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LABORATORY TESTING OF ALCOHOL SAFETY INTERLOCK SYSTEMS EMPLOYING DIVIDED ATTENTION TESTS

Contract No. DOT-TSC-857

December 1975

Final Report

Prepared for:

U.S. Department of Transportation
Transportation Systems Center
Cambridge, Massachusetts 02142

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16. Abstract

Prototype Alcohol Safety Interlock Systems employing measurements of tracking ability, reaction time, and response accuracy to discern alcohol impairment were submitted to laboratory testing. These systems were modified versions of a device tested previously in this laboratory. The purpose of the experiment was to determine the intoxication detection rates possible with these modified systems. Fourteen male Subjects participated in the experiment.

The report describes the devices tested and the experimental procedures employed, and documents the results of analyses of device performance.

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1. Introduction

This report, submitted to the U.S. Department of Transportation, Transportation Systems Center (TSC) under Contract DOT-TSC-857, describes procedures and results of laboratory tests of two prototype Alcohol Safety Interlock Systems (ASIS). These tests were conducted by Dunlap and Associates, Inc., during September 1975. The tests consisted of a series of controlled-drinking sessions, during which volunteer Subjects consumed ethanol and tested on the two ASIS devices. The devices were modified versions of a two-component divided attention task (DAT) previously tested in this laboratory (Oates, Preusser, Blomberg and Orban, 1975; Oates, Preusser and Blomberg, 1975).

This introductory section discusses the background and purpose of the testing program, describes the two devices, and enumerates the basic research questions and experimental variables. Section 2 describes the experimental procedures, focusing on the selection, training and testing of the volunteer Subjects. Section 3 documents data analyses conducted to address the research questions and presents the final conclusions of the study.

1.1 Background and Purpose of the Program

An ASIS is a device designed for installation in an automobile to determine automatically if the driver is intoxicated, and to prevent operation of the vehicle when intoxication is detected. Such devices are intended to detect intoxication before the driver starts the vehicle.

During two previous phases of Contract No. DOT-TSC-857, tests had been conducted on several configurations of a DAT device that required Subjects to perform a tracking task (central test component) while responding to randomly occurring light signals (peripheral test component). Results of those experiments indicated that the DAT device could detect as intoxicated approximately 70% of Subjects at a mean blood alcohol concentration (BAC) of 0.15%, with a "false

alarm" rate of 5%*. It was hypothesized that the intoxication detection rate could be improved if the peripheral test component were made more difficult. Accordingly, TSC designed two modified DAT devices, for which the peripheral light signals were replaced by numeric displays. The general purpose of the present experiment was to determine the intoxication detection rates possible with these modified devices. Satisfaction of this general purpose required answers to the following three research questions:

(1) What are the effects of the modified DAT design parameters on the susceptibility of the Subjects' performance to alcohol?

The device design parameters are described in Section 1.2 below. These parameters, together with experimental and control conditions constituting the experimental design, represent the major variables tested to determine the association between alcohol and Subjects' performance.

(2) To what degree do measures of Subjects' performance on these devices discriminate between intoxicated and sober individuals?

For purposes of this study, a Subject is considered to be intoxicated if his BAC is 0.10% or more. The central issue addressed in this question is whether his performance (scores) on the DAT devices provide reliable estimation of his BAC. To explore this issue it is necessary to identify alternate criteria against which scores can be rated as "pass" or "fail", and to determine the particular criterion providing the optimum combination of "hit" and "false alarm" rates.

*For purposes of this report, "false alarm" rate is the percentage of Subjects at BAC=0.00% who are incorrectly assessed as intoxicated by the ASIS device.

(3) Are the intoxication detection rates produced by these modified DAT devices significantly better than those produced by the original DAT configurations?

Results of the previous phases of Contract DOT-TSC-857 must be compared with the findings of the present experiment. The specific data to be compared consist of the percentages of DAT tests failed at various BAC intervals, under the respective optimum criteria for the original and modified design parameters.

1.2 Description of the Modified DAT Devices

Both devices tested in this study employ a compensatory tracking task as the central test component. The tracking display is mounted on the dashboard of the test bucket and consists of a horizontal row of closely-packed, small neon bulbs. The row is approximately 3.0 inches long. Display-control circuitry is designed to activate the neon elements so that the row can be illuminated for any segment length between 0 and 3 inches, beginning at its left side. Thus, the display constitutes an apparently continuous bar graph that seems to expand from or contract toward the left side in response to display or control inputs. The display exhibits unpredictable oscillations (expansions/contractions) induced by a randomized forcing function which serves as the task stimulus. The Subject's task is to compensate for these oscillations, i.e., to maintain the right-end of the illuminated segment exactly in the center of the display (a vertical white line approximately 1/8 inch wide marks the center point). The Subject does so by turning the test bucket's steering wheel in the appropriate direction: turns toward the right cause the display to expand toward the right, while left turns induce a contraction toward the left.

