THE EFFECT OF MASSING AND DISTRIBUTION OF PRACTICE ON TWO-HAND COORDINATION TEST SCORES

by

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A report on research conducted at the State University of Iowa, Iowa City, Iowa, in cooperation with the AAF School of Aviation Medicine in which the Department of Psychology, AAF School of Aviation Medicine determined the experimental design and supplied the necessary equipment and the National Research Council Committee on Selection and Training of Aircraft Pilots supplied a grant-in-aid, from funds provided by the Civil Aeronautics Administration, to cover the cost of test administration and statistical analysis.

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National Research Council

Committee on Selection and Training of Aircraft Pilots

Executive Subcommittee

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LETTER OF TRANSMITTAL

NATIONAL RESEARCH COUNCIL

2101 Constitution Avenue, Washington, D. C.
Division of Anthropology and Psychology

Committee on Selection and Training of Aircraft Pilots

April 30, 1945

Dr. Dean R. Brimhall
Director of Research
Civil Aeronautics Administration
Washington 25, D. C.

Dear Dr. Brimhall:

Attached is a report entitled The Effect of Massing and Distribution of Practice on Two-Hand Coordination Test Scores, by Kenneth W. Spence, Claude E. Buxton, and Arthur W. Melton. This report is submitted by the Committee on Selection and Training of Aircraft Pilots with the recommendation that it be included in the series of technical reports issued by the Division of Research, Civil Aeronautics Administration.

The report is the second of a series to be devoted to extensive research on psychomotor tests conducted at the State University of Iowa through the cooperation of the Committee on Selection and Training of Aircraft Pilots and the staff of the AAF School of Aviation Medicine. As indicated in the Editorial Foreword, while the Committee on Selection and Training of Aircraft Pilots has made but a minor contribution to this study in the form of funds to facilitate the statistical treatment of results, it is included in the series of Committee reports, with the consent of the Air Surgeon, AAF, in the interest of presenting a complete picture of research at the State University of Iowa on psychomotor tests employed in the selection and classification of pilots.

Cordially yours,

Morris S. Viteles, Chairman
Committee on Selection and
Training of Aircraft Pilots
National Research Council

MSV:cv

EDITORIAL FOREWORD

In 1943, the Committee on Selection and Training of Aircraft Pilots with the cooperation of the Army Air Forces and the U. S. Navy, undertook further investigation of the reliability and relative validity of certain of the psychomotor tests which were being currently employed in the selection of applicants for flight training. These studies were undertaken with the view to determining (1) the effects of extending the time limits (or increasing the number of trials) on the reliability and validity of these instruments; (2) the effects of certain other modifications in the procedures of administration on the reliability and validity; and (3) the interrelationships of these psychomotor tests and certain psychomotor and paper-and-pencil tests which are not being employed in selection batteries at the present time. The over-all goal is, of course, the construction of a selection test battery of greater validity than those already in use.

Prior to the initiation of the program sponsored by the Committee on Selection and Training of Aircraft Pilots the State University of Iowa was already cooperating with the Army Air Forces in an experimental analysis of certain psychomotor tests used in the Aviation Psychology Program of the Army Air Forces. Two reports of these investigations have appeared in the C.A.A. Division of Research Series as Reports Nos. 29 and 44. The present report describes a third study to grow out of this earlier program. While the Committee on Selection and Training of Aircraft Pilots has made but a minor contribution to this study in the form of funds to facilitate the statistical treatment of results, it is included in this series of Committee reports in the interest of presenting a complete picture of research at the State University of Iowa on psychomotor tests employed in the selection and classification of pilots.

CONTENTS

SUMMARY

The experiment described in this report was undertaken at the State University of Iowa in cooperation with the Department of Psychology, Army Air Forces School of Aviation Medicine, Randolph Field, Texas, as part of a research project directed at the determination of optimal administrative procedures for the School of Aviation Medicine Two-Hand Coordination Test. In particular, the study was concerned with the effects of various proportions of practice and rest on the level of test performance, the nature of the learning curve, the reliability of various types of scores, and the intercorrelations between learning segment scores, gain scores, and total scores.

