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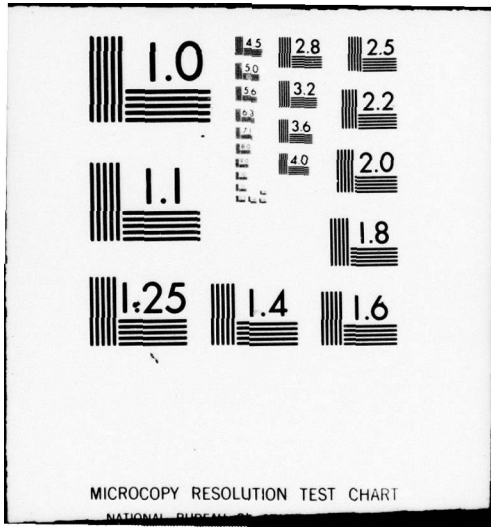
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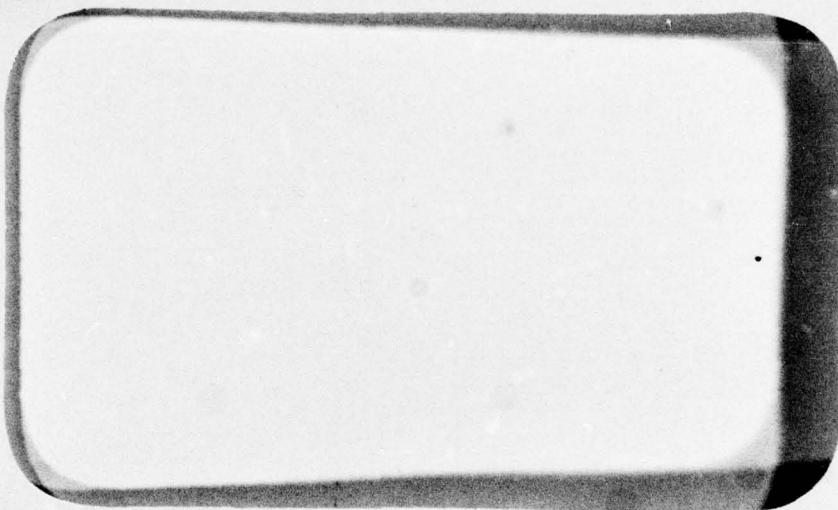
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Staff Paper

TRAINING ON A MOTOR SKILL FOR GROUPS  
OF DIFFERING ABILITIES

by  
Paul D. Hood

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HumRRO Division No. 3 (Recruit Training)

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19. ABSTRACT (Continue on reverse side if necessary and identify by block number) A pilot study was conducted to determine whether grouping by initial learning ability on a motor skill could lead to training efficiency. Enlisted men in one BCT company were divided into groups of fast, average, or slow learners, based on their performance (prior to training) on a portion of the Drill and Ceremonies exercise. A fourth, mixed, group was composed of (Continued)		

Block 20:

men randomly selected from each of the groups. Training was conducted for Drill and Ceremonies by Drill Sergeants who were assigned to each group on the basis of their ability to work with men of different abilities. Results indicated that grouping by initial performance ability or by GT might lead to training gains.

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## GROUPING BY ABILITY IN TRAINING ON A MOTOR SKILL

### INTRODUCTION

Significant portions of military training involve the acquisition of motor skills. In most cases these skills are taught by brief description and demonstration, followed by repeated drill, with corrective action and further demonstration given as required. In the training centers, groups of company or platoon size observe and copy basic movements. Practice or drill is usually confined to platoon size groups with coaching performed by one or two sergeants per 40 to 60 men. The groups are heterogeneous as to ability so the pace of instruction is set (by experience) on the progress of the slower learners. Obviously, the entire group may be held back while additional drill, demonstration or corrective action is given the slower men.

The question posed by this study is whether grouping by initial learning ability could lead to training efficiency. There appeared to be several possible sources for such improved efficiency. First, the faster learning men would not be slowed down while the less apt trainees were receiving additional drill and review. Second, the trainers could be assigned according to their special talents (e.g., the more patient and methodical sergeant could be assigned to work with the slower men while a less patient more demanding sergeant could be assigned to work with a faster group). Third, given the reality of short supply of trainers, the training manager (commander or field first sergeant) could assign his extra trainers to a slower group where they would be most needed rather than on a chance basis to one of several heterogeneous groups.

