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LABORATORY EVALUATION OF SECOND GENERATION BEHAVIORAL ALCOHOL SAFETY INTERLOCK SYSTEMS

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PRELIMINARY MEMORANDUM

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ABSTRACT

This report contains results of an experimental evaluation of devices designed to prevent an intoxicated individual from operating his automobile. These devices were developed by both private industry and the Transportation Systems Center. They are designed to detect intoxication by measuring changes in ability to perform a "second generation" psychomotor task (i.e., a task known or thought to be alcohol specific). Four such devices were tested and found to be at least as alcohol specific as those previously tested, although they were at an earlier stage of development.

PREFACE

The work described in this report was performed in support of an overall program at the Transportation Systems Center designed to develop and evaluate Alcohol Safety Interlock Systems (ASIS). This program was sponsored by the Department of Transportation through the National Highway Traffic Safety Administration Research Institute.

This report covers the laboratory testing of performance ASIS from Dec., 1972, to July, 1973. It elaborates upon earlier material[1] on three of the devices, and contains new analyses of the Visual Divided Attention Task based on a revised pass/fail criteria. In that it covers new devices submitted for evaluation of ASIS, it is also a continuation of previous work.[2]

The author would like to acknowledge that much of the success of this program is due to the efforts of the above organizations and many individuals. Specifically, much of the original formulation of the program and its overall management were the contribution of P. W. Davis and K. Bray. Design and construction of the TSC ASIS unit was carried out by A. Iannini. Aid in the analysis of the data was provided by B. A. Kolodziej and D. L. Smith. Computer programming and data processing were contributed by D. Ofsevit. Draft typing was done by B. Weiss.

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1.0 INTRODUCTION

1.1 SCOPE

This report presents a more extensive treatment of the data beyond that reported previously.[1] This treatment consists of:

a. Correlation analysis of performance on the devices as a function of BAQ level to verify the presence of a relationship between degree of intoxication and performance on each device.

b. Establishment of pass/fail criteria which essentially permits all sober attempts to pass.

c. Establishment of start/no-start strategies giving the operator more than one chance at passing a test, thereby permitting failure on specific attempts while still allowing him to start the car.

d. An analysis of variance to determine whether the obtained no-starts were in fact due not to fatigue or boredom in a laboratory situation but to the effects of alcohol.

e. A consideration of other factors affecting the preferential selection of one device over another. Such factors are:

   1) the structure of the task

   2) comments by operators about the task

   3) treatment of the scores obtainable on the task

   4) training schedules and possible group differences in performance on the task.

1.2 CONCLUSIONS

a. The ability of these devices to prevent the intoxicated individual (BAQ $\geq$ 0.10%) from driving and permit the sober (BAQ $\leq$ 0.03%) to drive is much greater than those previously tested.

b. However, further development of these devices is still necessary before any of them can be installed as potentially effective ASIS.

1.3 RECOMMENDATIONS

It is recommended that further study be conducted to answer questions concerning the effects of altering certain parameters upon the efficacy of each device as an actual installed ASIS.

2.0 SELECTION AND DESCRIPTION OF DEVICES

This report is concerned with investigations of behavioral Alcohol Safety Interlock Systems which took place from mid-1972 to mid-1973. The program was sponsored by the office of Driver Performance of the National Highway Traffic Safety Administration, in support of the NHTSA Office of Alcohol Countermeasures. The laboratory tests were performed by Dunlap and Assoc., Inc. under contract DOT-TSC-251 to the Transportation Systems Center.

Choice of the devices to be tested was based on a desire for improvement over previous data (2, p. 25) which indicated a ceiling of about 62% no-starts for the very intoxicated (BAQ $\geq$ 0.18) on the best of the psychomotor performance tests. It was decided that to obtain improved results, this series of laboratory studies should emphasize devices which fulfill at least one of the following two criteria:

a. Previous pilot data should be available indicating that the device works at least as well as those psychomotor tasks previously tested.

b. There should exist some a priori reason to suspect that operators' performance on the device should more directly reflect the debilitating effects of alcohol than do the general psychomotor devices previously tested.

The following four devices were chosen. The reasons for their choice are included below, followed by a description of the actual task requirements.

- Modified Reaction Analyzer (RA) -- Raytheon Company
- Complex Coordinator (CC) -- JWM, Inc.
- Critical Tracking Tester (CTT) -- General Motors Corp.
- Visual Divided Attention Task (DAT) -- DOT-TSC.

2.1 THE MODIFIED REACTION ANALYZER (RA)

This device, built by the Raytheon Company[3], was selected primarily because previous results (2, p. 25) had shown it

to be the only device with a consistently low failure rate up to 0.10% BAQ while still achieving the intoxicated no-start level of the others. Since those were the first data taken on this device, it was felt that a new version modified as described below would show an increased percent of no-starts for the very intoxicated while retaining the low sober no-start levels.

As in its original configuration, the operator is to track an unknown function by turning a knob approximately 180° clockwise. The modification consists of a second unknown function which the operator must track by turning the knob counterclockwise back to the original starting position. Feedback to the operator is provided by two light-emitting diodes: one indicates that the tracking is too slow, the other that it is too fast. In practice, the operator tries to keep them both about equally bright. There are six settings of difficulty marked from easiest to most difficult: E I M 2 3 D. Two other light-emitting diodes indicate a pass or failure on a trial. Essentially, this is a compensatory tracking task of about 15 seconds duration.

2.2 THE COMPLEX COORDINATOR (CC)

This device which was built by J. W. Microelectronics[4] has existed previously as a NASA testing device. Prior work on this device has revealed a definite relationship between performance and level of intoxication. Specifically, Maraman[5] reported an increase in time required to complete 100 problems due to the ingestion of alcohol. He also obtained differences in the total number of errors for all four limbs for the same 100 problems. Pilot data for a California Department of Justice study[6] showed a strong correlation between BAQ and the intoxicated minus the sober time to complete the task. In addition to these data some theoretical notion that the device would be directly alcohol sensitive also existed. It is well known that alcohol disturbs gait and muscular movements. It is also known that the cerebellum plays a key role in the regulation of posture and coordination of movement. Consequently, it is hypothesized that alcohol specifically acts on the cerebellum and that the resultant debilitation is measureable

by a test of coordination, the Complex Coordinator. Unfortunately, there is no concrete evidence that the cerebellum is directly affected by alcohol.[7]

The operator sits before a panel consisting of 4 columns of lights in 2 pairs of 5 different colors. He has control of one right hand column of lights by manipulation of a right hand lever. He has similar control of one left hand column of lights with a left hand lever. The device challenges the operator by presenting a problem. In the other right hand column a certain light illuminates and the operator must match that light in color/position by use of the right hand lever. Simultaneously, in the other left hand column a certain light illuminates and the operator must also match that light in color/position by use of the left hand lever. Once matched the operator must hold that match for both pairs for 0.5 seconds. After that, a new problem is presented for a total of 35 problems. Two measures are recorded: the total time required to complete all 35 problems and a count of the number of reversals made for each hand. The reversal count indicates the number of times the operator goes past the match point by counting the number of different times the match light was illuminated. A perfect reversal count would be 35 for each hand or 70, corresponding to the number of match lights presented during a trial. The device tests perceptual-motor coordination. Cumulated reaction time with an indicator of hand steadiness and the duration of a trial are dependent upon the operator's ability to perform.

2.3 THE CRITICAL TASK TESTER (CTT)

This device which was submitted by General Motors has also existed previously for the study of pilots and NASA crewmen. Results of pilot data* showed the device to be more alcohol sensitive than those previously tested at TSC. Those data have recently been formally presented.[9] Further, theoretical evidence implies that performance on this device is alcohol specific. Specifically, it has been established that this device measures the operator's

*Tennant, J. A., Unpublished data, December, 1972.

effective time delay.[10] This parameter is obtained from the operator's own remnant noise and is taken as an indicator of neuromuscular tonus.[11] It is this neuromuscular tonus which becomes directly affected by alcohol.[12] Consequently, measures on the Critical Task Tester should be more directly responsive to the actions of alcohol.

The operator sits before a small meter and must compensate for meter pointer movement by appropriately turning a steering wheel. At the beginning of a trial, the pointer rests vertically in the center of the meter. As the trial begins, the pointer is driven by the random oscillations of a system whose level of instability increases monotonically with trial time. By turning the steering wheel, the operator attempts to vertically realign the pointer. The trial may cease either when the operator can no longer compensate for the system instability or when a passing level of instability is achieved. The forcing voltage (λ) of the system corresponding to the level of instability at which the operator loses control is recorded.

2.4 THE VISUAL DIVIDED ATTENTION TASK

This device was developed at TSC[13] to assess the value of this type of task as an alcohol safety interlock system. Moskowitz and DePry,[14] as well as Talland,[15] had demonstrated an effect of alcohol upon divided attention in the auditory mode in a vigilance task although these results were somewhat confounded with motivation. However, the auditory mode is not considered appropriate for use as an ASIS. Two vigilance studies in the visual mode[16,17] consisting of a central tracking task and a horizontal peripheral visual field detection task have revealed decrements in performance in the peripheral component for both and in the central for one of the studies. Although these studies justified further work on the idea, the 40 minutes of subject time and the possibility of motivational biases towards one task over another implied the need for careful construstion of the task. In a review of attention and alcohol research Moskowitz[18] hypothesized that under the influence of alcohol, one unconsciously directs attention

to one channel or category of information. It was decided to divide the operator's attention between two dissimilar tasks known to be alcohol susceptible. A task distributed over the entire horizontal visual field would constitute the peripheral component. A pursuit tracking task was chosen as the central component because previous pilot work at TSC and work by others has shown this task to be the most alcohol susceptible psychomotor performance task especially when coupled with a secondary task (2, p. 16). The task duration was set at the longest tolerable, two minutes.

The operator sits before a task distributed throughout the horizontal peripheral visual field. One component is a pursuit tracking task; the other is a peripheral visual field detection task. For the pursuit tracking task, the target is horizontally driven by two sinusoidal forcing functions. The operator tracks this target using a steering wheel. Distributed every 11° out to 88° on the left and right sides of this pursuit tracking task is a series of peripheral lights subtending 1/2° at 28 inches. The operator must react to the illumination of one of these lights with an ipsilateral switch placed on the left and right sides of the steering wheel. These lights illuminate at random in space and time; they remain illuminated until responded to or for 1.4 seconds. Both the volt-seconds of tracking error and the reaction time to the peripheral lights are recorded. The task duration was set at 2 minutes, allowing for each peripheral light to illuminate at least once for a total of about 50 presentations distributed over all 16 peripheral lights.

The method of selecting operators and training them, testing the devices, administering alcohol, and their results are presented elsewhere.[1] The section immediately following presents further analytical results based on those data, and the section thereafter elaborates upon the potential problems in implementation of each device as an ASIS.

3.0 RESULTS

3.1 START/NO-START DIFFERENTIAL

Comparative results of the laboratory evaluation of potential behavioral ASIS devices are presented in Figure 1 as a percent of no-starts as a function of BAQ class interval (attempts to start were grouped into classes of BAQ to provide statistically comparable numbers of operator-trials on each of the devices as operator level of intoxication rose) for the optimal universal criterion for each device. These same data are compared in Table 1 with those data previously obtained on the original Reaction Analyzer, the Complex-Reaction Tester, the QuicKey, and the Phystester devices (2, p. 25). Clearly, the results from the present devices are better than those previously tested except for the Reaction Analyzer. It is concluded that the increase in no-start differential for the present devices over those previously tested is due less to their being of psychomotor nature and thereby susceptible only to the general debilitating effects of alcohol and more to being involved in the coordination of various psychomotor functions. The comparatively poor showing of the Reaction Analyzer most probably is further confirmation of its being a simple psychomotor test.

To confirm the relationship between alcohol and operator's performance on these four candidate ASIS devices, the data obtained from testing can be looked at in two ways:

a. by calculating the Pearson-product-moment coefficients of correlation (r) between an appropriate index of operator performance and the BAQ for each at the time of that performance.

b. by comparing the alcohol versus placebo performance of operators by means of an analysis of variance. This analysis will indicate whether any obtained no-starts were in fact primarily due to alcohol and not to fatigue or boredom in the laboratory situation.