A two-unit School of Aviation Medicine Two-Hand Coordination Test was set up to duplicate as closely as possible the testing conditions employed in the Army Air Forces. A special remote control unit made possible the automatic presentation of work and rest periods, while the time the subject was able to keep the control button in contact with the moving target was recorded on electric stop clocks. During the procedure the subject was required to use both hands simultaneously in manipulating the two lathe-type handles of the test.

Two hundred male students from the Army Specialized Training Program at the State University of Iowa were employed in the experiment. They ranged in age from 18 to 39 years, with the large majority being under 25. None of the subjects had previous experience with the test.

The subjects, divided into four groups of 50 individuals each, were run under different experimental conditions. In Condition A the subject worked continuously for 8 minutes (recorded as 16 trials of 30 seconds each); in Condition B, which duplicated the procedure used in the AAF testing situation, the subject was run for 60 seconds with rest intervals of 15 seconds between trials (8 trials); in Condition B-1 the work and rest periods and trials were distributed as in Condition B but the subject was instructed to take his hands off the handles immediately at the end of the test period and was not permitted to get back on the target between tests; and in Condition C the subject was tested for 30 seconds with rest intervals of 30 seconds interpolated between trials (16 trials).

The general findings of the study are summarized as follows:

1. When learning curves based on the per cent of time on the target for each of the 4 groups were compared, it was observed that the data revealed markedly superior performance for the group which learned under the most distributed practice condition (Group C). The continuous practice group (A) showed the poorest performance, while the learning curves for Groups B and B-1 were intermediate between those of Groups A and C.

2. The mean total scores in minutes of contact as well as the variability of the scores were practically identical for Groups B and B-1, which differed only with respect to returning to the target

between trials. Also, the critical ratio based on the differences between the means for Groups A and B were not significant, suggesting that the level of performance attained under the standard AAF testing conditions (60 minutes of work, 15 minutes of rest) closely approached the level of performance obtained with continuous practice.

3. The critical ratios based on the difference between means for Groups A and C and Groups B and C resulted in highly significant differences, suggesting that less "work inhibition" is developed under conditions of greater distribution of practice time.

4. Correlation coefficients between scores on odd and even trials under the four experimental conditions varied from .79 to .88. Reliability coefficients estimated for the full length test by the Spearman-Brown formula for the four conditions varied within the limits of .88 to .94, although neither the computed nor the estimated reliability coefficients appeared to differ significantly among themselves.

5. Correlations between trial segments and total score showed no consistent trends except those in Group B, the condition employed in the AAF testing program. In this group the correlations between trial segments and total score were consistently lower than in Groups A, B-1, and C. Further, no tendency was observed in any of the groups for the middle segments to correlate more closely with the total score than did the end segments, as was found in the case of the Rotary Pursuit Test.

6. Correlations between gain measures and successive practice segments for the four conditions varied from -.69 to .44. These values showed an increase from the second to the fourth segments. Gain scores showed little correlation with the total score, the coefficients ranging from -.21 to .1[illegible].

7. The gain score appeared to be most closely related to the final status score and is negatively correlated with the initial status score.

INTRODUCTION

The present experiment was undertaken in cooperation with the Department of Psychology, Army Air Forces School of Aviation Medicine, as part of a general research project directed at the determination of the optimal administrative procedures for psychomotor classification tests developed and produced by the AAF School of Aviation Medicine and used in the Army Air Forces selection and classification program for aircrew officers. The purpose of the present study was to determine whether the degree of massing and distribution of practice on the School of Aviation Medicine Two-Hand Coordination Test materially altered the rate of learning on that test during the standard 15-minute over-all testing period employed in the Army Air Forces selection and classification program. In the event that an experimental condition yielded a learning rate appreciably greater than that which occurs during administration of the test under standard AAF testing conditions, the over-all plan called for validation testing of that condition by the Department of Psychology, AAF School of Aviation Medicine, in collaboration with some testing or research unit of the Army Air Forces Training Command. The present study was therefore concerned with the effects of various proportions of practice and rest on the level of test performance, the nature of the learning curve, the reliability of various types of scores, and the intercorrelations between learning segment scores, gain scores, and total scores.

