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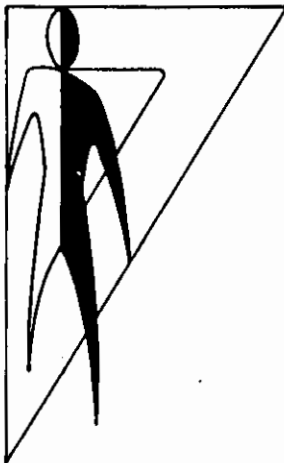
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Technical Memorandum 3-60

THE EFFECTS OF FOUR HOURS CONFINEMENT
IN MOBILE ARMORED PERSONNEL CARRIERS
ON SELECTED COMBAT RELEVANT SKILLS:
A PILOT STUDY

OCO Research Branch Project No TB1-1000

HUMAN ENGINEERING LABORATORIES



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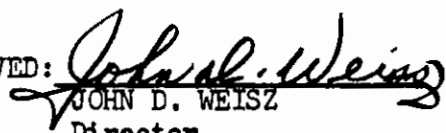
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ABSTRACT

This study was undertaken to determine changes in general combat relevant performance as a result of four hours confinement in a maneuvering Armored Personnel Carrier (APC). Fifty enlisted men were tested both before and after confinement on tests designed to measure stamina, response time, gross motor coordination, arm steadiness, equilibrium and eye-arm coordination. The four-hour confinement period resulted in losses in all areas. The losses were statistically significant in three areas. Recommendations are included for future research.

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THE EFFECTS OF FOUR HOURS CONFINEMENT IN MOBILE
ARMORED PERSONNEL CARRIERS ON SELECTED COMBAT RELEVANT SKILLS:

A PILOT STUDY

INTRODUCTION

Due to the anticipated mobility requirements of future wars and the associated probability of operating either under the threat of atomic attack or in areas of radiation fallout, it may be necessary for troops to live and fight for long periods of time from the confines of Armored Personnel Carriers (APCs) and other armored vehicles. The projected use of APCs as fighting vehicles in future wars raises serious questions as to the ability of the crew and passengers to withstand the adverse environmental conditions present and emerge as a fully effective fighting unit. For this reason an extended program of research has been initiated for the purpose of determining how long troops can be expected to endure under these conditions and maintain their combat efficiency and their units' resultant combat power.

The general problem area cited above may be broken down to include the assessment of the effects of certain conditions associated with confinement in armored vehicles, both individually and in interaction. These are: 1. temperature extremes; 2. high humidity; 3. vibration; 4. blast effects; 5. high ambient noise; 6. cramping; 7. air pollution; and 8. sleep deprivation. In addition to these, there may be others that will become evident as the program progresses.

It may appear that these areas are relatively well investigated and the answers as to their effects on the performance of men when confined can be found in previously reported research. This however is not true; for the great majority of work accomplished in these areas applies almost solely to short term exposure (i.e., 1 to 2 hours). Little if any indication is given to the tolerance limits of the individual or changes in performance as a result of changes in length of exposure time.

The ultimate goals of this program then are:

1. To determine the effects of long term confinement on human performance.
2. To formulate procedures for maintaining combat efficiency.
3. To spell out general design recommendations for future armored vehicles based on experimental findings.
4. To determine the psychological and physiological limits of the individual to confinement and conditions associated with confinement in closed tracked vehicles.

To fully achieve the above goals certain prerequisites necessary for continuation in this area must be met. These are:

1. Standardization of test procedures.
2. Validation of measuring devices used to detect changes in performance.
3. Determination of appropriate physiological measures and techniques in assessing functional changes due to the variables under investigation.

In line with both the ultimate goals of the overall program and the pre-requisites listed above, the purposes of this pilot study are to: 1. determine the changes, if any, in general psychomotor performance as a result of 4 hours confinement in a maneuvering APC; 2. test the general procedures; and 3. test under actual experimental conditions the appropriateness of the selected measuring devices.

METHOD

Subjects

The subjects (Ss) used in this study consisted of 50 enlisted men of the 2nd Bn., 3rd Armored Cavalry Regiment of Ft. George G. Meade, Maryland. All of the Ss possessed Light Weapons Infantryman Primary Military Occupation Specialties and were combat ready. For experimental purposes the Ss were divided into 5 squads of 10 men each including squad leaders. Four squads were designated as experimental while one was utilized as a control.

Apparatus

The apparatus consisted of 5 courses as follows:

1. Vehicle-Cross-Country Test Course - This course is a permanent facility at Aberdeen Proving Ground, Maryland. It was designed to submit vehicles to the most severe terrain features found in a natural setting thus testing the durability of the vehicle. Because of the ruggedness of the course it was selected as the treatment course for this investigation.
2. Obstructed-Run Course - This test, designed to measure gross motor coordination and stamina, consisted of a planned course of 220 yards total length. The course was constructed so that there were parallel lanes of 110 yards each. The course consisted of:
 - a. Four 10-foot wide ditches along a 40 yd. straightaway
 - b. 30 yds. of staggered automobile tires
 - c. A 30 yd. banked straightaway
 - d. 40 yds. of staggered 4 X 4s
 - e. 30 yds. of 2½ foot hurdles

There was a 10-yard unobstructed area between each series of obstructions. (See Figures 1 & 2).