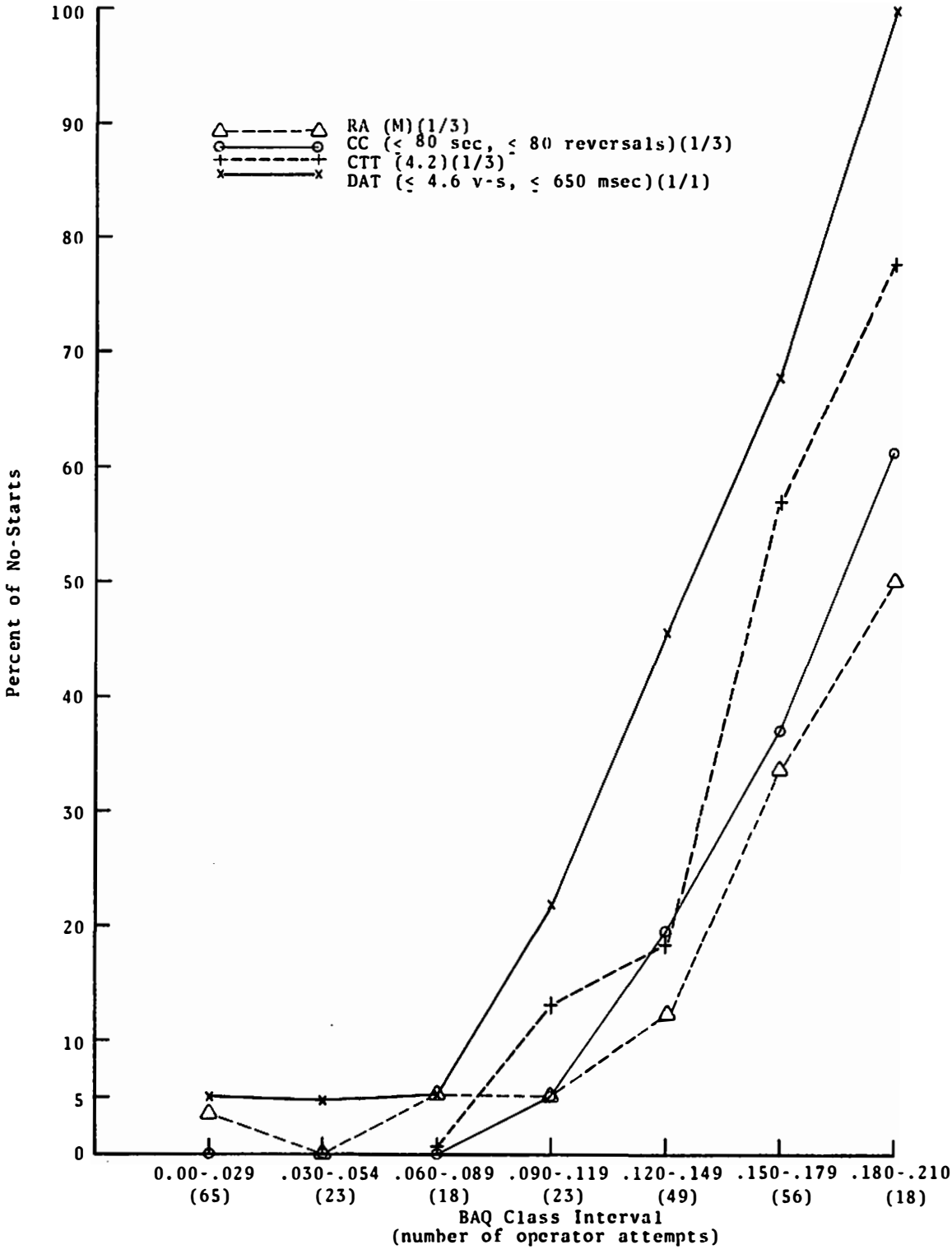

Figure 1. Percent of No-Starts as a Function of BAQ Class Interval for the Most Optimal Universal Criteria for Four Devices

TABLE 1. COMPARISON OF PERCENT OF NO-STARTS FOR UNIVERSAL CRITERIA BY BAQ CLASS INTERVAL FOR PRESENT AND PREVIOUS LABORATORY STUDIES

	Present				Previous			
BAQ Class Interval	RA	CC	CTT	DA	RA	QuicKey	Complex Reaction Tester	Phystester
.00 - .029	3.2%	0.0%	0.0%	4.6%	3.4%	8.5%	6.8%	1.7%
.03 - .059	0.0	0.0	0.0	4.4	0.0	16.7	16.7	4.2
.06 - .089	5.7	0.0	0.0	5.6	5.3	21.1	10.5	31.6
.09 .119	4.4	4.4	13.0	21.7	8.3	41.7	25.0	33.3
.12 - .149	12.2	19.2	18.4	45.8	30.6	38.8	28.6	34.7
.15 - .179	33.9	37.0	57.1	67.9	44.2	59.6	44.2	48.1
.18 - .210	50.0	61.1	77.8	100.0	61.9	61.9	57.1	61.9
No-Start Differential	46.8	61.1	77.8	95.4	58.5	53.4	50.3	60.2

3.2 CORRELATION COEFFICIENTS

The correlation coefficients for each device are listed in Table 2, and comparison with those previously obtained (2, p. 16) indicates stronger correlation between operator BAQ and performance measure. Figure 2 presents these same data in graphic form. Note that the curves are actually non-linear in that the deterioration generally accelerates at higher BAQ levels, especially for the CTT.

3.3 TREATMENT DIFFERENCES

The ability of these four candidate ASIS devices to discriminate between sober and intoxicated operators on the basis of start/no-start data can be further evaluated by use of an analysis of variance. The operators were tested hourly for two 8 hour sessions under an "alcohol" treatment (i.e., ingesting large quantities of alcohol in fruit juice and tested hour by hour for 8 hours) and two 8 hour sessions of "placebo" treatment (in which they were given fruit juice diluted with water and 2 milliliters of 95% alcohol floated on top to convey the odor of ethanol). Further commentary on the maintenance of the "placebo" treatment and its success are discussed in (1, p. 10). The results of these two treatments, "alcohol" versus "placebo", were analyzed using a 2 treatment by 8 testing conditions analysis of variance for each device. To compensate for the discrete nature of the no-start data and the tendency towards heterogeneous error variance in the data, an inverse sine transformation was employed (19, p. 316; 20, p. 221; 21, p.66). Tests of simple main effects were done comparing performance under alcohol versus placebo treatments at each of the eight hourly testing conditions: Control 1, Control 2, Drink 1, Drink 2, Drink 3, Drink 4, Post-Drink 1, Post-Drink 2. Comparisons between these two treatments are presented in Figure 3 as percent no-starts as a function of testing conditions for the best universal pass/fail criteria and start/no-start strategy for all four devices. The mean BAQ attained for each of the eight hourly testing conditions for both treatments is listed. The results of the analysis of variance are presented in Appendix A.

TABLE 2. CORRELATION COEFFICIENTS OF PERFORMANCE SCORES BY BAQ FOR EACH DEVICE

Device	r
Reaction Analyzer	
r (no. of passes out of 3 attempts x BAQ)	= 0.52**
Complex Coordinator	
r (total task time x BAQ)	= 0.50**
r (left plus right hand reversals x BAQ)	= 0.39**
Critical Task Tester	
r (λ x BAQ)	= 0.62**
Visual Divided Attention	
r (tracking error x BAQ)	= 0.64**
r (hit reaction time x BAQ)	= 0.57**

** $p \leq .005$

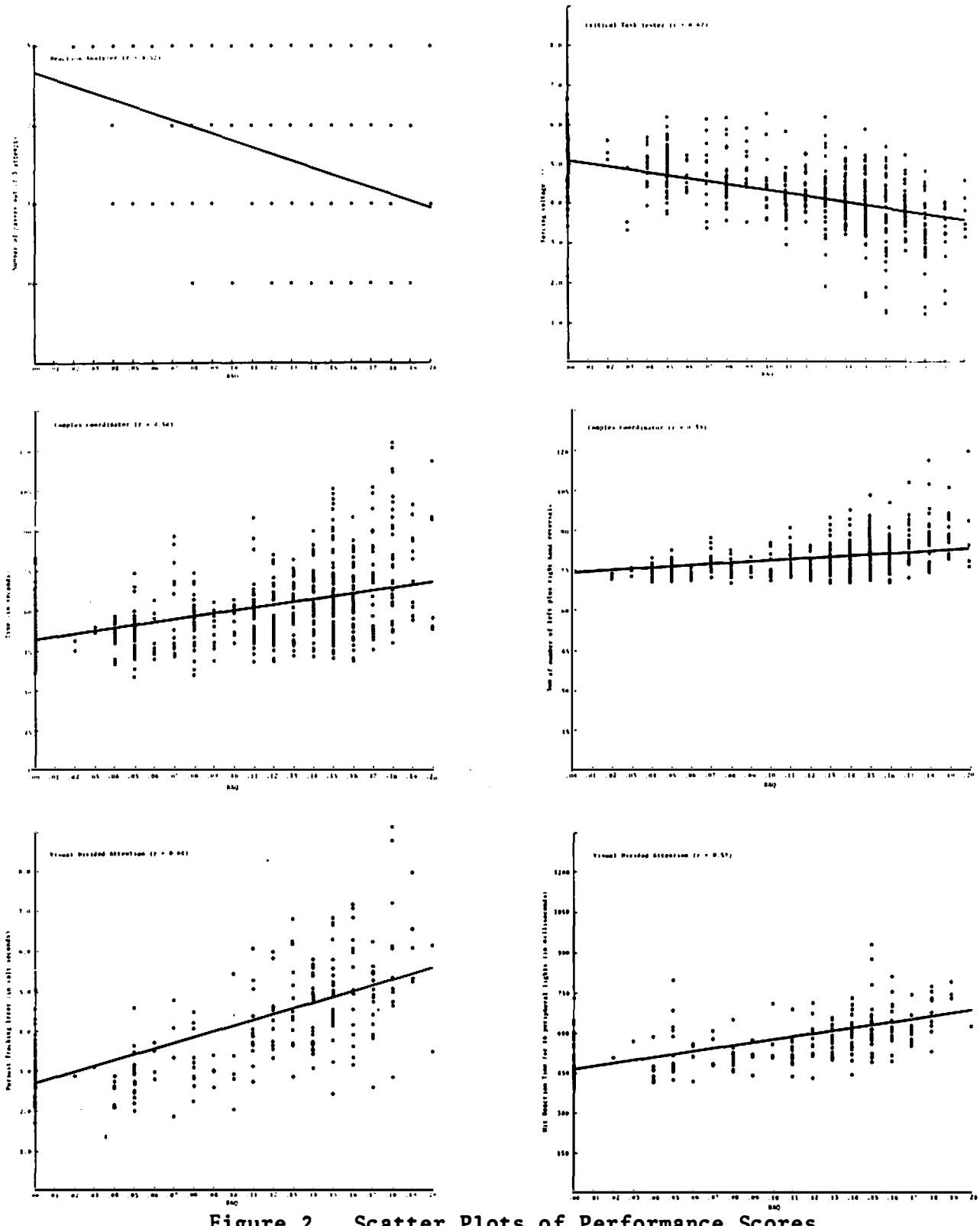

Figure 2. Scatter Plots of Performance Scores for Each Device Against BAQ for All Operators During the Alcohol Treatment with Linear Regression Line