APPARATUS

A two-unit School of Aviation Medicine Two-Hand Coordination Test[1] provided by the Department of Psychology, School of Aviation Medicine, was set up so as to duplicate as closely as possible the standard conditions employed in the Army Air Forces test situation. A special remote control unit provided for practice conditions in which work periods were alternated with rest periods or for continuous practice with scores recorded for successive 30-second periods. The test required the subject to use both hands simultaneously in manipulating two lathe-type handles so as to maintain contact between a small button and a brass target which moves in an irregular circular pattern. An individual's score was recorded (by means of electric stop clocks) in terms of the time the subject-controlled button was in contact with the moving target. Individual data sheets of the type shown in Appendix A were provided for recording.

SUBJECTS

A total of 200 subjects were employed in the experiment, 50 in each of four different work-rest conditions of practice. All were students in the

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[1] The School of Aviation Medicine Two-Hand Coordination Test for the classification of aviation cadets: 1 apparatus and procedures. Project No. 124, Report No. 1, Research Reports, School of Aviation Medicine.

This test is a revision of the Two-Hand Coordination Test used in earlier studies by the National Research Council Committee on Selection and Training of Aircraft Pilots and described in: McFarland, Ross A., and Channell, Ralph C. A revised two-hand coordination test. Washington, D.C.: C.A.A. Airman Development Division. Report No. 36, October 1944. It differs from the latter in that the pattern of movement of the target is repeated every four one-minute trials rather than every trial, thus minimizing specific learning of the pattern.

various Army programs at the University of Iowa. They ranged in age from 18 to 39 years, with the large majority being under 25 years of age. Only students who reported no previous experience with the test were used in the experiment.

EXPERIMENTAL PROCEDURE

The subjects, divided into four different groups of equal size, were run under different experimental conditions. Table 1 summarizes the practice conditions used. Group A practiced continuously for eight minutes, performance scores being recorded for successive 30 second periods. Groups B and B-1 were run under the same work-rest conditions, 60 seconds of practice alternated with 15 seconds of rest. The conditions under which these two groups worked differed only with respect to the procedure the subject

TABLE 1

DISTRIBUTION OF PRACTICE-REST CONDITIONS

Group	Practice-Rest Condition	Trials
A (N = 30)	Continuous Practice 8 Minutes (30 sec. scores)	16
B (N = 30)	Work -- 60 seconds; Rest -- 15 seconds	8
B-1 (N = 30)	Work -- 60 seconds; Rest -- 15 seconds	8
C (N = 30)	Work -- 30 seconds; Rest -- 30 seconds	16

was required to follow at the completion of each work period. In Group B the subject was instructed to get back on the target, if necessary, and then take his hands off the handles until the warning signal for the next practice period. This procedure duplicated that used in the AAF test situation. Subjects in Group B-1 were required at the end of the test period to take their hands off the handles immediately and they were not permitted to get back on the target between tests. The practice distribution for Group C consisted of 30 seconds of work alternated with 30 seconds of rest. In this condition the subject was permitted, as in Group B, to get back on the target, if necessary, between work periods.

An assistant, carefully instructed in the use of the control unit and experienced in recording clock data served as experimenter for all four groups. The order of running the subjects was counterbalanced among the four different conditions, two subjects being run at a time. The instructions and demonstrations given each pair of subjects before the start of the test are presented in Appendix B.