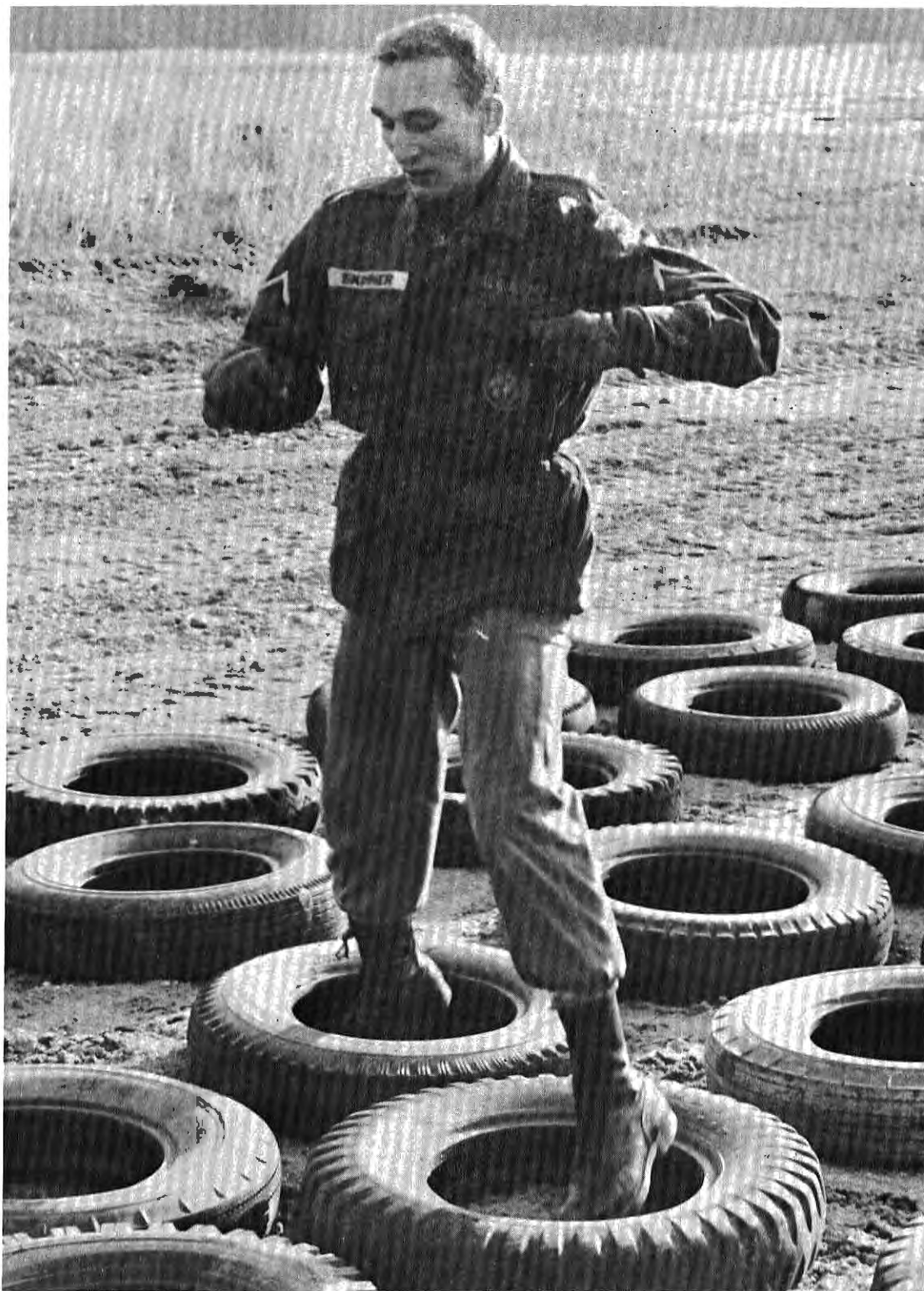


Fig. 1. SUBJECT MOVING THROUGH STAGGERED AUTOMOBILE TIRES ON THE OBSTRUCTED-RUN COURSE
(Notice that in order to clear each tire he must stay on the ball of his feet.)



10-foot Holes



Banked Straightaway

Fig. 2. Subjects Performing on Four Obstacles Making up Parts of the Obstructed-Run Course.



Change-of-Pace Ties



Low Hurdles

Fig. 2. Continued.

3. Grenade-Throw Course - This course, designed to measure eye-arm coordination, consisted simply of nine 4-foot-square pits and a restraining line 25 yards from the center of the target. The pits were covered with 8 inches of fine sand placed there to stop the grenades on impact. (See Figure 3).

4. Rail-Walking Course - This course, designed to measure equilibrium, consisted of 27 rails categorized as follows: 9 rails 4 inches in width; 9 rails 2 inches in width; and 9 rails 1 inch in width. Three rails, one of each width, were placed in a triangular pattern, resulting in 9 separate test groups. (See Figure 4).

5. Rifle-Fire Course - This course, designed to measure rifle accuracy, consisted of 2 banks of pop-up targets. Each bank consisted of 9 targets placed at distances of 100-130 yards from the firing line and 20-25 feet apart. The targets were controlled from a point behind the firing line. (See Figure 5).