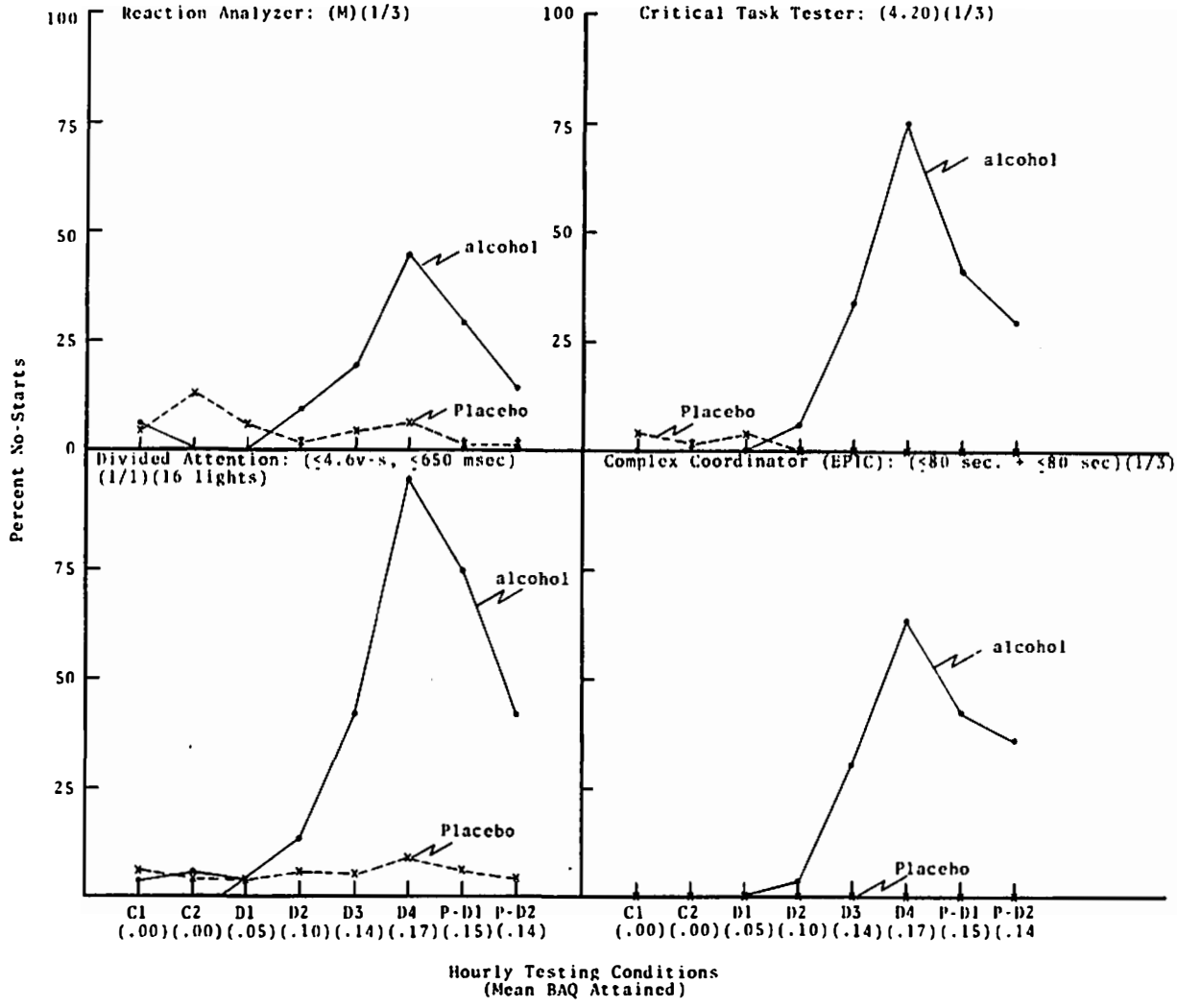

Figure 3. Comparison of the Percent No-Start Performance of 16 Operators Under Alcohol and Placebo Treatments Over 8 Hourly Testing Conditions for a Universal Criterion on the Four Devices

Each device produced a statistically signigicant difference between treatments and a further analysis of the simple main effects indicated at which of the eight hourly testing conditions treatment levels contributed to those differences. Note that the first two testing conditions were run as controls with no drinking for both treatment conditions. There was no difference between treatments for these first two testing conditions. Differences did appear as the mean BAQ level rose, especially beyond .10%, Testing Condition D2.

4.0 PROBLEMATICAL EFFECTS OF VARIOUS PARAMETERS

In the process of establishing training performance schedules and criteria, pass/fail criteria, and start/no-start strategies, it became apparent that these four devices are at an earlier stage in their practical development than were those previously tested.[2] The design parameters are not optimized, and on the basis of the results of this training and testing series better definition of them can be made. Comments on these problems have been summarized in Table II of Reference 6, p. 7. In the discussion below, each device will be treated separately as to the structure, operator comments, treatment of raw scores, training schedules and probable group differences in performance on these four devices.

4.1 REACTION ANALYZER

a. Concerning the structure of the task, it was noted that:

   1. The configuration is set for right-handed operators. Use by the left-handed obscures the feedback lights and pass/fail indicators.

   2. There is no mark indicating where the reversal point of the turning knob lies. This may be beneficial in failing the intoxicated, while sober operators had no noticeable difficulty with this factor after training.

   3. Consideration should be given to changing the feedback from indicator lights to a continuous meter.

   4. In conjunction with that change, a raw tracking error score should be obtainable to facilitate more refined selection of an adequate training schedule and a pass/fail criteria.

   5. The trial duration of 15 seconds is desirable.

b. Concerning comments by observers about the task:

   1. There was a distinct lack of trust in the pass/fail

results. Observers felt that the device was not correctly reflecting their performance. A raw tracking error score would permit better, less subjective feedback to operators, especially during training.

2. Only two of the fourteen observers felt that the device was practical for real application; however, this opinion was quite probably biased by the presence of an elaborate automobile simulation for another device.

3. It was ranked fourth by ten out of fourteen operators.

c. Concerning the treatment of scores obtainable on the device:

1. A universal pass/fail criteria was readily obtainable for this device.

2. The pass/fail criteria on this device was somewhat adjustable, and all operators were able to readily attain the "M" setting as the training data reported in Table 3 indicates; however, most failed to go beyond this level. Consequently, a setting of "M" was used as the pass/fail criteria (1, p. 30).

3. The best start/no-start strategy required one pass in three attempts (1/3), unlike that previously used (3/3). This selection was designed to fail (no-start) as few sober and as many intoxicated as possible.

4. From these data, and as illustrated in Figure 3, this device did penalize operators when they were sober.

5. The results reported in Table B-1 (Appendix B) for the RA show that for both alcohol and placebo conditions older or female operators contributed most of the no-starts. In the past, further training on a device has alleviated such problems, but the training data in this case (Table 3) is unbalanced and done in steps to

TABLE 3. NUMBER OF PASSES OUT OF 10 ATTEMPTS FOR EACH DIFFICULTY SETTING OF THE REACTION ANALYZER

Setting		E	I	M
Gender	Age			
Males	O	10	9	8 8 7 6 8 9 9 9 7 8 9 10 10 7 10 10
	O	10	8	6 9 9 10 6 9 8 10 9
	O	10	10	10 9
	O	9	10	8 10 9
Females	O	0 10	4 8	5 5 0 10 9 5 7 7 9 10 9
	O	0 10	5 8	2 6 4 8 10 6 8 9 6 8 4 7 4 6 10 10 7
	O	2 5 10	1 5 8	1 0 2 7 4 2 6 9 4
	O	2 9	5 9	4 10
	O	5 8	9	10 9
Male	Y	9	10	10 9 9 10 10 10 10 10 10 10
	Y	9	9	9 4 10 9
	Y	10	9	6 4 6 9 7 9 10 9 10 10 10 10 7
Female	Y	5 9	6 10	3 9 7 6 9 8 8 5 8 8 7 9 9 9 10
	Y	6 9	10	10 10
	Y	2 10	10	9 6 10
	Y	10	8	8 9 10
Training Trial Number		1 2 3	4 5 6	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

previously determined criteria. Therefore, no analysis was done. Nor can any differences between subgroups be discerned.

4.2 COMPLEX COORDINATOR

a. Concerning the structure of the task, it was noted that:

1. The task requires two hands and may therefore discriminate against a certain segment of the driving population.

2. The task incorporated a single, fixed and most probably learnable sequence of problems. Any increase in randomness of these problems would most likely improve the start/no-start discrimination of this device.

3. A rather arbitrary choice of number of matching problems presented(35) and required holding time (.5 sec.) was made. This choice in turn greatly affects total trial time. The device possesses a wide variety of task variables which are not represented in these data and further exploration of them may prove the device to be more alcohol-susceptible than these data indicate.

4. The trial duration ranged from 35 to 85 seconds and became quite long, as three repetitions were required.

b. Concerning comments by observers about the task:

1. Nearly all stated that this device was "fun" to operate.

2. Seven out of fourteen felt it would be impractical for use as an actual ASIS.

3. A few complained of nausea thought to be associated with this device.

c. Concerning the treatment of scores obtainable on the device:

1. Either a universal or an individual pass/fail criteria could be used.

2. Using individual criteria, a better no-start differential is obtainable (1, p. 37). However, this criteria is based on training data which can easily be manipulated by the operator (2, p. 23).

3. The universal pass/fail was again rather arbitrarily chosen (1, p. 38). The best one required the operator to complete the task in 80 seconds or less and achieve a reversal count of less than or equal to 80.

4. The best universal start/no-start strategy required at least one pass in three attempts (1/3).

5. As illustrated in Figure 3, this device did not penalize operators when they were sober.

6. The intercorrelation of left hand reversal count with that for the right was 0.62, indicating that one was predictable of the other. Their dispersion was slight, indicating little effect due to alcohol. The correlation of the sum of left and right hand reversal scores with BAQ was 0.39, indicating some alcohol involvement. Elimination of reversal scores as a basis for pass/fail criteria deteriorated the start/no-start differential results. Observation of the scores which caused the fail and their BAQ range suggested that the hand reversal score did not become important until higher BAQ levels ($\geq$ .12) were reached.

7. A very long training period may be required as suggested by the slow but continual improvement illustrated in Figure 4, and the wide range of scores reached by the end of training. Figure 4 shows the high, mean and low task times of all operators during both training (3 scores/sitting) and sober testing conditions (3 scores/sitting).

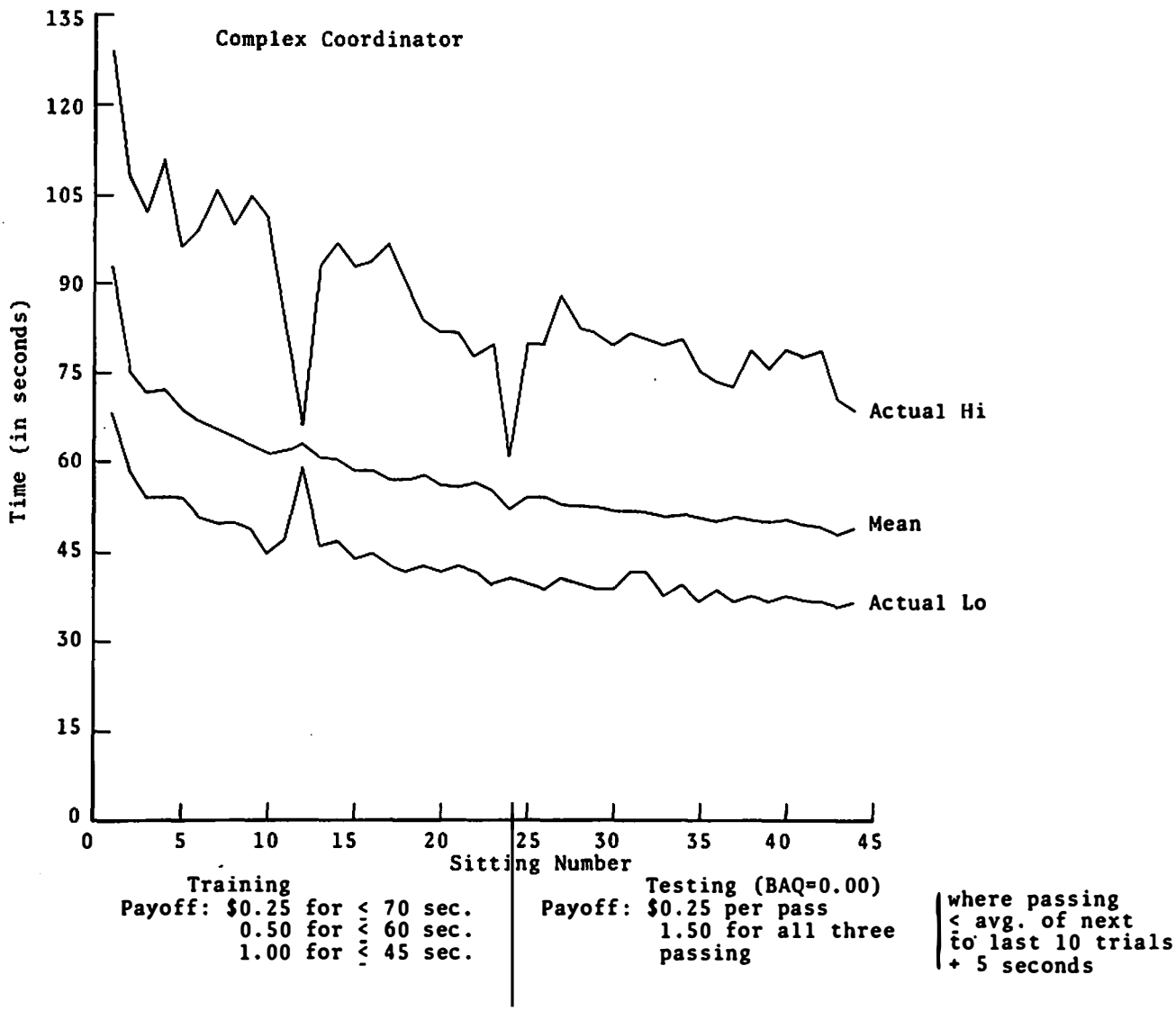

Figure 4. Hi, Me, and Lo Task Time on the Complex Coordinator as a Function of Sitting Number at BAQ = 0.00 for Both Training and Testing Conditions

8. Males did somewhat better than females throughout training and testing as shown in Figure 5 for total task time only, but this difference was not apparent in their start/no-start data (Appendix B, Table B-2).

9. Younger did do better than older operators throughout training and testing as shown in Figure 6 and this difference is further borne out by differences in their start/no-start data (Appendix B, Table B-2).