RESULTS

Figure 1 gives the curves of learning as well as the per cent of time

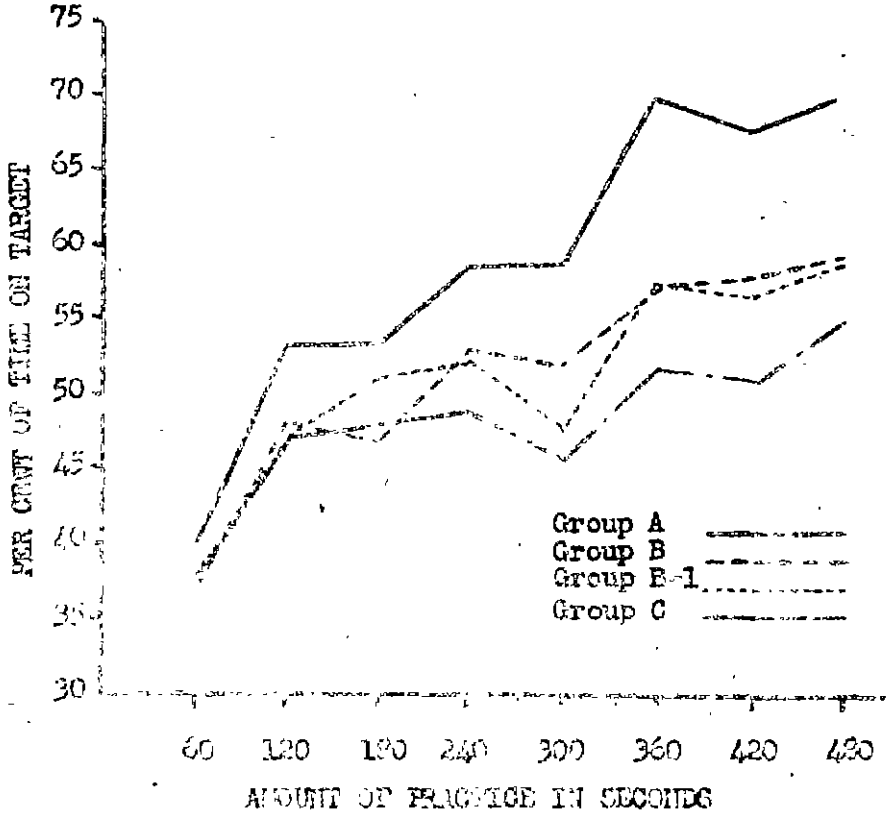
75
70
65
60
55
50
45
40
35
30
PER CENT OF TIME ON TARGET
Group A
Group B
Group B-1
Group C
60
120
180
240
300
360
420
480
AMOUNT OF PRACTICE IN SECONDS

Figure 1

trials, the data for each group [illegible] presented in terms of the percent of each by combining adjacent pairs of 30-second trials. Table 2 provides the summarized data for the four groups of subjects.

TABLE 2

MEAN PER CENT OF TIME ON TARGET AND CUMULATIVE AMOUNT OF PRACTICE

	Group A		Group B		Group B-1		Group C	
Trial	Cum. Sec. Prac.	% Time Contact	Cum. Sec. Prac.	% Time Contact	Cum Sec. Prac.	% Time Contact	Cum Sec. Prac.	% Time Contact
1	30	44.9	60	36.8	60	37.8	30	45.4
2	60	29.8	120	48.0	120	47.1	60	34.1
3	90	48.7	180	47.2	180	50.9	90	53.1
4	120	45.5	240	53.8	240	52.0	120	52.9
5	150	49.3	300	51.9	300	47.7	150	54.0
6	180	46.1	360	57.0	360	57.2	180	52.4
7	210	43.8	420	57.6	420	56.4	210	58.9
8	240	47.9	480	58.6	480	58.4	240	57.7
9	270	49.4					270	60.2
10	300	41.5					300	57.2
11	330	51.3					330	68.6
12	360	52.1					360	70.8
13	390	51.1					390	67.5
14	420	50.4					420	67.2
15	450	56.4					450	69.61
16	480	53.1					480	69.85

These data reveal a markedly superior performance by Group C, which learned under the most distributed practice condition. The continuous practice group (A) was the poorest while Groups B and B-1 were intermediate. A comparison of the curves of Groups B and B-1 shows little difference in their performance. Table 3, which presents in its upper portion the mean total contact-time scores and their standard deviations for the different groups shows almost identical scores for these two groups. While the curve of Group A tends to be below that of Group B during the latter part of the learning period the lower portion of Table 3 reveals that the difference between their mean total contact-time scores is not statistically significant (CR = 1.08). On the other hand, this table shows that the differences between the most distributed practice group (C) and Groups B and A are statistically significant for these total contact-time scores (CR = 3.33 and 4.30).

The primary purpose of running Group B-1 was to determine whether subjects had any advantage in learning when they were permitted to return the target follower to the center of the target at the end of each trial, as was the case in the standard classification testing condition employed in Group B. This was the necessary control condition since in Group A the subjects were never permitted to have such practice and in Group C the subjects would get twice as much practice of this type as in the standard condition represented in Group B. The experimental data do not reveal any such tendency for the means or standard deviations of the total scores in Group B-1, to be higher than those for Group B (see Table 3).