The target devices used on this course were the M31 remote controlled train-fire target mechanisms. Briefly, the M31 target is an electrically powered, remote controlled mechanism which presents a silhouette target that falls when struck by a bullet. It is designed to simulate a human figure that alternately appears and disappears. To obtain the desired data, the M31 trainfire mechanisms were modified to score hits on a remote 10-channel recorder, rather than fall when struck.

The last four courses described above made up the combat test battery used to assess changes in psychomotor performance as a result of 4 hours confinement in a mobile APC.



Fig. 3. Test Subjects Performing on the Grenade-Throw Course. Notice the target boxes in the background.



Fig. 4. Test Subjects Being Tested for Equilibrium on the Rail-Walking Test. The subject in the foreground is attempting to complete the 1-inch rail.



Fig. 5. A Test Subject in Position on the Rifle-Fire Course. Silhouette targets appeared 100 to 130 yards to the front of the subject. Note arrow pointing to silhouette in background.

PROCEDURE

The general procedure during the course of this investigation followed the general model listed below.

	<u>EXPERIMENTAL GROUP</u>	<u>CONTROL GROUP</u>
Trial 1	Practice	Practice
Trial 2	Practice	Practice
Trial 3	Practice	Practice
Trial 4	Pre-Confinement	Control 1
Treatment	X	--
Trial 5	Post-Confinement	Control 2

In following this model, it was assumed first that in general, the performance of the experimental Ss would exhibit a gradual trial-to-trial increase. Secondly, the use of practice sessions would serve to decrease intra-subject variability thereby lending greater reliability to any performance loss observed after the 4-hour period of confinement for the experimental groups. And finally, the proficiency of the control group would follow the same pattern and would either continue to increase or remain the same during Trial 5 as compared with Trial 4. (Trials 4 and 5 of the control group correspond to the pre- and post-confinement trials of the experimental groups).

In following this procedure two means of comparison were available. It was possible to compare within-group performance (pre- and post-treatment) and between-group performance (experimental and control). Thus, the use of the control group served as a check on the results achieved by the experimental groups.

A treatments-by-Ss design was used to determine reasons for any existing difference in performance between trials of the same group. The use of this method allowed the experimenter to ascertain whether or not an observed difference was due to the 4-hour period of confinement.

Prior to the administration of any test, printed instructions were read to all Ss. (See Appendix A.) After the instructions were read and before the first trial, a demonstration was run by a proctor to show exactly what was required on each test. Scheduling of each test was arranged so that no more than one test was introduced to a squad during any one work period.

The schedule of tests was arranged so that there were practice sessions run before any trial of record. However, in order to facilitate scheduling, practice sessions and experimental sessions for the Rail-Walking Test and the Grenade-Throw Test were scheduled on the same days for all squads. Where the tasks were more demanding physically or more time consuming, all sessions were scheduled on successive days. (The Rifle-Fire Test and Obstructed-Run Test.)

On each day that an experimental session was scheduled, the pre-treatment session was given immediately before entering the APC. The lone exception to this occurred in the case of the Rifle-Fire Test. In order to have approximately the same conditions of illumination for the pre- and post-treatment administrations of the Rifle-Fire Test, these measures were taken on successive days. The pre-treatment measure was taken at approximately the same time the post-treatment measures were to be taken on the following day.

Upon completion of the pre-treatment sessions the Ss were loaded on the APC along with all personal gear, interior On Vehicle Mounted (OVM) equipment and crew-served weapons organic to the Armored Infantry Squad. (See Figures 6, 7 and 8). The presence of this equipment severely restricted the movement of the Ss inside of the vehicle. After the Ss were loaded on the APC all means of exit were closed and the vehicle departed the assembly area for the cross-country test course. (See Figure 9). Here the Ss were exposed to an extremely rugged ride of 4 hours duration. During the ride the test Ss were subjected to high noise levels, extreme vibration, high accelerative forces due to the impact of the vehicle falling off of high terrain rises and an undetermined amount of air pollution.

During this period all means of exit from the vehicle were sealed and the driver was instructed to open the vehicle only in the event of mechanical trouble or physical injury to one of the Ss. At the completion of the ride the APC returned to the test area, the Ss dismounted and were immediately run through the post-treatment sessions. (See Figure 10). This procedure was followed for each of the 4 tests and on all experimental squads.