4.3 CRITICAL TASK TESTER

a. Concerning the structure of the task, it was noted that:

1. The initial level of difficulty may not be optimal. The device was tested using only that wired into it by the manufacturer.

2. The rate of increase of this level of difficulty may also not be optimal. Again, the device was tested using only the one wired into it by the manufacturers.

3. As used in this test, the better one did on the task, the longer the trial up to about 25 seconds. However, this was done to obtain a raw score, and in actual use the task will be terminated within a period fixed by the minimum level of difficulty required to pass.

b. Concerning comments by observers about the task:

1. Rated highest by fourteen operators, however, this rating may be due to the face validity of its installation in a realistic automobile dashboard mockup.

2. Considered to be of least nuisance of the four devices by fourteen of the operators.

c. Concerning the treatment of scores obtainable on the devise:

1. Either a universal or individual pass/fail criteria could be used.

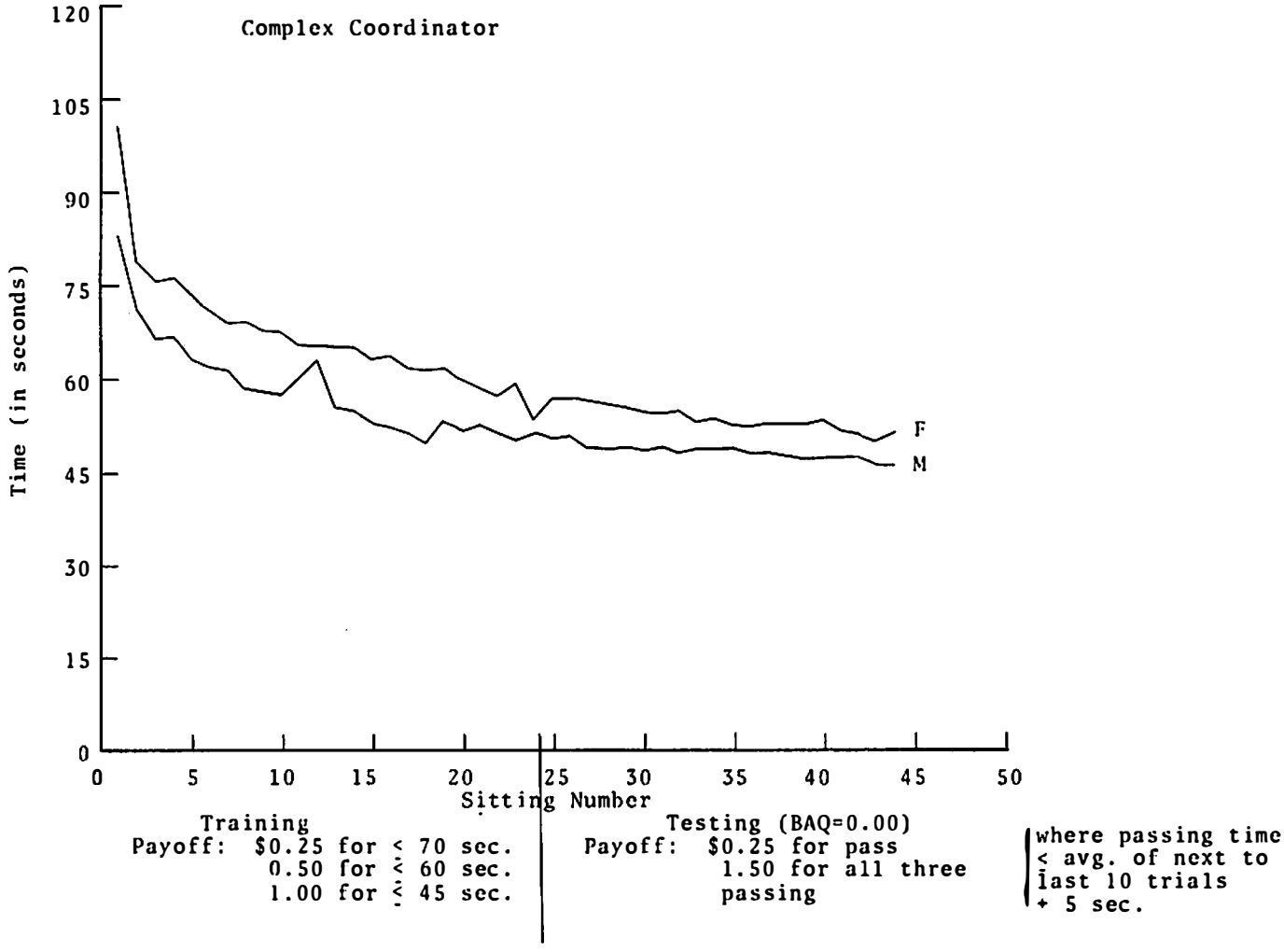

Figure 5. Comparison of Task Times for Males and Females on the Complex Coordinator as a Function of Sitting Number at BAQ = 0.00 for Both Training and Testing Conditions

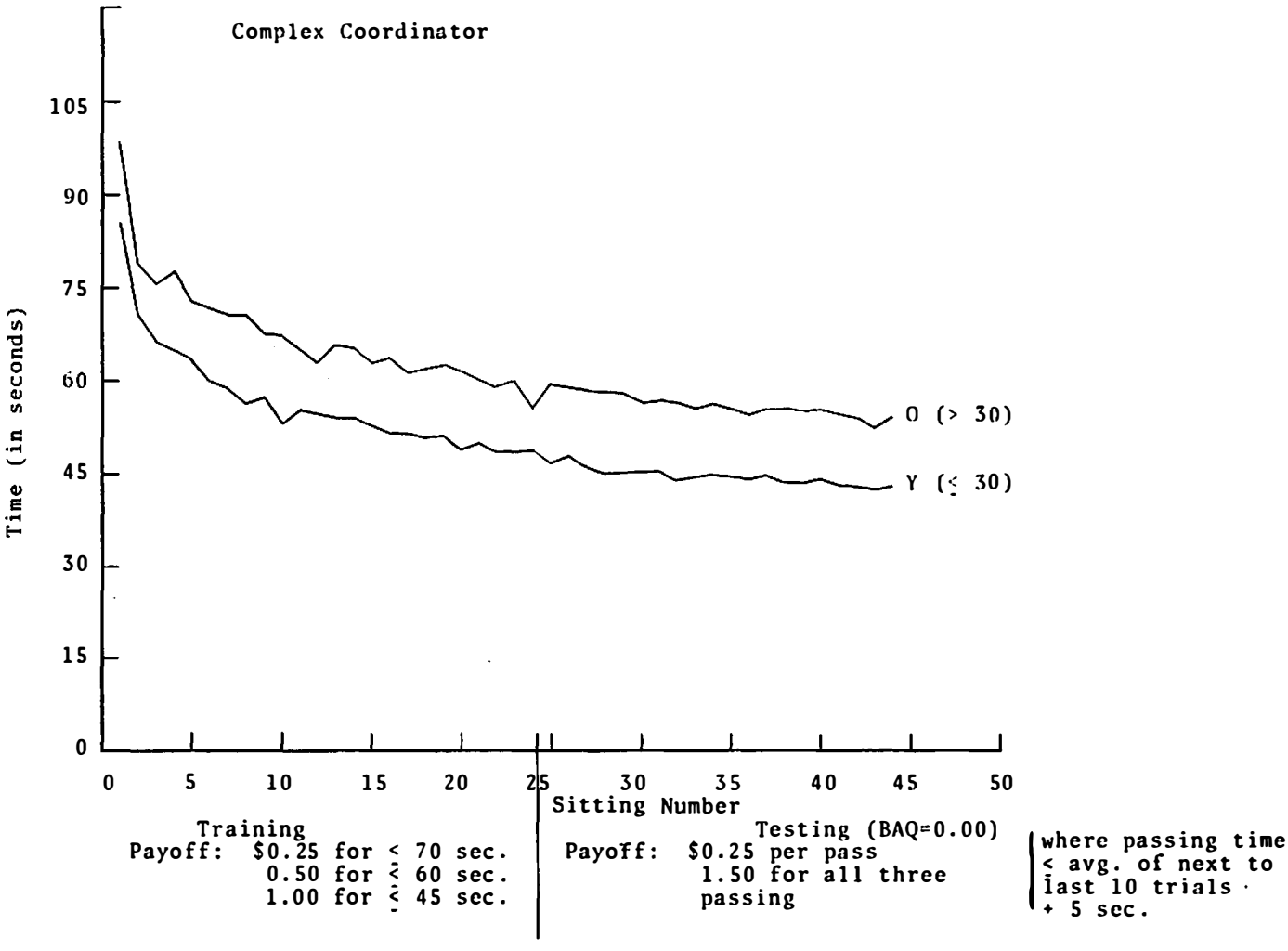

Figure 6. Comparison of Task Times for Young (≤ 30 yrs) and Older (> 30 yrs) Operators on the Complex Coordinator as a Function of Sitting Number at BAQ = 0.00 for Both Training and Testing Conditions

2. Using individual criteria, a slightly better no-start differential is obtainable (1, p. 24). However, this criteria is based on training data which could easily be manipulated by the operator (2, p. 23).

3. The universal pass/fail criteria was obtained by assessing the no-start differential for alcohol trials for several different possible final scores (3.8, 4.0, 4.2, and 4.4). The best was found to be 4.20 (1, p. 10).

4. The universal start/no-start strategy was found in parallel with the pass/fail criteria. The best one requires at least one pass out of three attempts (1, p. 19).

5. As illustrated in Figure 3, this device did not penalize operators when they were sober.

6. The training was sufficient to keep the lowest scores above the pass/fail mark of 4.20 and hold it there during testing. Figure 7 indicates the high, median and low scores of all operators both during training (10 scores/sitting) and sober testing conditions (3 scores/sitting).

7. There was a very slight continuation of learning through the testing trials; the extent of this trend is not known (See Figure 7).

8. Males did slightly better than females throughout training and testing as shown in Figure 8, but this difference is not apparent in their start/no-start data (Appendix B, Table B-3).

9. Young did slightly better than older operators throughout training and testing as shown in Figure 9, but again this difference is not apparent in the start/no-start data (Appendix B, Table B-3).

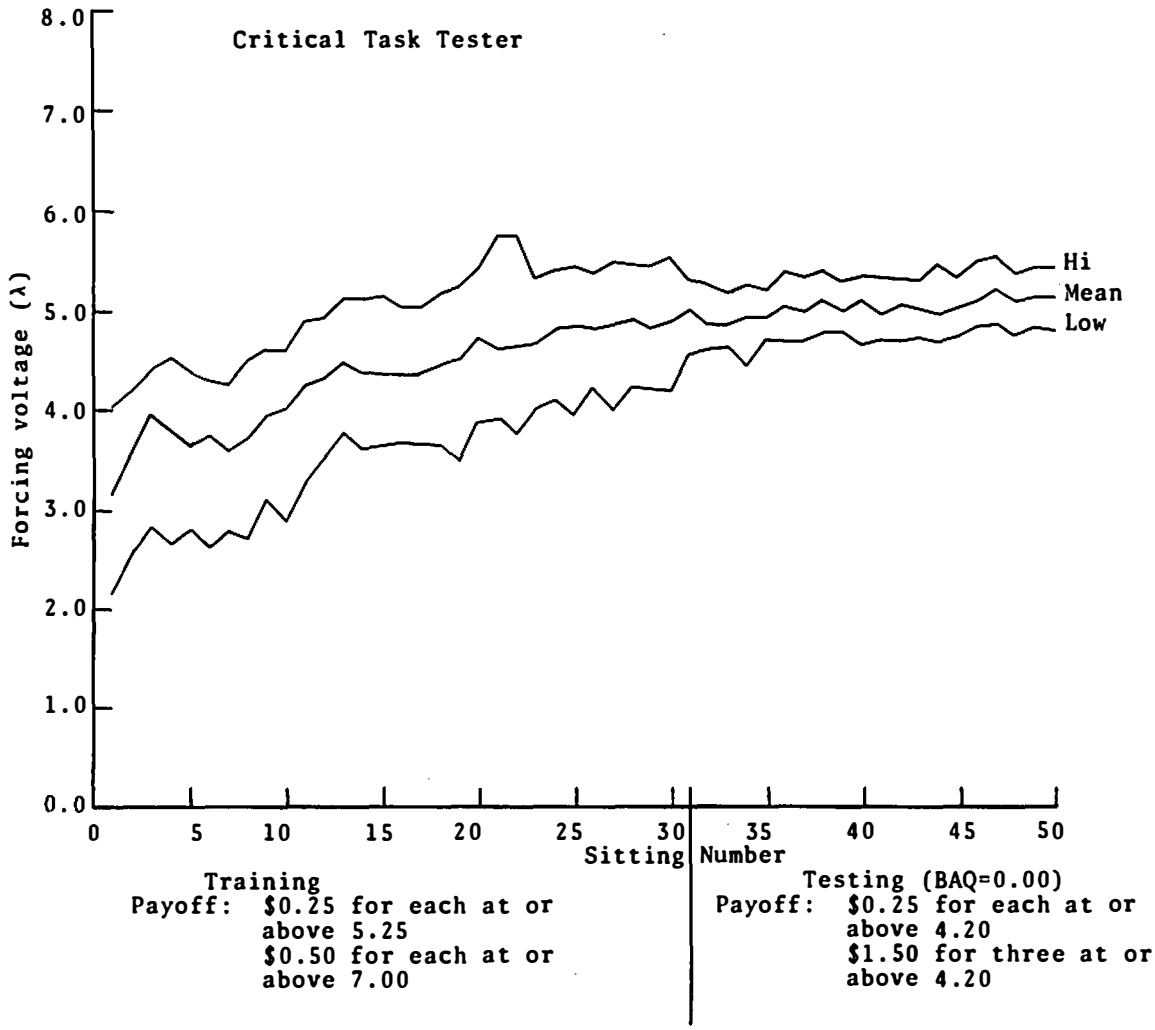

Figure 7. Hi, Me, and Lo Scores on the Critical Task Tester as a Function of Sitting Number at BAQ = 0.00 for Both Training and Testing Conditions