MEAN TOTAL SCORES IN MINIMUM CONTACT, AND SIGNIFICANCES OF DIFFERENCES

	Group A	B	B-1	C
M	3.84	4.10	4.08	4.70
S.D.	1.16	.95	.96	.90
$S.D._M$	.149	.133	.134	.126

Evaluation of Differences Between Selected Means

M_1	M_2	D	σ_D	C.R.	P-value
A	C	.86	.20	4.30	< .01
A	B	.26	.24	1.08	.28
B	C	.60	.18	3.33	< .01

These results indicate then that Condition B under which the Two-Hand Coordination Test has been administered in the AAF psychomotor battery, is one which produces a performance level only slightly, if at all superior to that attained under the most highly massed practice conditions (i.e., continuous work). The data suggest that considerable "work inhibition" is developed under these conditions as compared with practice distributions involving a greater proportion of rest to work.

Table 4 presents the correlation coefficients obtained between the scores on odd and even trials under the four different experimental conditions. The range of these values, extending from .79 to .88 is consistently lower than for comparable coefficients obtained for the Rotary Pursuit Test, which ranged from .91 to .98.[2] These reliability coefficients as estimated for total (full-length test) scores on the Two-Hand Coordination Test fall between .88 and .94. Neither the computed nor the estimated coefficients indicate significant differences in reliability of total scores in the four different conditions.

Evidence on the increase of the reliability of scores based on successively longer segments of practice is provided in Table 5 and Figure 2.

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[2]Spence, K. W., Buxton, C. E., and Melton, A. W. The effect of massing and distribution of practice on rotary pursuit test scores. Washington, D. C.: Civil Aeronautics Administration Division of Research, Report No. 44, March 1945.

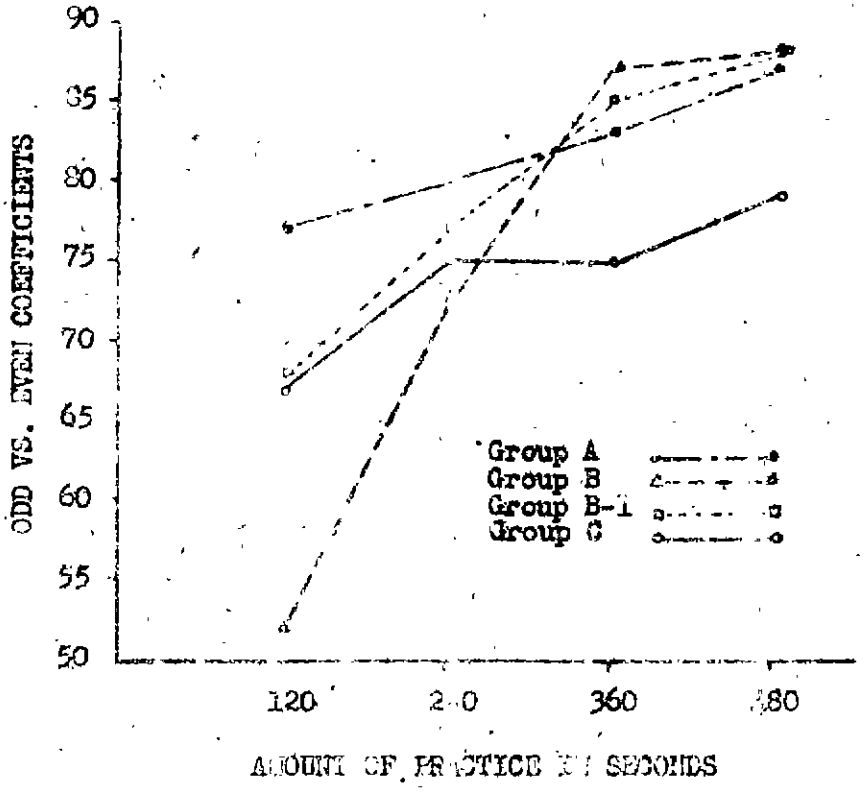
90
85
80
75
70
65
60
55
50
ODD VS. EVEN COEFFICIENTS
Group A
Group B
Group B-1
Group C
120
240
360
480
AMOUNT OF PRACTICE IN SECONDS