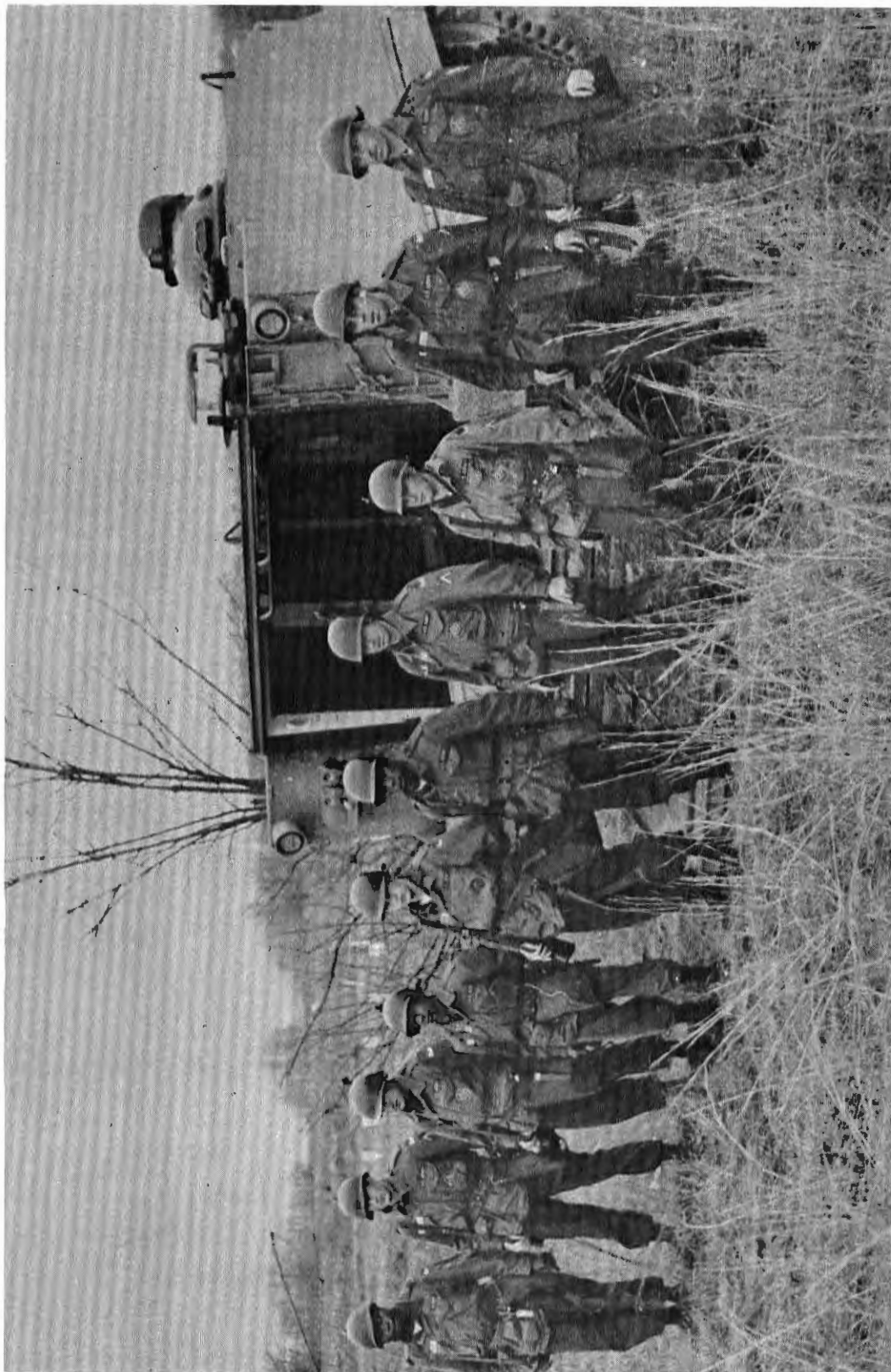


Fig. 6. An Experimental Squad Prior to Loading on the APC.



Fig. 7. Interior of Test APC With Interior OVM Equipment and Organizational Equipment Stowed.



Fig. 8. An Experimental Squad in Position Prior to Departure.



Fig. 9. A Test Vehicle in the Fully Buttoned Condition. The hood at the right of the commander's cupola allowed the driver an unobstructed view of the outside terrain without permitting circulation of fresh air to the passenger compartment.



Fig. 10. Subjects Dismounting from an APC Prior to Beginning a Post-Confinement Test Session.

RESULTS AND DISCUSSION

The Rail-Walking Test

Both time and distance scores were obtained from the Rail-Walking Test. The distance scores were based on feet traversed per rail, thus the maximum attainable distance score for each rail was:

27 feet	---	4-inch rail
27 feet	---	2-inch rail
18 feet	---	1-inch rail

These distance scores were then converted into a weighted score yielding a maximum score of 153. This score resulted from the following $(1 \times 27) + (2 \times 27) + (4 \times 18)$ or 1, 2 and 4 times the distances traveled on the 4, 2 and 1 inch rails respectively. Through this arrangement the most difficult or narrowest rail received the highest value. (For a more detailed explanation of this procedure see Heath 4.) The time scores were based on the total expired time on each rail.

Mean scores of the results were computed and a test for the significance of difference between means was performed between the mean distance and mean time scores. This test was between the pre- and post-confinement mean scores for the experimental group and corresponding trials of the control group. The .05 level was selected as the region for rejection of null hypothesis. The results of the test for significance of differences between means are presented in Table 1.

TABLE 1

THE RAIL-WALKING TEST

Means, Differences Between Means and Significance of Differences
for Time and Distance Variables for Experimental and Control Groups

GROUP		PRE- CONFINEMENT	POST- CONFINEMENT	D	t	
Experimental	Dis.	146.7	129.6	17.1**	4.53**	N=36
	Time	63.5 sec.	66.2 sec.	2.7	1.15	N=36
Control	Dis.	147.0	150.5	3.5	1.24	N=9
	Time	59.6 sec.	55.4 sec.	4.2	2.18	N=9

** Significant beyond the .01 level

Table 1 reveals that the mean difference between pre- and post-confinement distance scores of 17.1 is significant beyond the .01 level for experimental groups and that this difference demonstrates a loss in performance. Further, the performance of the control group followed the expected trend and an increase

in performance of 3.5 is noted in distance scores. Perhaps of more importance is the increase of 2.7 seconds in time required by the experimental group. Although this difference is not statistically significant, it certainly points up the difficulty of this task after the confinement period particularly when it is contrasted with the results observed in the control group where a mean time score on Trial 5 (Control 2), was 4.2 seconds faster than the score made during Trial 4 (Control 1). This decrease in time occurred in spite of the increased distance traveled.