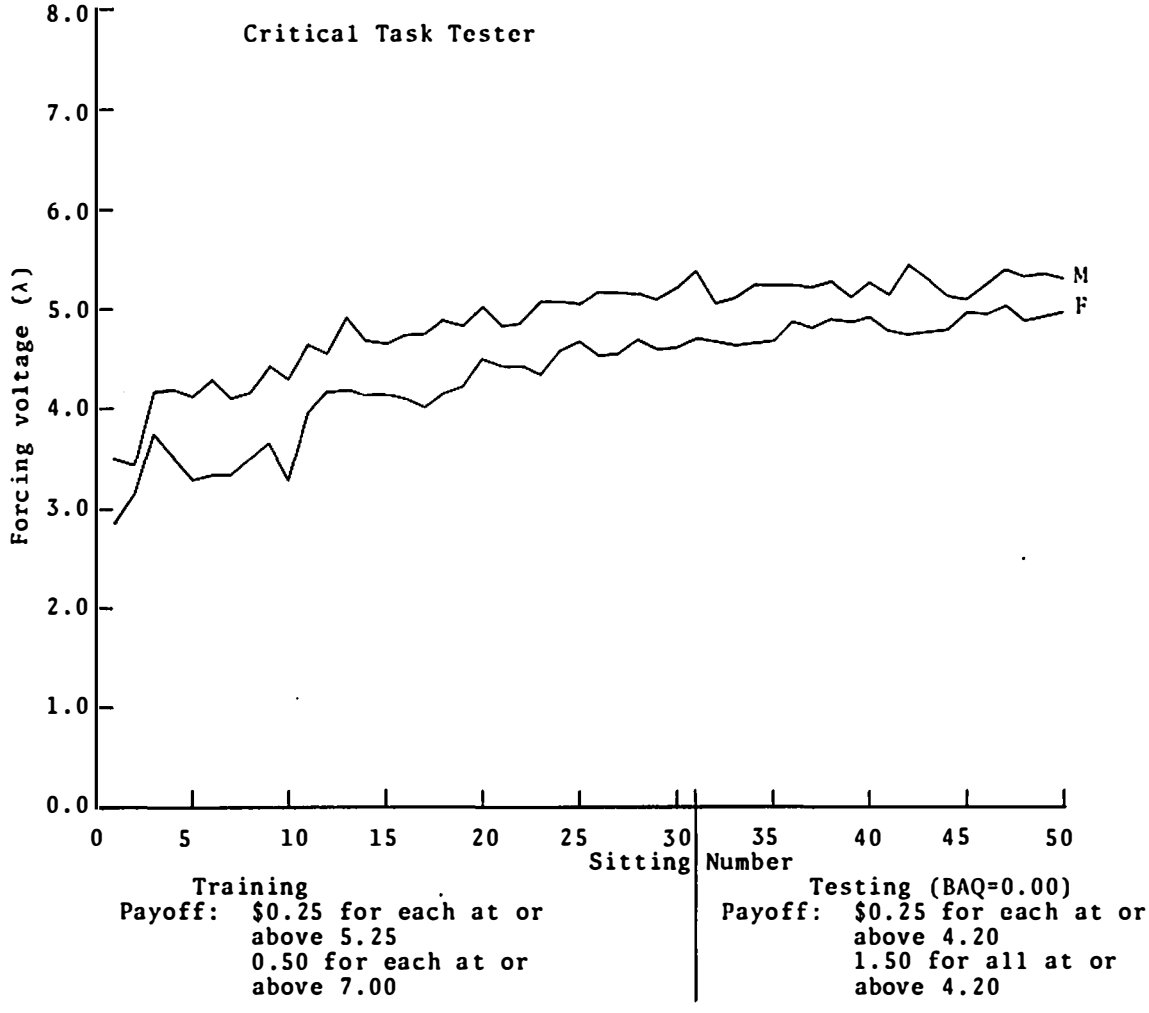

Figure 8. Comparison of Scores for Males and Females on the Critical Task Tester as a Function of Sitting Number at BAQ = 0.00 for Both Training and Testing Conditions

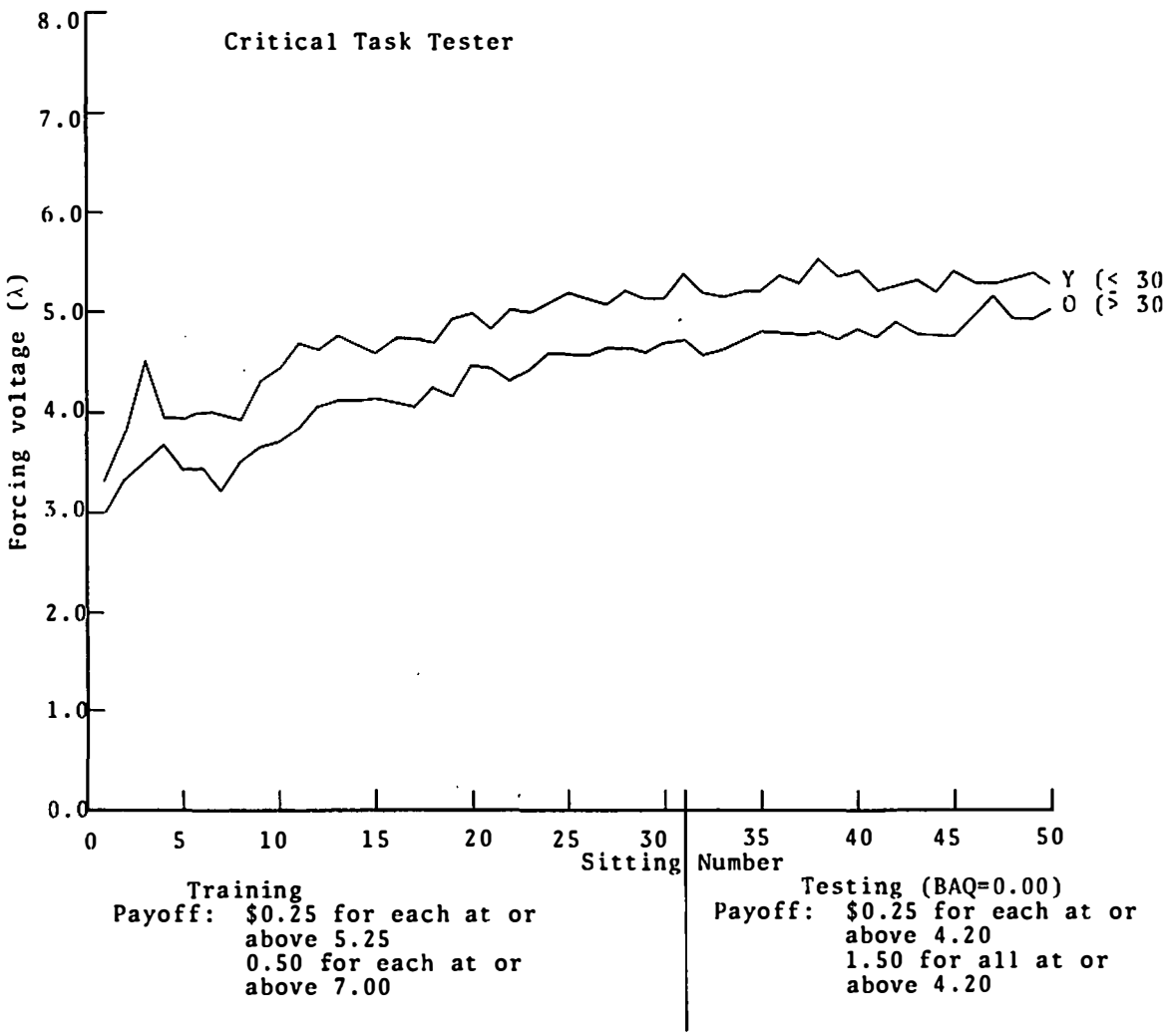

Figure 9. Comparison of Scores for Young (≤ 30 yrs) and Older (> 30 yrs) Operators on the Critical Task Tester as a Function of Sitting Number at BAQ = 0.00 for Both Training and Testing Conditions

4.4 VISUAL DIVIDED ATTENTION TASK

a. Concerning the structure of the task, it was noted that:

1. The number of peripheral lights is too great for practical use.

2. The task duration of 2 minutes is too long for practical use of the device.

3. The lights extend too far into the periphery and there is a resultant bias in the task against those who wear spectacles for driving.

b. Concerning comments by observers about the task:

1. This task was rated as moderately acceptable.

2. Many had difficulty in considering it as practical due to its large physical size and long task duration.

3. Some reported feelings of nausea while operating this device.

c. Concerning the treatment of scores obtainable on the device:

1. Although an individual criteria might result in fewer sober no-start, only universal criteria were studied.

2. The universal pass/fail criterion was arrived at in the following manner: The frequency of occurrence of central pursuit tracking scores for all testing session attempts with BAQ at 0.00 was plotted and a 5% false failure rate cut-off was chosen. For the peripheral task component pass/fail criterion, a linear correlation with BAQ of total reaction time, hit reaction time, and proportion of misses for all 16 lights indicated that hit reaction time was the best score to use (see Table 2). In the manner described above, the frequency of occurrence of hit reaction times for all testing session arrempts with BAQ at 0.00 was plotted and a 5% false failure rate cut-off was chosen. These two cut-offs were used to

calculate a tentative start/no-start differential. Reiterations on both components were tried until an optimal pass/fail criteria of less than or equal to 4.60 volt-seconds of tracking error and less than or equal to a mean hit reaction time of 650 msec. was established.

3. Since the two minutes of running time was required to obtain data on all peripheral lights, there was only one usable start/no-start strategy (1/1).

4. By this method of scoring an operator could fail (no-start) by exceeding the criterion of either the central, the peripheral, or both components for one two-minute setting. These results are tabulated below as a function of BAQ class interval.

BAQ Class Intervals	% No-Starts	No. of Failures/ No. of Attempts	Failure Due to Criteria of		
			Central	Both	Peripheral
.00 - .029	4.62	(3/65)	2	0	1
.03 - .059	4.35	(1/23)	0	0	1
.06 - .089	5.56	(1/18)	1	0	0
.09 - .119	21.74	(5/23)	3	1	1
.12 - .149	45.83	(22/48)	12	7	3
.15 - .179	67.92	(36/53)	20	11	5
.18 - .20	100.00	(18/18)	6	10	2

It was expected that both components of the visual divided attention task would contribute equally to the failure rate. However, the failures reported were due predominately to the central component. Two possible explanations or this disparity are offered: Rewards for performance on the central component were based on one score only, the accumulated tracking error in volt-seconds; whereas, that for the peripheral component was a composite score, only roughly indicative of task performance. Operators

having at least 25 reaction times less than or equal to 500 msec. were rewarded. Consequently, this reward scheme may have inadvertently biased the operators towards concentrating on the component possessing the most direct, easiest to comprehend pay-off criterion - the central component. The second explanation is that since there was no manipulation of the relative task loading for the two components, the disparity in failure rates is due directly to a real disparity in task loading resulting in a relatively easier peripheral component. Only the systematic manipulation of task loading and reward levels will resolve this question of the relative value of each task component for construction of criteria for use of the task as an ASIS.

5. As illustrated in Figure 3, there was a noticeable sober failure rate for both alcohol and placebo conditions. It is hoped that a reconfiguration of the layout of the device to accommodate spectacle wearers and a shortening of the duration coupled with a better training schedule will lead to far fewer sober failures.

