	7.15
Third	16.85	7.10
Fourth	11.11	5.72
Fifth	10.05	5.55

<sup>a</sup>Each fifth consists of 30 items.

TABLE 4  
 Mean Number of RCAT Items  
 Omitted, by Test Fifths  
 (N=30 recruits; 1,690 omits)

Fifth of Test	Mean Number of Items Omitted	
First	5.83	} 22.96
Second	7.60	
Third	9.53	
Fourth	16.93	} 33.36
Fifth	16.43	



### C. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The Radio Code Aptitude Test (RCAT) has been used during and since WWII in the selection of personnel for Morse Code training. As a result of recent criticism that the test was too highly speeded toward the end, and was thus hopelessly outpacing and demotivating the testees, an analysis was made of the feasibility of eliminating most of the fast-paced latter items of the RCAT.

Statistical analysis of a sample of completed RCAT answer sheets showed the final sixty items (40 per cent) of the RCAT could be eliminated with no loss in psychometric efficiency. The short (60 per cent) form correlated .96 with the long form, and each form had a reliability of .95. Since most items unanswered by the testees were found to have occurred in the final, highly-speeded 40 per cent of the test, it may be assumed that testee frustration will be greatly reduced by the shortened RCAT.

It is recommended that items 166 through 225 be omitted from future testing with the Radio Code Aptitude Test. A conversion table for obtaining Navy Standard Scores from the new short form RCAT is provided as an appendix to this report.

### REFERENCES

1. Tentative Manual and Guide for using the Radio Code Test: Speed of Response, Form I. (National Defense Research Committee Project N-107) New York: The Psychological Corporation, 1943.
2. Swanson, L., Eells, Janet, & Kach, P. H. Validation of Selection Procedures for Radioman Class "A" Schools. (Technical Bulletin 55-13) Washington, D.C.: Bureau of Naval Personnel, June 1955.

APPENDIX

Table for Converting Short (90-Item) Radio Code Aptitude  
Test Scores to Navy Standard Scores Comparable to  
150-Item Radio Code Aptitude Test (Form 2)

RCAT Short Form Rights Minus 1/2 Wrong			RCAT Short Form Rights Minus 1/2 Wrong			RCAT Short Form Rights Minus 1/2 Wrong		
		NSS			NSS			NSS
90		80	60		60	30		48
89		77	59		60	29		47
88		75	58		59	28		47
87		74	57		59	27		47
86		73	56		58	26		46
85		72	55		58	25		46
84		72	54		58	24		46
83		71	53		57	23		45
82		70	52		57	22		45
81		70	51		56	21		45
80		69	50		56	20		44
79		69	49		55	19		44
78		68	48		55	18		44
77		68	47		55	17		43
76		67	46		54	16		43
75		67	45		54	15		42
74		66	44		53	14		42
73		66	43		53	13		41
72		65	42		53	12		41
71		65	41		52	11		40
70		64	40		52	10		40
69		64	39		51	9		40
68		64	38		51	8		39
67		63	37		51	7		39
66		63	36		50	6		38
65		62	35		50	5		38
64		62	34		49	4		37
63		62	33		49	3		36
62		61	32		49	2 and below		35
61		61	31		48			

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