After establishing, through the use of the t test, that the difference observed in mean distance scores was significant and could be attributed to some factor other than chance, a treatments-by-S's analysis of variance was performed on the data in an effort to determine whether this difference was a result of intra-subject variability or was in fact a function of the 4-hour confinement. Specifically, the post-confinement score of any S was compared with that same S's pre-confinement score. The results of the analyses of variance are summarized in Tables 2, 3, 4, and 5.

TABLE 2

THE RAIL-WALKING TEST

Summary of Analysis of Variance for Distance
Scores Achieved by Experimental Squads

SOURCE	df	SUM OF SQUARES	MEAN SQUARE	F
Subjects	35	19424.62	554.99	
Treatments	1	5253.13	5253.13	
Subjects x Treatments	35	8200.13	234.28	22.42**
Total	71	32877.88		

** Significant beyond the .01 level

TABLE 3

THE RAIL-WALKING TEST

Summary of Analysis of Variance for Distance
Scores Achieved by Control Squad

SOURCE	df	SUM OF SQUARES	MEAN SQUARE	F
Subjects	8	375.12	46.89	
Treatments	1	56.92	56.92	1.48
Subjects x Treatments	8	307.08	38.38	
Total	17	739.12		

TABLE 4

THE RAIL-WALKING TEST

Summary of Analysis of Variance for Time Scores
Achieved by Experimental Squads

SOURCE	df	SUM OF SQUARES	MEAN SQUARE	F
Subjects	35	7627.80	217.93	
Treatments	1	130.40	130.40	1.14
Subjects x Treatments	35	3985.99	113.88	
Total	71	11744.19		

TABLE 5

THE RAIL-WALKING TEST

Summary of Analysis of Variance for Time Scores
Achieved by Control Squad

SOURCE	df	SUM OF SQUARES	MEAN SQUARE	F
Subjects	8	1060.84	132.60	
Treatments	1	79.80	79.80	2.54
Subjects x Treatments	8	250.61	31.32	
Total	17	1391.25		

The results of the analysis of variance of the distance scores of the experimental group yielded an F ratio of 22.42 between treatment scores. This value of F is statistically significant beyond the .01 level of significance, thus showing conclusively that the decrease in distance scores exhibited by the experimental group during post-confinement testing is definitely a function of the treatment effects. Even though it has previously been shown that there was no significant difference between the time and distance variables for the control group, the results of the analysis of variance for these variables have been included in Tables 3 and 5. These results (F values of 1.48 and 2.54) show conclusively that the changes in time and distance scores are not significant and may be due to some chance effect or to the effects of practice. Further, the presence of these results lend greater meaningfulness to the results acquired from the experimental group.

The Rifle-Fire Test

The Rifle-Fire Test yielded only scores based on total hits out of 18 shots fired. It was intended to differentiate hits as to the length of time each target was visible, however, due to the failure of the timing mechanism in the target control circuit, it was impossible to obtain these scores.

Mean hit scores were computed for both experimental and control groups and for pre- and post-confinement trials. The differences between means of pre- and post-confinement trials were then tested for statistical significance. The results of the test for significance are presented in Table 6.

TABLE 6

THE RIFLE-FIRE TEST

Means, Differences Between Means and Significance of Differences
for Accuracy Variables for Experimental and Control Groups

GROUP	PRE- CONFINEMENT	POST CONFINEMENT	D	t	
Experimental	9.1	6.6	2.5**	5.68**	N=36
Control	8.1	8.6	.5	.59	N=9

** Significance beyond the .01 level

Inspection of Table 6 reveals that the results followed the predicted trend. The mean difference of 2.5 hits exhibited by the experimental groups between pre- and post-confinement scores represented a decrease in number of targets hit, while the .5 difference exhibited by the control group describes a slight though nonsignificant increase in accuracy.

Since the 2.5 mean difference was statistically significant, a treatments-by-Ss analysis of variance was performed on the Rifle-Fire Test scores. The results of the analyses of variance are presented in Tables 7 and 8.

TABLE 7

THE RIFLE-FIRE TEST

Summary of Analysis of Variance of Total Hits
Scored by Experimental Groups

SOURCE	df	SUM OF SQUARES	MEAN SQUARE	F
Subjects	35	446.38	12.75	
Treatments	1	110.01	110.01	17.88**
Subjects x Treatment	35	215.49	6.15	
Total	71	771.88		

** Significant beyond the .01 level

TABLE 8

THE RIFLE-FIRE TEST

Summary of Analysis of Variance of Total
Hits Scored by Control Group

SOURCE	df	SUM OF SQUARES	MEAN SQUARE	F
Subjects	8	49.28	6.16	
Treatments	1	1.39	1.39	.084
Subjects x Treatment	8	131.61	16.45	
Total	17	182.28		

The analysis of variance performed on the scores of the experimental group yielded an F ratio of 17.88 between treatment scores. This F value indicates that the 2.5 difference in rifle accuracy is directly attributable to the effects of confinement. The F ratio of .084 between trials of the control group indicates that the observed .5 difference in mean hit scores may be due only to some chance fluctuation.