6. As illustrated in Figure 10, learning on both the central and peripheral components of the task appears to have persisted well into the testing period, even though mean scores for both task components fell well below the pass/fail criteria. These results imply a need for an improved training schedule.

7. On the peripheral component, there was no difference due to gender, as shown in Figure 11. However, on the central component, males did slightly better throughout the training and testing periods. This central component apparently contributed largely to the gender differences in the start/no-start data (Appendix B, Table B-4).

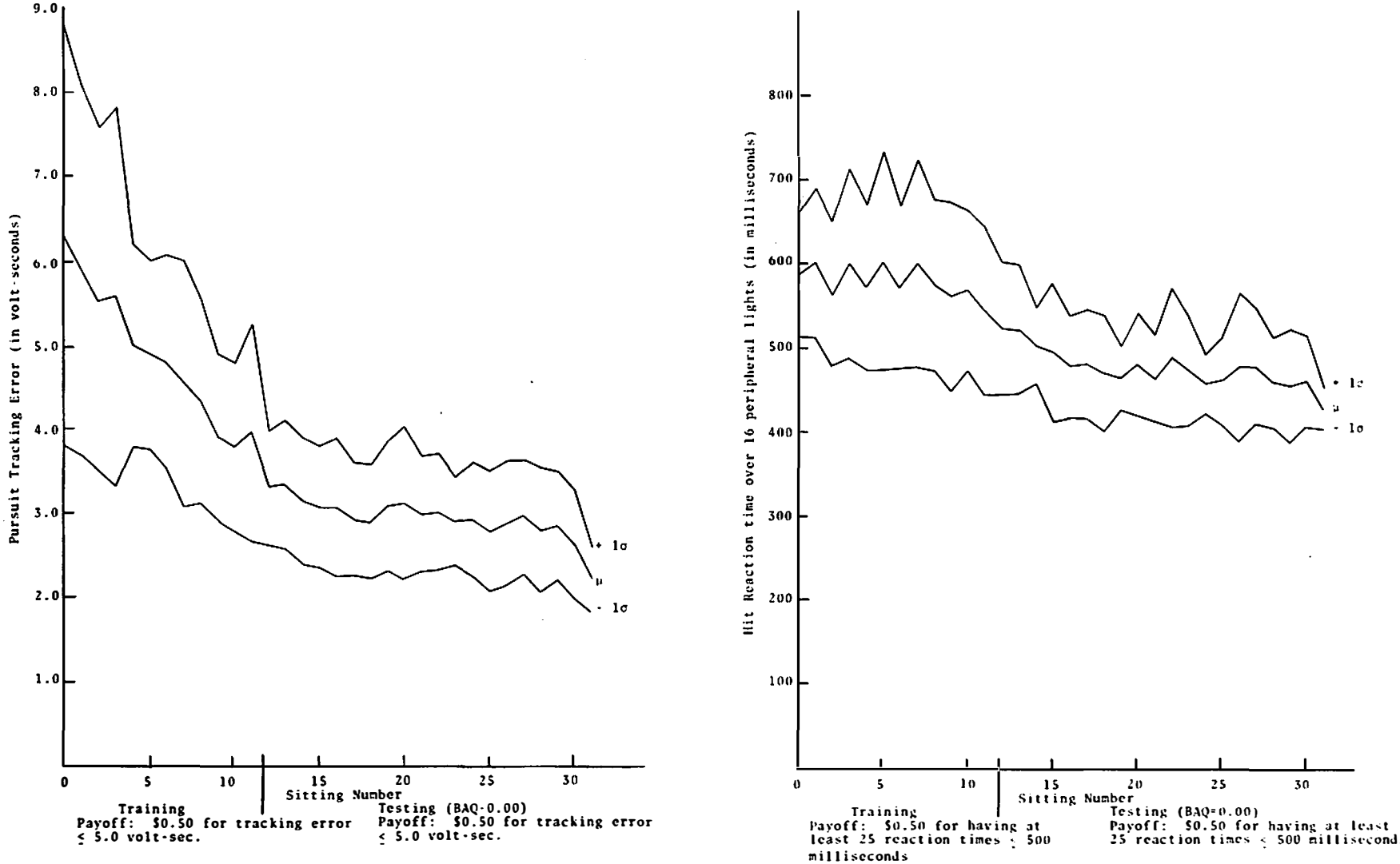

Figure 10. Central and Peripheral Mean and Standard Deviation Scores on the Visual Divided Attention Task as a Function of Sitting Number at BAQ = 0.00 for Both Training and Testing Conditions

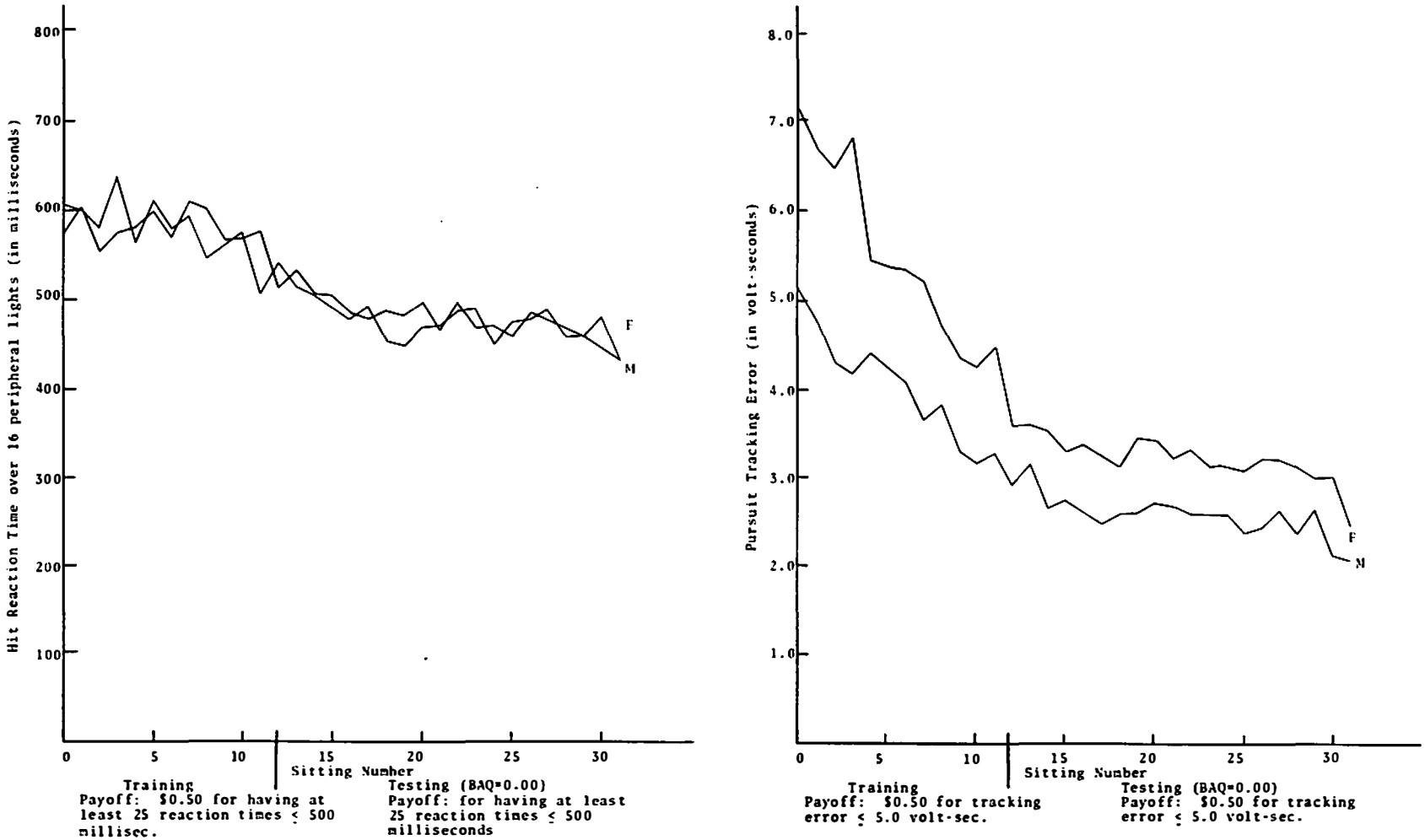

Figure 11. Comparison of Central and Peripheral Scores for Males and Females on the Visual Divided Attention Task as a Function of Sitting Number BAQ = 0.00 for Both Training and Testing Conditions

8. On both task components, young learned faster than older operators during training, but showed no difference in performance during testing as shown in Figure 12. Such a difference did appear in the start/no-start data (Appendix B, Table B-4) implying a possible age interaction with alcohol on this visual divided attention task.

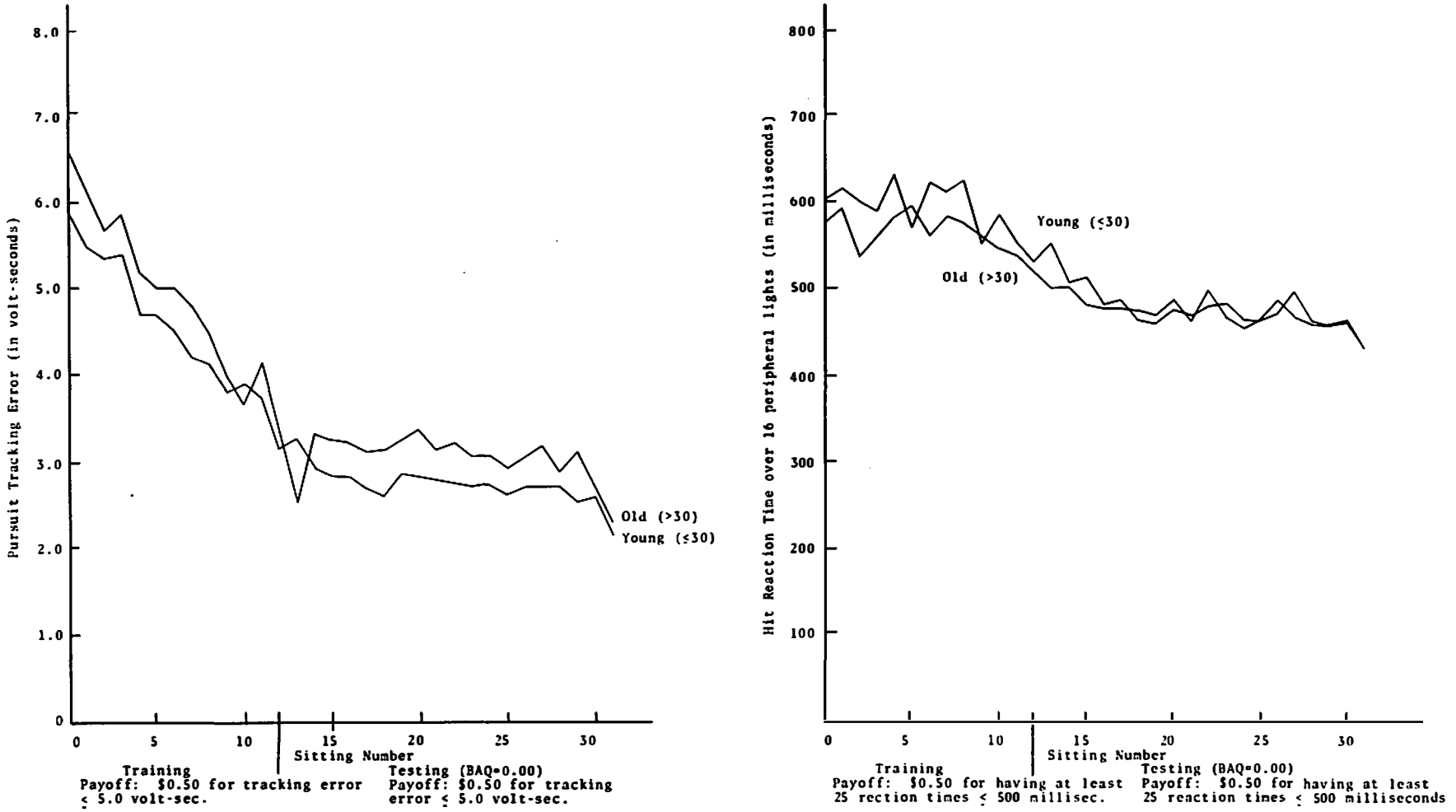

Figure 12. Comparison of Central and Peripheral Scores for Young (≤ 30 yrs.) and Older (> 30 yrs.) Operators on the Visual Divided Attention Task as a Function of Sitting Number at BAQ = 0.00 for Both Training and Testing Conditions