Drill and Ceremonies was chosen as the subject area for study because it requires a highly visible and exact performance in which there are over 20 single-hour periods devoted to individual movements. Hence, cumulative improvement is possible.

### PROCEDURE

As a pilot test, one Basic Combat Training company was chosen to serve as an experimental group. During the zero week, prior to any formal drill training (i.e., except for the essentials which have to be taught to control troop movement at the reception station), platoon size groups of the soldiers of this company were taught four new commands: column right, column left, change step, and hand salute. These particular commands had been chosen by the company on the basis of experience that they were moderately difficult. Four Drill Sergeants were the instructors, each teaching one command. The sergeants moved from platoon to platoon, using ten minutes to teach each of five platoons. Following this hour of instruction, a panel of three other Drill Sergeants graded each man



in the company on the execution of the four commands. Each grader independently assigned one point if he considered the performance acceptable, a zero otherwise; hence, with three graders and four commands, scores could range from zero to twelve. In fact, the distribution used the entire range, was symmetrical and slightly platykurtic.

On the basis of these performance scores, the company was then physically divided into three groups: "fast" (green), "average" (black) and "slow" (red) with approximately 80 men in each group. Twenty men were then pulled randomly from each group to form a "mixed" (blue) group. This group constituted the "control" group against which the three homogeneous groups were to be compared. The groups were called by their colors. The company commander assigned a Drill Sergeant to each group on the basis of his judgment of the sergeant's ability to work with men of different ability. Assistant Drill Sergeants, when available, were assigned to the groups on the basis of priority (red, then black and blue, then green).<sup>1</sup>

Except for this special grouping during the first 25 hours of Drill and Ceremonies, there were no other changes in the company. The experiment was explained to the trainees as "an experiment to see if drill could be taught any better by grouping trainees and then assigning Drill Sergeants who were skilled in helping trainees of particular abilities."

Sergeants from the Graded Test Platoon and from the Drill Committee of the Drill Sergeants' Course were used three times to appraise progress in the experimental company. They also tested another company in the same week of training on two occasions.<sup>2</sup> Tests were administered during the 8th, 17th, and 25th periods.<sup>3</sup> This was accomplished by adding one hour of "commander's time" to each of these periods and then testing both hours in an area immediately adjacent to the company's drill area. Successive

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<sup>1</sup>There are usually only five or six Drill Sergeants available for a given hour of training. In most cases of drill, each group had one Drill Sergeant, except the red (slow) group which usually had two.

<sup>2</sup>A scheduling problem made it impossible to collect data on a comparable period for the 8th hour in the control company.

<sup>3</sup>These periods are review periods, chosen because they terminate lesson segments and afford a nearly equal tricotomy of the 25 hours covering individual movements and squad drill.

groups of 60 men were tested at one time (10 or 15 men at six or four stations). Since testing required approximately 20 minutes and another 20 minutes were required to prepare the men for the test and move them to and from the test area, training time in the company was still approximately one hour. To equate for practice and any grader variation over the two hours, equal numbers of men were drawn from each training group to form the 60-man test groups.<sup>1</sup> The same grader graded two (or three) commands for all trainees.

Table 1

List of Drill Commands Used in Three Tests

Test 1 (8th hour): Attention, parade rest, dress right, open ranks,\* right face, about face, at close interval fall in,\* at close interval dress right,\* left step, column right, backward march, hand salute.

Test 2 (17th hour): Left shoulder arms, order arms, inspection arms, right shoulder arms, trail arms, sling arms, present arms, rifle salute, parade rest, about face, backward march.

Test 3 (25th hour): Attention, right or left step march, backward march, about face (twice), forward march (rifle automatically at trail), stack arms, right shoulder arms, rifle salute, port arms, inspection arms, parade rest, left shoulder arms.

\*NOTE: the commands "open ranks," "at close interval fall in," and "at close interval dress right" were erroneously included in Test 1 although they are not normally taught till much later. The effect was to depress the average score on Test 1 by approximately six points, (see Table 4).