The Obstructed-Run Test

The Obstructed-Run Test yielded two sets of scores. These scores were total time taken to complete the course and the number of obstacles missed. The time score served as an index of stamina while the number of obstacles missed served as an index to gross motor coordination. During this test a total of 4 Ss were lost due to sickness prior to the test. During the course of the experiment, time scores were lost on 2 Ss due to timer failure. They were, however, permitted to continue through the course so that at least one score would be available for comparison purpose, thus the time scores have an N of 32 and the error scores an N of 30.

Mean error (obstacles missed) scores and time scores were computed for both experimental and control groups. The mean differences between both scores achieved on this test were computed and tested for significance. The results of this test are presented in Table 9.

TABLE 9

THE OBSTRUCTED-RUN TEST

Means, Differences Between Means and Significance of Differences
for Time and Error Variables for Experimental and Control Groups

GROUP		PRE- CONFINEMENT	POST- CONFINEMENT	D	t	
Experimental	Time	71.5 sec.	77.3 sec.	5.8**	4.56**	N=30
	Error	4.6	7.5	2.9**	4.14**	N=32
Control	Time	76.2 sec.	78.9 sec.	2.7	1.78	N=9
	Error	7.0	6.0	1.0	.90	N=9

** Significant beyond the .01 level

The results of the test for significance point out that the mean differences for both time and error scores of the experimental group are statistically significant, thus the differences may be due to some factor other than chance.

The error scores recorded for the control group followed the expected trend and a decreased error score was observed in Control Trial II. The increased time score of 2.7 seconds, however, did not follow the expected trend. Coupled with the decrease in error scores and normal fluctuations in running speed of humans after reaching their physical limitations, this increase in time may in all probability be quite normal.

A treatments-by-Ss analyses of variance were performed for both time and error scores for experimental and control groups. The results of these analyses are presented in Tables 10, 11, 12 and 13.

TABLE 10

THE OBSTRUCTED-RUN TEST

Summary of Analysis of Variance on Time Scores
Achieved by Experimental Groups

SOURCE	df	SUM OF SQUARES	MEAN SQUARE	F
Subjects	29	4007.08	138.17	
Treatments	1	515.09	515.09	12.51**
Subjects x Treatment	29	1193.44	41.15	
Total	59	5715.61		

** Significant beyond the .01 level

TABLE 11

THE OBSTRUCTED-RUN TEST

Summary of Analysis of Variance of Time Scores
Achieved by Control Group

SOURCE	df	SUM OF SQUARES	MEAN SQUARES	F
Subjects	8	865.01	108.12	
Treatments	1	32.00	32.00	2.27
Subjects x Treatments	8	112.75	14.09	
Total	17	1009.76		

TABLE 12

THE OBSTRUCTED-RUN TEST

Summary of Analysis of Variance of Error Scores
Achieved by Experimental Groups

SOURCE	df	SUM OF SQUARES	MEAN SQUARES	F
Subjects	31	410.74	13.24	
Treatments	1	145.14	145.14	13.23**
Subjects x Treatments	31	10.97	10.97	
Total	63	666.85		

** Significant beyond .01 level

TABLE 13

THE OBSTRUCTED-RUN TEST

Summary of Analysis of Variance of Error Scores
Achieved by Control Group

SOURCE	df	SUM OF SQUARES	MEAN SQUARES	F
Subjects	8	141.00	17.62	
Treatments	1	5.50	5.50	.69
Subjects x Treatments	8	63.00	7.87	
Total	17	209.50		

The results of the analyses of variance indicate that the observed differences in time and error scores (5.8 seconds and 2.9 misses (error)), of the experimental groups are directly attributable to the treatment effects. Conversely, the differences observed in the performance of the control groups may possibly be due to normal chance variance in the control groups resting in the intra-subject variance.

The Grenade-Throw Test

The final test in the battery, The Grenade-Throw Test, was intended to yield scores based on the number of hits out of six grenades made in a 4-foot square target. The number of hits made in the target, however, was relatively small. On only 4 occasions did a S get more than 2 hits in the target and a total of 2 hits was achieved by only 18 Ss out of 72 for the Experimental Group ($72 = 2 \times N$ or 2×36) and on 30 occasions no hits at all were recorded. Thus, this test was deemed too difficult for this population in its present form. The results of the grenade throw, however, are presented in Table 14.

TABLE 14
SUMMARY OF GRENADE-THROW TEST RESULTS

GROUP	SQUAD	TREATMENT	SHORT	OVER	LEFT	RIGHT	HIT
Experimental	I	Pre	21	6	2	8	5
		Post	33	1	3	0	5
	II	Pre	22	10	7	2	13
		Post	34	5	5	5	5
	III	Pre	19	7	8	9	11
		Post	24	11	4	2	13
	IV	Pre	15	13	4	10	11
		Post	39	7	2	2	4
Control	V	TOTAL Pre	77	36	21	29	40
		TOTAL Post	130	24	14	9	27
		Control I	23	9	4	2	16
		Control II	22	10	4	5	13

Even though this test yielded little data on the loss of accuracy as defined by a difference in the number of hits during the post-treatment trial as compared with the pre-treatment trial, perhaps one important observation was noted. Generally, there was a tendency on the part of all experimental groups to throw short of the target box during the post-treatment trials.