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APPENDIX A

ANOVA AND SIMPLE MAIN EFFECTS SUMMARY TABLES

TABLE A-1

Reaction Analyzer: Universal Pass/Fail Criteria (M); No-Start Strategy (1/3)

Source of Variance	degrees of freedom	sum of squares	mean squares	F-ratio	
Alcohol vs Placebo	1	1.03	1.03	20.80	p < .0005
error	15	0.74	0.05		
Testing Conditions	7	1.30	0.19	3.99	p < 0.001
error	105				
Interaction	7	1.76	0.25	5.45	p < 0.001
error	105	4.84	0.05		

Difference between alcohol and placebo treatments at each testing condition

Testing Conditions	df	ss	ms	F	
Control 1	1		0.00	0.00	p > .05
Control 2	1		0.14	2.91	p > .05
Drink 1	1		0.01	0.16	p > .05
Drink 2	1		0.08	1.72	p > .05
Drink 3	1		0.21	4.41	p < .05
Drink 4	1		1.28	27.54	p < .0005
Post Drink 1	1		0.67	14.48	p < .0005
Post Drink 2	1		0.42	9.11	p < .005
error	120		0.05		

Complex Coordinator: Universal Pass/Fail Criteria (≤ 80 sec + ≤ 80 reversals); No-Start Strategy (1/3)					
Source of Variance	degrees of freedom	sum of squares	mean squares	F-ratio	
Alcohol vs Placebo	1	2.17	2.17	17.77	p < .001
error	15	1.83	0.12		
Testing Conditions	7	3.11	0.44	10.73	p < 0.001
error	105	4.35	0.04		
Interaction	7	3.04	0.43	11.98	p < 0.001
error	105	3.80	0.04		

Difference between alcohol and placebo treatment at each testing condition					
Testing Conditions	df	ss	ms	F	
Control 1	1		0.00	0.00	p > .05
Control 2	1		0.00	0.00	p > .05
Drink 1	1		0.00	0.00	p > .05
Drink 2	1		0.01	0.15	p > .05
Drink 3	1		0.82	17.47	p < .0005
Drink 4	1		3.38	72.06	p < .0005
Post Drink 1	1		0.67	14.34	p < .0005
Post Drink 2	1		0.23	4.93	p < .05
error	120		0.05		

Critital Task Tester: Universal Pass/Fail Criteria (4.2); No-start Strategy (1/3)

Source of Variance	degrees of freedom	sum of squares	mean squares	F-ratio	
Alcohol vs Placebo	1	3.72	3.72	39.92	p < .0005
error	15	1.40	0.09		
Testing Condition	7	4.39	0.63	25.20	p < 0.001
error	105	2.62	0.03		
Interaction	7	4.78	0.68	23.03	p < 0.001
error	105	3.12	0.03		

Difference between alcohol and placebo treatment at each testing condition

Testing Condition	df	ss	ms	F	
Control 1	1		0.01	0.19	p > .05
Control 2	1		0.00	0.00	p > .05
Drink 1	1		0.01	0.19	p > .05
Drink 2	1		0.03	0.77	p > .05
Drink 3	1		1.04	27.56	p < .0005
Drink 4	1		4.87	129.36	p < .0005
Post Drink 1	1		1.41	37.51	p < .0005
Post Drink 2	1		1.04	27.56	p < .0005
error	120		0.04		

Visual Divided Attention: Universal Pass/Fail (≤ 4.6 vs ≤ 650 msec); No-start Strategy (1/1)

Source of Variance	degrees of freedom	sum of squares	mean squares	F-ratio	
Alcohol vs Placebo	1	5.55	5.55	43.24	p < 0.0005
error	15	1.92	0.13		
Testing Conditions	7	7.18	1.03	39.93	p < 0.001
error	105	2.70	0.03		
Interaction	7	5.95	0.85	29.48	p < 0.001
error	105				

Difference between alcohol and placebo treatment at each testing condition

Testing conditions	df	ss	ms	F	
Control 1	1		0.01	0.18	p > .05
Control 2	1		0.01	0.18	p > .05
Drink 1	1		0.00	0.00	p > .05
Drink 2	1		0.08	1.94	p > .05
Drink 3	1		1.04	25.13	p < .0005
Drink 4	1		5.25	127.19	p < .0005
Post Drink 1	1		3.81	92.30	p < .0005
Post Drink 2	1		1.28	31.02	p < .0005
error	120		0.04		

APPENDIX B

ALCOHOL AND PLACEBO TREATMENT DATA

TABLE B-1

Results: RA-U Alcohol Treatment Data Performance vs BAQ

	BAC CLASS INTERVAL	STRATEGY 1/1	1/2	2/2	1/3	2/3	3/3	NO. OF REPETITIONS
A	-<.03	14.58	6.25	20.31	3.13	10.94	29.69	64
L	.03- .06	11.59	4.35	13.04	0.00	13.04	21.74	23
L	.06- .09	33.33	16.67	55.56	5.56	33.33	61.11	18
	.09- .12	31.88	17.39	52.17	4.35	26.09	65.22	23
	.12- .15	42.86	26.53	63.27	12.24	46.94	69.39	49
	.15- .18	62.50	42.86	75.00	33.93	64.29	89.29	56
	≥.18	68.52	50.00	83.33	50.00	66.67	88.89	18
M	<.03	8.33	3.57	10.71	3.57	3.57	17.86	28
A	.03- .06	7.69	0.00	7.69	0.00	7.69	15.38	13
L	.06- .09	38.10	14.29	57.14	14.29	28.57	71.43	7
E	.09- .12	33.33	18.18	54.55	9.09	27.27	63.64	11
S	.12- .15	27.78	11.11	50.00	5.56	22.22	55.56	18
	.15- .18	52.78	25.00	70.83	20.83	50.00	87.50	24
	≥.18	54.55	27.27	72.73	27.27	54.55	81.82	11
F	<.03	19.44	8.33	27.78	2.78	16.67	38.89	36
E	.03- .06	16.67	10.00	20.00	0.00	20.00	30.00	10
M	.06- .09	30.30	18.18	54.55	0.00	36.36	54.55	11
A	.09- .12	30.56	16.67	50.00	0.00	25.00	66.67	12
L	.12- .15	51.61	35.48	70.97	16.13	61.29	77.42	31
E	.15- .18	69.79	56.25	78.13	43.75	75.00	90.63	32
S	≥.18	90.48	85.71	100.00	85.71	85.71	100.00	7
Y	<.03	9.20	0.00	10.34	0.00	10.34	17.24	29
O	.03- .06	14.81	11.11	22.22	0.00	22.22	22.22	9
U	.06- .09	28.57	14.29	57.14	0.00	28.57	57.14	7
N	.09- .12	11.11	0.00	11.11	0.00	0.00	33.33	9
G	.12- .15	29.33	16.00	48.00	8.00	28.00	52.00	25
	.15- .18	53.33	36.00	72.00	20.00	52.00	88.00	25
	≥.18	42.86	14.29	71.43	14.29	28.57	85.71	7
O	<.03	19.05	11.43	28.57	5.71	11.43	40.00	35
L	.03- .06	9.52	0.00	7.14	0.00	7.14	21.43	14
D	.06- .09	36.36	18.18	54.55	9.09	36.36	63.64	11
	.09- .12	45.24	28.57	78.57	7.14	42.86	85.71	14
	.12- .15	56.94	37.50	79.17	16.67	66.67	87.50	24
	.15- .18	69.89	48.39	77.42	45.16	74.19	90.32	31
	≥.18	84.85	72.72	90.91	72.73	90.91	90.91	11

TABLE B-1

Results: RA-U Placebo Treatment Data Performance vs Cycle

CYCLE NUMBER		STARTEGY 1/1	1/2	2/2	1/3	2/3	3/3	NO. OF REPETITIONS
ALL	1	17.71	3.13	25.00	3.13	12.50	37.50	32
	2	25.00	18.75	37.50	12.50	21.88	40.63	32
	3	22.92	12.50	37.50	3.13	21.88	43.75	32
	4	14.58	6.25	28.13	0.00	9.38	34.38	32
	5	13.54	6.25	25.00	3.13	9.38	28.13	32
	6	17.71	15.63	28.13	6.25	15.63	31.25	32
	7	11.46	3.13	18.75	0.00	6.25	28.13	32
	8	8.60	0.00	16.13	0.00	6.45	19.35	31
MALES	1	7.14	0.00	21.43	0.00	0.00	21.43	14
	2	9.52	7.14	14.29	0.00	14.29	14.29	14
	3	4.76	0.00	7.14	0.00	0.00	14.29	14
	4	2.38	0.00	0.00	0.00	0.00	7.14	14
	5	4.76	0.00	7.14	0.00	0.00	14.29	14
	6	4.76	0.00	7.14	0.00	0.00	14.29	14
	7	2.38	0.00	7.14	0.00	0.00	7.14	14
	8	0.00	0.00	0.00	0.00	0.00	0.00	14
FEMALES	1	25.93	5.56	27.78	5.56	22.22	50.00	18
	2	37.04	27.78	55.56	22.22	27.78	61.11	18
	3	37.04	22.22	61.11	5.56	38.89	66.67	18
	4	24.07	11.11	50.00	0.00	16.67	55.56	18
	5	20.37	11.11	38.89	5.56	16.67	38.89	18
	6	27.78	27.78	44.44	11.11	27.78	44.44	18
	7	18.52	5.56	27.78	0.00	11.11	44.44	18
	8	15.69	0.00	29.41	0.00	11.76	35.29	17
YOUNG	1	4.76	0.00	14.29	0.00	0.00	14.29	14
	2	7.14	0.00	21.43	0.00	0.00	21.43	14
	3	11.90	0.00	21.43	0.00	7.14	28.57	14
	4	9.52	0.00	14.29	0.00	0.00	28.57	14
	5	7.14	0.00	14.29	0.00	0.00	21.43	14
	6	9.52	7.14	14.29	0.00	7.14	21.43	14
	7	7.14	7.14	14.29	0.00	7.14	14.29	14
	8	0.00	0.00	0.00	0.00	0.00	0.00	13
OLD	1	27.78	5.56	33.33	5.56	22.22	55.56	18
	2	38.89	33.33	50.00	22.22	38.89	55.56	18
	3	31.48	22.22	50.00	5.56	33.33	55.56	18
	4	18.52	11.11	38.89	0.00	16.67	38.89	18
	5	18.52	11.11	33.33	5.56	16.67	33.33	18
	6	24.07	22.22	38.89	11.11	22.22	38.89	18
	7	14.81	0.00	22.22	0.00	5.56	38.89	18
	8	14.81	0.00	27.78	0.00	11.11	33.33	18

TABLE B-2

Results: CC-U Alcohol Treatment Data Performance vs BAC

	BAC CLASS INTERVAL	STRATEGY 1/1	1/2	2/2	1/3	2/3	3/3	NO. OF REPETITIONS
ALL	<.03	4.62	1.54	12.31	0.00	1.54	12.31	65
	.03- .06	1.45	0.00	4.35	0.00	0.00	4.35	23
	.06- .09	16.67	11.11	27.78	0.00	16.67	33.33	18
	.09- .12	26.09	21.74	38.13	4.35	30.43	43.48	23
	.12- .15	37.59	27.68	59.57	19.15	31.91	61.70	47
	.15- .18	56.79	46.30	72.22	37.04	57.41	75.93	54
	≥.18	75.93	66.67	83.33	61.11	77.78	88.89	18
MALES	<.03	1.19	0.00	3.57	0.00	0.00	3.57	28
	.03- .06	2.56	0.00	7.69	0.00	0.00	7.69	13
	.06- .09	9.52	0.00	14.29	0.00	0.00	28.57	7
	.09- .12	36.36	27.27	54.55	0.00	45.45	63.64	11
	.12- .15	45.10	35.29	70.59	17.65	41.18	76.47	17
	.15- .18	48.48	40.91	72.73	27.27	45.45	72.73	22
	≥.18	75.76	63.64	81.82	54.55	81.82	90.91	11
FEMALES	<.03	7.21	2.70	18.92	0.00	2.70	18.92	37
	.03- .06	0.00	0.00	0.00	0.00	0.00	0.00	10
	.06- .09	21.21	18.18	36.36	0.00	27.27	36.36	11
	.09- .12	16.67	16.67	25.00	8.33	16.67	25.00	12
	.12- .15	33.33	23.33	53.33	20.00	26.67	53.33	30
	.15- .18	62.50	50.00	71.88	43.75	65.63	78.13	32
	≥.18	76.19	71.43	85.71	71.43	71.43	85.71	7
YOUNG	<.03	6.90	3.45	17.24	0.00	3.45	17.24	29
	.03- .06	0.00	0.00	0.00	0.00	0.00	0.00	9
	.06- .09	14.29	0.00	28.57	0.00	14.29	28.57	7
	.09- .12	11.11	11.11	22.22	0.00	11.11	22.22	9
	.12- .15	33.33	28.00	44.00	16.00	36.00	48.00	25
	.15- .18	36.23	26.09	52.17	21.74	30.43	56.52	23
	≥.18	52.38	42.86	57.14	28.57	57.14	71.43	7
OLD	<.03	2.78	0.00	8.33	0.00	0.00	8.33	36
	.03- .06	2.38	0.00	7.14	0.00	0.00	7.14	14
	.06- .09	18.18	18.18	27.27	0.00	18.18	36.36	11
	.09- .12	35.71	28.57	50.00	7.14	42.86	57.14	14
	.12- .15	42.42	27.27	77.27	22.73	27.27	77.27	22
	.15- .18	72.04	61.29	87.10	48.39	77.42	90.32	31
	≥.18	90.91	81.82	100.00	81.82	90.91	100.00	11