Figure 2

TABLE 4

RELIABILITY COEFFICIENTS

Groups	Trials	Odd vs Even Coefficients	Estimated Reliability Coefficient*
A	(1-15) vs (2-16)	.87	.93
B	(1-7) vs (2-8)	.88	.94
B-1	(1-7) vs (2-8)	.88	.94
C	(1-15) vs (2-16)	.79	.88

*Based on Spearman-Brown Formula

In the case of Groups A and C the coefficients for 120 seconds were obtained by correlating trials 1+3 with trials 2+4, the coefficients for 240 seconds by correlating trials 1+3+5+7 with trials 2+4+6+8, etc. In Groups B and B-1, in which the trials were 60 seconds in length, the reliability coefficients were obtained by correlating trials 1 with 2, trials 1+3 with 2+4, etc.

TABLE 5

ODD VS EVEN TRIAL CORRELATION COEFFICIENTS FOR CUMULATIVE SEGMENTS OF LEARNING

Amount of Practice	Group A	B	B-1	C
120	.77	.52	.68	.67
240	.80	.72	.77	.75
360	.83	.87	.85	.75
480	.87	.88	.88	.79

The fact that the curves do not show any marked tendency to approach an asymptote suggests that lengthening of the practice period in this test might result in a substantial increase in the reliability of the score.[3] It is interesting to compare the data of Figure 2 with comparable measures for the Rotary Pursuit Test.[4] In the latter the coefficients approached their maxi-

[3]However, this expected increase was not obtained in another study by the writers, conducted at the State University of Iowa for the Committee, in which training was continued for 900 seconds.

[4]Spence, K. W., Buxton, C. E., and Melton, A. W. Op. cit.

mum values after 200 seconds of practice in the case of three of the practice conditions and after 320 seconds in the fourth.

In Table 6 are presented coefficients of correlation obtained between various practice segments, on the one hand, and either the total score or the gain score (determined by subtracting the score on the first quarter of practice from that for the last quarter of practice). The correlations between trial segments and total score showed no consistent trend except that those for Group B, the condition employed in the AAF testing program, were consistently lower than those in the other conditions. There was no tendency for the middle practice segments to correlate more closely with total score than the end segments, as was found in the case of the Rotary Pursuit Test.[5]

The correlations between the gain measures and successive practice segments varied all the way from fairly high negative values (-.69) to medium positive coefficients (.44). These values showed a consistent directional trend with successive practice segments, as may be seen by examining Figure 3. Comparable data obtained in the Rotary Pursuit Test study revealed a similar tendency except that in this latter study the coefficients with the first segment began around zero correlation and rose to as high as .70. Finally, it will be observed that in this study the gain scores showed little or no correlation with the total scores, the coefficients varying from -.21 to .19. The gain score is most closely related to the final status score and is definitely negatively correlated with the initial status score.

SUMMARY

Two hundred students in the Army Specialized Training Program at the University of Iowa were used as subjects in a study concerned with the effects of different combinations of work and rest on scores obtained with the Two-Hand Coordination Test. Fifty subjects practiced under each of four different experimental conditions which varied in degree of distribution of effort. The main findings may be summarized as follows:

1. The level of performance attainable under the standard AAF testing condition (60 minutes work, 15 minutes rest) closely approached that obtained with completely massed (continuous) practice. The most distributed practice condition (30 minutes work, 30 seconds rest) resulted in a clearly superior performance level.

2. Variability in scores obtained in the standard AAF condition was not changed by forbidding the subject to get back on the target at the end of each trial.

3. The split-half (odd-even trial) reliability coefficients for the total test varied between .79 and .86 for the four experimental conditions. Analysis of the reliability of successively longer segments of the test showed little evidence that the coefficients had as yet reached their limit and suggested the possibility of still higher reliability with a longer test period.

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[5]Spence, K. W., Burton, C. E., and Melton, A. W. Op. cit.