The reason for this tendency is not known, however, it is felt that it may be: 1. the result of a tendency to under estimate distance; 2. a momentary loss of strength; or 3. actually representative of a decrement since there is also a decrease of 13 hits exhibited from the pooled experimental group scores. Despite these results, the general conclusion is that as the Grenade-Throw Test is now constructed it is much too difficult to yield satisfactory comparison between pre- and post-treatment.

General

Even though it is not and cannot be accounted for in the treatment of the data, perhaps one of the most important contributing agents to any performance decrement is the feeling of nausea reported by several Ss, witnessed in 3 Ss during the ride and in one immediately after the ride in the APC. While it is generally felt that the occurrence of nausea is due to the pitching and rolling motion of the vehicle as it maneuvers cross-country, the Ss report that this state may have been a function of food eaten during or before the period of confinement or the presence of some noxious fumes.

The most frequent complaint of the Ss however had little to do with nausea. The complaint revolved around the cramping caused by the limited space and a concomitant loss of circulation in the lower part of the body. This factor, if severe enough, may have been the major contributing factor to the decrements observed in equilibrium and gross motor coordination. If true, this variable should be isolated and studied in the future.

Despite the seemingly obvious decrements reported here, caution should be exerted in the utilization of these results to identify substandard performance in field situations. Until such time as the results are validated against a more ultimate performance criteria, they should be treated as merely indicative rather than demonstrative results.

SUMMARY

The present study was undertaken to determine changes in general psychomotor performance, related to basic Infantry skills, as a result of 4 hours confinement in a moving APC.

Fifty enlisted men of the 2nd Battalion, 3rd Armored Cavalry Regiment served as Ss during this study. Data was collected for each S on 4 tests before and after confinement in an APC. The tests used and the corresponding psychomotor measures are listed below:

- | | | |
|------------------------|---|--|
| 1. Rail-Walking Test | - | equilibrium |
| 2. Obstructed-Run Test | - | stamina and gross motor coordination |
| 3. Rifle-Fire Test | - | response time*, hand-arm steadiness and eye-arm coordination |
| 4. Grenade-Throw Test | - | eye-arm coordination |

* Not achieved due to equipment failure

At the outset of this study it was assumed that the performance of the Ss would be marked by a gradual trial-to-trial increase in proficiency on each test. With the introduction of the confinement period, the performance of the experimental groups would suffer a decline, the extent of which was unknown. Conversely, the performance of the control groups would continue to increase. Comparison of pre- and post-confinement scores indicate that this trend was followed in 3 of 4 tests administered to the experimental Ss. Generally, as a result of confinement, performance deteriorated on the Rail-Walking Test, Rifle-Fire Test and Obstructed-Run Test for the experimental groups and a slight though nonsignificant increase was noted for the control groups. While the results followed the expected trend, it is not practical at this time to definitely conclude that the observed decrements would result in serious impairment of the performance of Infantry personnel in a combat situation. It is entirely possible that the effects of the period of confinement under investigation here are of an extremely transient nature.

Treatments-by-Ss analyses of variance were used to assess the differences in performance due to confinement. The results of the analyses of variance indicate that as a result of 4 hours confinement:

1. There is a significant loss in firing accuracy.
2. There is a decrease in stamina and gross motor coordination.
3. Equilibrium is significantly impaired.

The Grenade-Throw Test yielded no usable data due in all probability to restrictions within the task itself.

RECOMMENDATIONS

As a result of the findings of this investigation it is recommended that:

1. Future studies be conducted with the period of confinement increased to 8, 16, and 24 hours.
2. In addition to simply determining whether a decrement exists, an

attempt should be made at ascertaining the persistence of each observed decrement.

3. The Grenade-Throw Test be decreased in difficulty.

4. A test should be included to investigate target detection and range estimation ability.

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APPENDIX A
MANUAL OF INSTRUCTIONS
FOR
ADMINISTERING COMBAT TEST BATTERY

Test Battery Rationale

The individual tests making up this battery were devised or selected keeping in mind the job of the infantryman. An attempt has been made to select a series of tests that will give an accurate picture of the losses encountered in critical behavioral measures that could hinder the performance of the individual infantryman and the infantry squad most significantly. The tests to be used and their behavioral counterparts are listed below:

<u>TEST</u>	<u>BEHAVIORAL MEASURE</u>
1. Rifle-Fire Test	1. Response time and hand-arm steadiness
2. Obstructed-Run Test	2. Gross muscular coordination
3. Rail-Walking Test	3. Equilibrium
4. Grenade-Throw Test	4. Eye-arm coordination

TESTS

RIFLE-FIRE TESTS

Equipment

1. Eighteen M31 Trainfire Target Mechanisms
2. Cal. .30 M1 Rifles
3. Cal. .30 Ball Ammunition
4. Stoelting Electronic Timer
5. Multi-Channel Recorder

Instructions for Rifle-Fire Test:

First Day:

I am _____ of _____.