The procedure for testing was essentially that followed in the regular BCT graded test (ATT 21-2), except that 12 commands were graded on each testing occasion. (The commands chosen were selected from material taught by that time as listed in the A Subj Scd 21-2, Drill and Ceremonies. Table 1 lists the commands.) Scoring was two points for acceptable performance, one point for partial failure (in some detail of movement or position) and no credit for complete failure (inability to execute command or gross discrepancy in movement or position). Hence, each test had a possible range of zero to twenty-four points. Figure 1 presents the results for the three tests. Tables 2, 3, and 4 present the statistical analyses.

<sup>1</sup>The 60-man test groups were formed and then moved to grading stations. The order of men from the four groups was mixed and graders did not know from which group the men came.

## RESULTS

Since the three tests are distinctly different in content, they cannot be treated as learning curves. However, changes in relative position and the significance of differences on a particular test are meaningful.

Table 2. Analysis of Drill Performance

Source of Variation	SS	df	MS	f	p
Between Subjects	1111.99	167			
Between Groups	203.59	3	67.863	12.25	<.01
Subjects within Groups	908.40	164	5.539		
Within Subjects	7374.67	336			
Tests	6045.36	2	3022.680	798.17	<.01
Groups by Tests	87.13	6	14.522	3.83	<.01
Tests by Subjects within Groups	1242.18	328	3.787		

We first note that an analysis of variance using a repeated measures design indicates a highly significant main effect--that there are non-chance differences between the groups. The significant difference between trials is meaningless except to remove this source from the error term to test the "tests by subjects within groups" interaction. This interaction is significant, and we conclude that the relative difference between groups changed over tests. Due to the lack of comparable metric, no inferences should be drawn concerning changes in learning rate, only that the groups differed inconsistently in their relative positions on the three tests. Tests of simple effects are in order and the major differences were implied in the design (i.e., did the three homogeneous groups differ significantly from the mixed group that represents the typical distribution of ability?).

Dunnett's *t*-test, which makes allowances for the comparison of several treatments with one control, was used. The results appear in Table 3 and Figure 1. At the 8th hour of drill, the slow group was significantly slower than the mixed group and the fast and average groups were not significantly different from the mixed. By the 17th hour of drill the slow group had passed the mixed group, but they and the average group were not significantly different from the mixed group.

PERFORMANCE ON THREE TESTS OF DRILL, EXPRESSED AS DIFFERENCES IN STANDARD ERRORS FROM THE MIXED (CONTROL) GROUP.