TABLE 6

INTERCORRELATIONS BETWEEN VARIOUS TRIAL SEGMENTS AND TOTAL SCORES AND GAIN SCORES

	Group A			Group B			Group B-1			Group C		
	Trials Combined	Total Score	Gain (#4-#1)	Trials Combined	Total Score	Gain (#4-#1)	Trials Combined	Total Score	Gain (#4-#1)	Trials Combined	Total Score	Gain (#4-#1)
[illegible]	1-4	.90	-.28	1-2	.81	-.45	1-2	.94	-.03	1-4	.93	-.69
[illegible]	5-8	.86	.13	3-4	.79	-.14	3-4	.89	.19	5-8	.94	-.10
[illegible]	9-12	.94	.21	5-6	.85	.15	5-6	.90	.24	9-12	.93	-.19
[illegible]	13-16	.93	.38	7-8	.91	.35	7-8	.91	.44	13-16	.89	.18
Total	1-16	---	.09	1-8	---	.06	1-8	---	.19	1-16	---	-.21

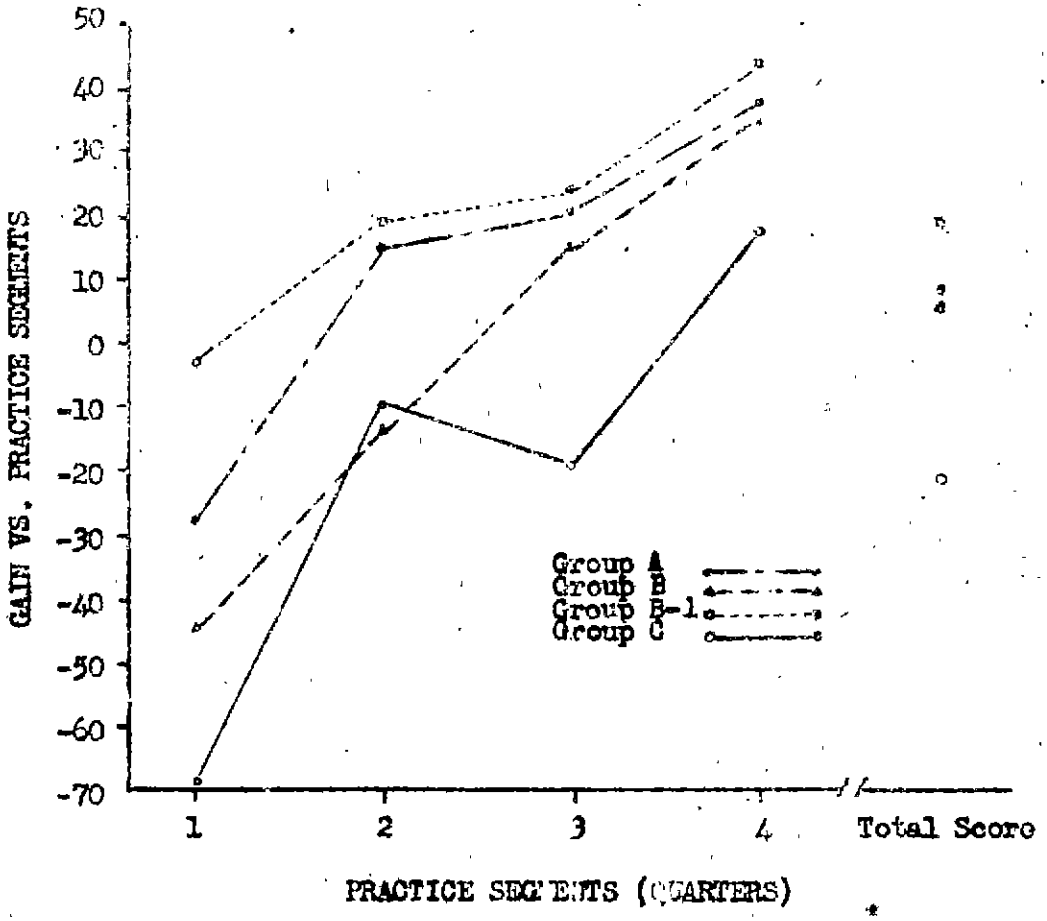
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
GAIN VS. PRACTICE SEGMENTS
Group A
Group B
Group B-1
Group C
1
2
3
4
Total Score
PRACTICE SEGMENTS (QUARTERS)

Figure 3

4. A gain score based on the amount of improvement between the first and last quarter of practice showed little or no correlation with the total score, ranging from -.31 to .19 in the four conditions. There was a marked tendency for the gain score to be negatively correlated with the score on the first quarter of practice and positively correlated with the last quarter.