TABLE B-2

Results: CC-U Placebo Treatment Data Performance vs Cycle

CYCLE NUMBER	STRATEGY 1/1	1/2	2/2	1/3	2/3	3/3	NO. OF REPETITIONS
A 1	5.21	3.13	12.50	0.00	3.13	12.50	32
L 2	1.04	0.00	3.13	0.00	0.00	3.13	32
L 3	3.13	0.00	6.25	0.00	0.00	9.38	32
4	2.08	0.00	6.25	0.00	0.00	6.25	32
5	2.08	0.00	6.25	0.00	0.00	6.25	32
6	3.13	0.00	3.13	0.00	0.00	9.38	32
7	1.04	0.00	3.13	0.00	0.00	3.13	32
8	3.33	0.00	6.67	0.00	0.00	10.00	30
M 1	7.14	0.00	21.43	0.00	0.00	21.43	14
A 2	0.00	0.00	0.00	0.00	0.00	0.00	14
L 3	2.38	0.00	0.00	0.00	0.00	7.14	14
E 4	2.38	0.00	7.14	0.00	0.00	7.14	14
S 5	0.00	0.00	0.00	0.00	0.00	0.00	14
6	2.38	0.00	0.00	0.00	0.00	7.14	14
7	2.38	0.00	7.14	0.00	0.00	7.14	14
8	2.56	0.00	7.69	0.00	0.00	7.69	13
F 1	3.70	5.56	5.56	0.00	5.56	5.56	18
E 2	1.85	0.00	5.56	0.00	0.00	5.56	18
M 3	3.70	0.00	11.11	0.00	0.00	11.11	18
A 4	1.85	0.00	5.56	0.00	0.00	5.56	18
L 5	3.70	0.00	11.11	0.00	0.00	11.11	18
E 6	3.70	0.00	5.56	0.00	0.00	11.11	18
S 7	0.00	0.00	0.00	0.00	0.00	0.00	18
8	3.92	0.00	5.88	0.00	0.00	11.76	17
Y 1	2.38	0.00	7.14	0.00	0.00	7.14	14
O 2	0.00	0.00	0.00	0.00	0.00	0.00	14
U 3	2.38	0.00	7.14	0.00	0.00	7.14	14
N 4	0.00	0.00	0.00	0.00	0.00	0.00	14
G 5	0.00	0.00	0.00	0.00	0.00	0.00	14
6	2.38	0.00	0.00	0.00	0.00	7.14	14
7	0.00	0.00	0.00	0.00	0.00	0.00	14
8	2.56	0.00	7.69	0.00	0.00	7.69	13
O 1	7.41	5.56	16.67	0.00	5.56	16.67	18
L 2	1.85	0.00	5.56	0.00	0.00	5.56	18
D 3	3.70	0.00	5.56	0.00	0.00	11.11	18
4	3.70	0.00	11.11	0.00	0.00	11.11	18
5	3.70	0.00	11.11	0.00	0.00	11.11	18
6	3.70	0.00	5.56	0.00	0.00	11.11	18
7	1.85	0.00	5.56	0.00	0.00	5.56	18
8	3.92	0.00	5.88	0.00	0.00	11.76	17

TABLE B-3

Results: CTT-U Alcohol Treatment Data Performance vs BAQ

	BAC CLASS INTERVAL	STRATEGY 1/1	1/2	2/2	1/3	2/3	3/3	NO. OF REPETITIONS
A	<.03	8.21	1.54	13.85	0.00	4.62	20.00	65
L	.03- .06	10.14	0.00	13.04	0.00	8.70	21.74	23
L	.06- .09	14.81	5.56	22.22	0.00	11.11	33.33	18
	.09- .12	36.23	26.09	47.83	13.04	43.48	52.17	23
	.12- .15	48.30	26.53	65.31	18.37	46.94	79.59	49
	.15- .18	73.21	60.71	78.57	57.14	75.00	87.50	56
	≥.18	85.19	83.33	83.33	77.78	83.33	94.44	18
M	<.03	7.14	3.57	14.29	0.00	7.14	14.29	28
A	.03- .06	7.69	0.00	7.69	0.00	7.69	15.38	13
L	.06- .09	14.29	0.00	28.57	0.00	14.29	28.57	7
E	.09- .12	36.36	9.09	45.45	9.09	45.45	54.55	11
S	.12- .15	44.44	33.33	61.11	16.67	55.56	61.11	18
	.15- .18	65.28	58.33	70.83	54.17	66.67	75.00	24
	≥.18	81.82	81.82	81.82	72.73	81.82	90.91	11
F	<.03	9.01	0.00	13.51	0.00	2.70	24.32	37
E	.03- .06	13.33	0.00	20.00	0.00	10.00	30.00	10
M	.06- .09	15.15	9.09	18.18	0.00	9.09	36.36	11
A	.09- .12	36.11	41.67	50.00	16.67	41.67	50.00	12
L	.12- .15	50.54	22.58	67.74	19.35	41.94	90.32	31
E	.15- .18	79.17	62.50	84.38	59.38	81.25	96.88	32
S	≥.18	90.48	85.71	85.71	85.71	85.71	100.00	7
Y	<.03	3.45	0.00	6.90	0.00	0.00	10.34	29
O	.03- .06	3.70	0.00	11.11	0.00	0.00	11.11	9
U	.06- .09	9.52	0.00	0.00	0.00	0.00	28.57	7
N	.09- .12	7.41	11.11	11.11	0.00	11.11	11.11	9
G	.12- .15	36.00	12.00	48.00	12.00	32.00	64.00	25
	.15- .18	49.33	32.00	56.00	24.00	52.00	72.00	25
	≥.18	61.90	57.14	57.14	42.86	57.14	85.71	7
O	<.03	12.04	2.78	19.44	0.00	8.33	27.78	36
L	.03- .06	14.29	0.00	14.29	0.00	14.29	28.57	14
D	.06- .09	18.18	9.09	36.36	0.00	18.18	36.36	11
	.09- .12	54.76	35.71	71.43	21.43	64.29	78.57	14
	.12- .15	61.11	41.67	83.33	25.00	62.50	95.83	24
	.15- .18	92.47	83.87	96.77	83.87	93.55	100.00	31
	≥.18	100.00	100.00	100.00	100.00	100.00	100.00	11

TABLE B-3

Results: CTT-U Placebo Treatment Data Performance vs Cycle

CYCLE NUMBER	STRATEGY 1/1	1/2	2/2	1/3	2/3	3/3	NO. OF REPETITIONS
ALL 1	12.50	3.13	12.50	3.13	6.25	28.13	32
ALL 2	9.38	3.13	15.63	0.00	6.25	21.88	32
ALL 3	9.38	6.25	15.63	3.13	9.38	15.63	32
4	5.21	0.00	9.38	0.00	6.25	9.38	32
5	6.25	0.00	12.50	0.00	6.25	12.50	32
6	4.17	0.00	3.13	0.00	3.13	9.38	32
7	5.21	0.00	9.38	0.00	0.00	15.63	32
8	2.15	0.00	3.23	0.00	0.00	6.45	31
MALES 1	4.76	0.00	0.00	0.00	0.00	14.29	14
MALES 2	4.76	0.00	14.29	0.00	0.00	14.29	14
MALES 3	0.00	0.00	0.00	0.00	0.00	0.00	14
MALES 4	0.00	0.00	0.00	0.00	0.00	0.00	14
MALES 5	7.14	0.00	14.29	0.00	7.14	14.29	14
6	2.38	0.00	0.00	0.00	0.00	7.14	14
7	0.00	0.00	0.00	0.00	0.00	0.00	14
8	0.00	0.00	0.00	0.00	0.00	0.00	14
FEMALES 1	18.52	5.56	22.22	5.56	11.11	38.89	18
FEMALES 2	12.96	5.56	16.67	0.00	11.11	27.78	18
FEMALES 3	16.67	11.11	27.78	5.56	16.67	27.78	18
FEMALES 4	9.26	0.00	16.67	0.00	11.11	16.67	18
FEMALES 5	5.56	0.00	11.11	0.00	5.56	11.11	18
FEMALES 6	5.56	0.00	5.56	0.00	5.56	11.11	18
FEMALES 7	9.26	0.00	16.67	0.00	0.00	27.78	18
8	3.92	0.00	5.88	0.00	0.00	11.76	17
YOUNG 1	2.38	0.00	0.00	0.00	0.00	7.14	14
YOUNG 2	2.38	0.00	7.14	0.00	0.00	7.14	14
YOUNG 3	2.38	0.00	7.14	0.00	0.00	7.14	14
YOUNG 4	0.00	0.00	0.00	0.00	0.00	0.00	14
YOUNG 5	0.00	0.00	0.00	0.00	0.00	0.00	14
6	0.00	0.00	0.00	0.00	0.00	0.00	14
7	2.38	0.00	0.00	0.00	0.00	7.14	14
8	0.00	0.00	0.00	0.00	0.00	0.00	13
OLD 1	20.37	5.56	22.22	5.56	11.11	44.44	18
OLD 2	14.81	5.56	22.22	0.00	11.11	33.33	18
OLD 3	14.81	11.11	22.22	5.56	16.67	22.22	18
4	9.26	0.00	16.67	0.00	11.11	16.67	18
5	11.11	0.00	22.22	0.00	11.11	22.22	18
6	7.41	0.00	5.56	0.00	5.56	16.67	18
7	7.41	0.00	16.67	0.00	0.00	22.22	18
8	3.70	0.00	5.56	0.00	0.00	11.11	18

TABLE B-4

Results: DA-U Alcohol Treatment Data Performance vs BAQ

	BAC CLASS INTERVAL	STRATEGY 1/1	NO. OF REPETITIONS
ALL	<.03	4.62	65
	.03- .06	4.35	23
	.06- .09	5.56	18
	.09- .12	21.74	23
	.12- .15	45.83	48
	.15- .18	67.92	53
	≥.18	100.00	18
MALES	<.03	3.57	28
	.03- .06	7.69	13
	.06- .09	0.00	7
	.09- .12	36.36	11
	.12- .15	41.18	17
	.15- .18	50.00	20
	≥.18	100.00	11
FEMALES	<.03	5.42	37
	.03- .06	0.00	10
	.06- .09	8.46	11
	.09- .12	8.34	12
	.12- .15	48.38	31
	.15- .18	78.78	33
	≥.18	100.00	7
YOUNG	<.03	3.45	29
	.03- .06	0.00	9
	.06- .09	0.00	7
	.09- .12	11.11	9
	.12- .15	41.67	24
	.15- .18	56.52	23
	≥.18	100.00	7
OLD	<.03	5.56	36
	.03- .06	6.50	14
	.06- .09	8.46	11
	.09- .12	28.57	14
	.12- .15	49.99	24
	.15- .18	76.66	30
	>.18	100.00	11

TABLE B-4

Results: DA-U Placebo Treatment Data Performance vs Cycle

	CYCLE NUMBER	STRATEGY 1/1	NO. OF REPETITIONS
A	1	6.00	32
L	2	3.00	32
L	3	3.00	32
	4	6.00	32
	5	6.00	32
	6	9.00	32
	7	6.00	32
	8	3.00	32
M	1	0.00	14
A	2	0.00	14
L	3	0.00	14
E	4	0.00	14
S	5	0.00	14
	6	0.00	14
	7	0.00	14
	8	0.00	14
F	1	11.00	18
E	2	6.00	18
M	3	6.00	18
A	4	11.00	18
L	5	11.00	18
E	6	11.00	18
S	7	11.00	18
	8	6.00	18
Y	1	0.00	14
O	2	0.00	14
U	3	0.00	14
N	4	0.00	14
G	5	0.00	14
	6	7.14	14
	7	0.00	14
	8	0.00	14
O	1	11.11	18
L	2	5.56	18
D	3	5.56	18
	4	11.11	18
	5	11.11	18
	6	11.11	18
	7	11.11	18
	8	6.25	16