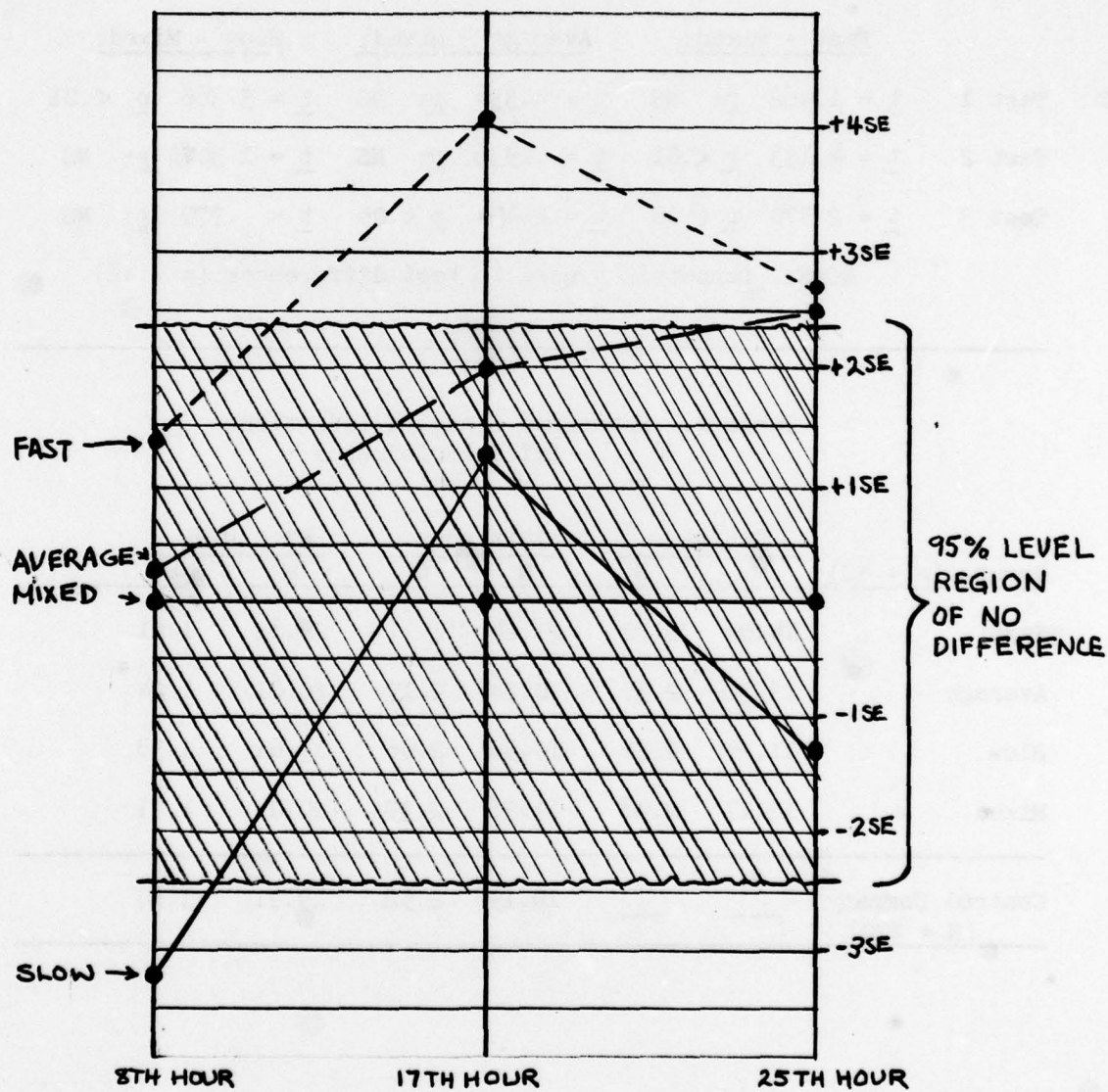


FIGURE 1

NOTE: EACH POINT IS BASED ON 42 TRAINEES

However, the fast group was significantly better. By the 25th hour the slow group was still making scores which were not different from those of the mixed group, but both the fast and the average were significantly better than the mixed group.

Table 3. Comparison of Homogeneous Groups with Heterogeneous Groups on Each Drill Test

	<u>Fast - Mixed:</u>	<u>Average - Mixed:</u>	<u>Slow - Mixed:</u>
Test 1	$\underline{t} = 1.462$ $\underline{p}: NS$	$\underline{t} = .334$ $\underline{p}: NS$	$\underline{t} = 3.386$ $\underline{p} < .01$
Test 2	$\underline{t} = 4.133$ $\underline{p} < .01$	$\underline{t} = 1.936$ $\underline{p}: NS$	$\underline{t} = 1.307$ $\underline{p}: NS$
Test 3	$\underline{t} = 2.570$ $\underline{p} < .05$	$\underline{t} = 2.494$ $\underline{p} < .05$	$\underline{t} = .779$ $\underline{p}: NS$

NOTE: Dunnett's  $\underline{t}$  used to test differences ( $n = 42$ ).

Table 4. Means and Standard Deviations Drill Performance

Groups ( $n = 42$ )	8th Hour		17th Hour		25th Hour	
	M	S	M	S	M	S
Fast	14.00	2.72	21.24	1.71	20.83	1.21
Average	13.36	2.35	20.24	2.17	20.81	1.24
Slow	11.24	2.34	19.95	2.06	19.81	1.38
Mixed	13.17	2.98	19.36	2.35	20.05	1.71
Control Company ( $N = 220$ )	—	—	19.19	2.52	19.71	1.67

## RELATION OF DRILL PERFORMANCE TO OTHER FACTORS

It is possible that efficient grouping of trainees for motor-skills training may be accomplished on other bases than initial performance on relevant behavioral tasks. In conjunction with this study, data were collected on the General Technical (GT) Aptitude score (Arithmetic and vocabulary tests), military component (enlistee, draftee or reservist), and on prior military training (essentially, duty with reserve units).