This morning we will begin a series of tests designed to determine your ability to get off a fast, well aimed rifle shot at targets placed at varying ranges and visible for only short periods of time (show targets). As you can see there are two targets in each lane, however, only one target will be visible at any one time. Your task will be to fire one and only one shot at each target as they are presented.

Are there any questions?

You will lock and load on my command. After the first clip of ammunition is expended you will reload and continue firing until the last target is presented.

After all of the targets have been presented you will unload and lock your weapons and wait for clearance from the Range Safety Officer. Do not leave the firing line until you have been given clearance. If you have any left over ammunition, hold on to it until it is collected.

Are there any questions?

Remember, this is a test of your speed and accuracy with your weapon.

Give fire command (below)

1. Lock and load
2. Ready on right - left. Firing line
3. You may commence firing

Second and Third Day

Good morning. This morning each of you will go to the same lane you fired from yesterday.

The procedure today will be the same as it was yesterday. Remember, fire only one shot on each target presentation. Are there any questions?

Give the fire command.

Fourth Day - Instructions will be given by Officer or NCO in charge of APC.

Instructions:

This morning we will ride to the rifle range in an armored personnel carrier. When we mount the carrier men numbered 1 through 5 will sit on the left side of the carrier behind the driver; 6 through 9 will sit on the right side. When we dismount you will stay in numerical order. Number 1 man will be on the left flank and number 9 man on the right flank. You will double time to the firing line, take up your positions, pick up the ammunition placed at your stations and await the command to load and fire.

Are there any questions?

Officer or NCO in charge will check seating inside APC to make certain all men are in their correct seat.

PRESENTATION OF TARGETS

<u>FIRST DAY</u>			<u>SECOND DAY</u>			<u>THIRD DAY</u>			<u>FOURTH DAY</u>		
SHOT	TARGET	TIME	SHOT	TARGET	TIME	SHOT	TARGET	TIME	SHOT	TARGET	TIME
1	2*	7	1	1*	3	1	2	7	1	2	5
2	1**	3	2	1	7	2	1	3	2	1	7
3	2	5	3	2	5	3	2	5	3	1	3
4	1	7	4	1	7	4	2	3	4	1	7
5	2	3	5	1	5	5	1	5	5	2	3
6	2	5	6	2	3	6	1	7	6	1	5
7	2	7	7	2	7	7	1	5	7	1	5
8	1	3	8	2	3	8	2	3	8	2	7
9	1	5	9	1	5	9	2	7	9	2	3
10	1	7	10	2	3	10	2	5	10	1	7
11	1	5	11	2	5	11	1	7	11	2	5
12	2	3	12	1	7	12	2	3	12	2	3
13	1	3	13	1	5	13	1	3	13	1	5
14	2	7	14	1	3	14	2	7	14	2	7
15	1	5	15	2	7	15	1	5	15	1	3
16	2	5	16	2	5	16	1	3	16	1	3
17	2	7	17	1	3	17	1	7	17	2	5
18	1	3	18	2	7	18	2	5	18	2	7

* 150 yds.

** 100 yds.

Time - in seconds

GRENADE-THROW TEST

Equipment

1. Fifty-four practice grenades (inert)
2. Nine 4-foot square target pits

Instructions for Grenade Throw:

Good morning. I am _____ of _____. This morning we will begin a test to measure your accuracy with hand grenades. Your task here will consist of simply throwing the six grenades at your station into the pit directly in front of you. Remember, this is a test of accuracy. Throw as rapidly as you can without losing accuracy.

OBSTRUCTED-RUN TEST

Equipment

1. Course 220 yds. long, 5 ft. wide
2. Used automobile tires
3. Hurdles 2 ft. high
4. Railroad ties (4 X 4)
5. Stopwatches

Instructions for Obstructed-Run Test:

Good morning. I am _____ of _____. This morning we will begin a series of tests to determine your overall coordination. In front of you are three identical courses. Each course has the same type and number of obstacles. Your task will be to run the length of this course as fast as you are able.

The first section of the course is marred by a group of staggered tires. In running through this section, you must step in each tire. The second section of the course consists of a group of hurdles which you are to jump. Try not to knock any of the hurdles down. Following the hurdles will be a group of ditches which you are to jump. Do not go around the ditches. If you do not make the jump over any one ditch, climb out and continue on to the next one. The fourth section is merely a banked straightaway. You are to run over this section as fast as you can. Finally you will run into a group of railroad ties. The distance between these ties varies. You are to step from one tie to another as rapidly as you can without missing one.

Are there any questions? We will now begin.

RAIL-WALKING TEST

Equipment

1. Rails
 - a. 9 feet long X 4 inches wide
 - b. 9 feet long X 2 inches wide
 - c. 6 feet long X 1 inch wide
2. Tape measure
3. Stopwatches

Instructions for Rail-Walking Test:

Good morning. I am _____ of _____. This morning we will begin a task designed to test your sense of balance. In front of you are 3 rails arranged in _____ form. The rails are numbered 4, 2 and 1.

Starting at the rail marked 4, your task will be to walk across the rail in a heel-to-toe manner. (Demonstrate.) If your foot comes off the rail at any time you must go back to the beginning of the rail and start again. When you have walked completely across the 4 rail or when you have made three attempts at crossing it, you will move to the rail marked 2. You will follow the same procedure here and then move to the rail marked 1. Are there any questions?