APPENDIX A

SAMPLE OF DATA SHEET

APPENDIX A

SAMPLE OF DATA SHEET

Distribution Study, Lathe, Two-Hand Coordination Test

S.U.I. 1943

Age_____E_____Hour_____Name_____

Taken before: rotor_____p,cue_____Washburn_____Group_____

Trial	Score	Cum.	Trial	Score	Cum.
1			11		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		

Remarks:

APPENDIX B

DIRECTIONS FOR THE ADMINISTRATION OF THE SCHOOL OF AVIATION MEDICINE TWO-HAND COORDINATION TEST

DEMONSTRATION FOR THE ADMINISTRATION OF THE SCHOOL OF AVIATION PSYCHOLOGY TWO-HAND COORDINATION TEST[6]

(3 minute test period)

I. This is a Two-Hand Coordination Test. The black disc will rotate very slowly in a clockwise direction. (1) This small brass target (2) will move with the disc (3) and will also move in an irregular manner within the curved slot. (4) Your task will be to keep the small button (5) anywhere on top of this (6) brass target. Your score will be the total amount of time you stay on the target. When you get off, get back on as quickly as possible.

II. You are to move the button by turning the two handles (7) at the same time. The upper handle moves the button toward and away from you. (8) The lower handle moves it from side to side.

III. Now take your places. Do not touch the apparatus until I tell you what to do. (10)

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(1) Illustrate a slow clockwise movement by moving your hand halfway around the periphery of the disc.

(2) Point.

(3) Starting with your finger pointing at the target, move your hand in a clockwise direction through about one quadrant.

(4) Move your hand back and forth several times, over the arc of the slot.

(5) Point.

(6) Point.

(7) Pause briefly while you place your right hand first on the upper handle and then your left hand on the lower handle

(8) Turn the upper handle two complete revolutions clockwise to move the contact button toward you, and then move it back on to the center of the target (as close to the center as possible when the knob on the handle is at the lowermost part of its revolution).

(9) Turn the lower handle four complete revolutions to move the contact button off the target (toward the center of the disc) and then turn it back on to the center of the target (as close to the center as possible when the knob on the handle is at the lowermost part of its revolution).

(10) Check names with apparatus number.

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[6]These are standard AAF classification test instructions.

IV. Now, using your right hand on the upper handle only, move the button about an inch off the target and then back on again. (11) Let go of the upper handle. (12) Using your left hand on the lower handle only, move the button about an inch off the target and back on again. (13) Now let go of the handle. (14)

V. (Condition B) There will be a series of test periods and short rest intervals. At the end of each test period, get back on the target and then take your hands off the handles. There will be no practice. When I say "ready," grasp the handles but do not turn them. When I say "go," the target will begin to move. Try to keep the button on top of it. Never release the handles in order to spin them.

V'. (Condition B-1) There will be a series of test periods and short rest intervals. At the end of each test period, take your hands off the handles immediately, no matter where the button is. There will be no practice. When I say "ready," grasp the handles but do not turn them. When I say "go," the target will begin to move. Try to keep the button on top of it. Never release the handles in order to spin them.

VI. There will be no talking during this test. Do you have any questions?

VII. Remember, when I say "ready," take hold of the handles. (15)

VIII. Get on the target. Take your hands off the handles. Ready, go. (16)

IX. That is the end of the test. (17)

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(11) Wait until all subjects have moved the contact button onto the target before proceeding with the instructions. Ask any subject who keeps turning the button back and forth, or who turns it more than two inches away from the target, to move it back without delay. If any subject stops when the contact is near the edge of the target, ask him to turn it near the center.

(12) Wait until all subjects have released the handles before proceeding with the instructions.

(13) Follow the procedure described in (12)

(14) Wait until all subjects have released the handles before proceeding with the instructions.

(15) Depress the starting button until the timers start recording.

(16) Give these instructions at the end of the first test period, and when necessary at conclusion of other test periods.

(17) Give these instructions at the end of the test.