Mean GT scores for the groups formed on the basis of initial performance are presented below:

<u>Initial Drill Performance Grouping</u>	<u>Mean GT Scores</u>
Fast	116
Average	109
Slow	105
Mixed	108

These differences are significant at the .01 level and suggest that GT scores may be useful as a basis for grouping trainees for primarily motor-skills training.

To further assess the potency of GT as a possible basis for grouping, the data were regrouped using GT rather than initial performance to constitute the groups. Four groups were formed on the basis of GT scores: a High GT group (GT=119 to 149), a Medium GT group (GT=105 to 118), a Low GT group (GT=68 to 104), and a Mixed GT group (GT=61 to 149) which was formed by random selection from the other three groups. Means on the drill performance tests for the GT groupings are presented in Table 5.

Table 5

Means and Standard Deviations for Drill  
Performance Resulting from GT Score Regrouping

GT Groups	8th Hour		17th Hour		25th Hour	
	$\bar{X}$	S	$\bar{X}$	S	$\bar{X}$	S
High GT	13.54	3.21	20.58	1.90	20.50	1.53
Medium GT	13.00	2.80	20.16	1.99	20.47	1.50
Low GT	12.14	2.58	19.86	2.25	19.93	1.73
Mixed GT	13.14	2.77	20.12	2.44	20.46	1.29

Comparing Table 5 with Table 4 indicates that the GT score grouping produced the same pattern of group differences as did grouping on initial performance. These data were treated by analysis of variance in the same manner as that reported previously for the initial performance groupings. The between groups main effect yielded an F of 2.46 (where F of 2.60 was needed to reach significance at the .05 level). The groups by test interaction was clearly not significant ( $F=.46$ ). The correlation of drill performance with GT is approximately .2 with a single test and .3 for the total of three tests. Although a relation of this magnitude is not strong, it is statistically significant and indicates that further research is needed to determine the relative value of aptitude and initial performance tests as bases for grouping in motor-skills training.

As one might expect, the men with any prior service do score significantly higher than those with no prior service. These prior service results, however, are confounded with GT as the prior service trainees in this sample had significantly higher GT scores. Similar differences were also noted for component, with National Guard and Enlisted Reserve trainees scoring higher than draftees and regular Army enlistees.

#### ATTITUDES

Initially, some of the cadre found it uncomfortable to change their usual methods, that is, of working with their own platoons. As the experiment progressed, this resistance faded and it appeared that each trainer took a genuine interest in his group. Of course, from the very beginning they accepted the challenge of trying to work with their groups.

Trainee reaction, primarily in the slow group, was at first adverse. Some wanted to know how they could be transferred out of the red group. (The groups were never labeled as to ability, but performance differences were obvious even to the trainees.) After a few drill periods the members of all the groups found their own esprit and there was less negative feeling about not being in a faster group. Part of this was undoubtedly due to the fact that the pace of training was "right" for most members of the homogeneous groups. Obviously, the loss of platoon integrity cannot be discounted entirely, but our conclusion is that trainee attitude is more a matter of the Drill Sergeants' attitudes and treatment of the trainee. All groups progressed and, in fact, excelled the control company on the two occasions when comparable data were obtained. (See Table 4.)

It should be further noted that, although the company was permitted to shift men back and forth among the homogeneous groups (but not with the mixed group) as training progressed, not many changes were made. These results pertain only to grouping on the basis of initial ability and not to grouping on the basis of progress during training.

#### CONCLUSION

This being a pilot study confined to one company with only one instructor or team of instructors assigned to each group, treatment groups are completely confounded with instructors. We can conclude only that grouping by initial ability was successful in this particular company. The initially slow group showed a marked improvement by the 17th hour and was still comparable at the 25th hour. The fast group was significantly faster at the 17th and 25th hour, and even the average group scored significantly higher than the mixed group by the 25th hour. These same trends hold when the data are regrouped on the basis of GT. These results are not definitive, but certainly suggest that grouping by ability or aptitude may lead to training gains.