A numeric display window is located immediately adjacent to each side of the tracking display. Associated with these display windows are four pushbuttons, two of which are mounted on the steering wheel spokes and two of

which are mounted on the test bucket floor. The placement of these push-buttons is such that they are readily accessible by the Subject's left or right thumb (spoke positions) or left or right foot (floor positions). Figure 1 illustrates the DAT displays.

The numeric display windows and their associated pushbuttons constitute the stimuli/controls for the peripheral test component. During the course of a trial, i.e., while the Subject is performing the central tracking task, unpredictable numeric values appear in the display windows at unpredictable intervals. The Subject must note the value(s) displayed, identify the appropriate pushbutton associated with the value(s) shown, and depress that pushbutton as rapidly as possible to extinguish the numeric display. He then releases the pushbutton in preparation for the next numeric signal. If the Subject fails to observe and/or respond to a signal, it automatically will extinguish after 1.5 seconds. If the Subject responds to a signal by depressing an inappropriate pushbutton, or by depressing two or more pushbuttons simultaneously, the signal will be extinguished, but the event will be recorded as an error. A trial lasts until a total of 20 numeric signals have illuminated and been extinguished. Trial duration is approximately 30 seconds.

The two DAT devices differ with respect to the numeric display paradigm. For one device, referred to as DAT-2, a signal appears in only one display window at any given time; during the course of a trial, the signals appear in either the left-or right-side window in an unpredictable sequence. The value displayed for any given signal is either 4, 5, 6 or 7. If a 4 appears, the Subject must depress the left-thumb pushbutton; if a 5 appears, the right-thumb button is to be depressed. Similarly, a 6 requires the left-foot button to be depressed, a 7 calls for the right-foot button. The other device is referred to as DAT-3*. In this case, numeric values appear in both display windows during

*The designation DAT-1 is reserved for the original design of the divided attention task, in which light signals rather than numeric values served as the peripheral task stimuli.

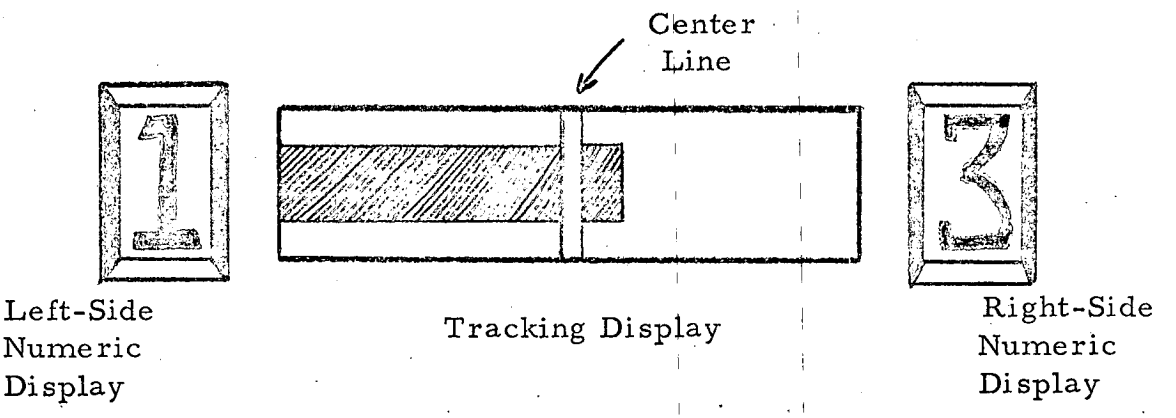


Figure 1. DAT Displays.

each signal. The value shown in either window ranges from 0 to 7; the two values always add to either 4, 5, 6 or 7. The Subject must add the values and respond by depressing the appropriate pushbutton; the same value-pushbutton association described for the DAT-2 applies to the DAT-3.

At the conclusion of a trial, three scores were recorded. The first was the accumulated tracking error (central score), measured in volts. The second was the integrated reaction time of response to the numeric signals (peripheral score), also measured in volts. The third score was the total number of errors committed during the trial. As stated above, an error was any occasion where the Subject depressed an inappropriate pushbutton, or two or more pushbuttons simultaneously, in response to a numeric signal. The error score does not include those occasions where the Subject failed to respond to a signal within the 1.5 seconds interval. However, separate records were maintained of the total numbers of "missed signals" that occurred during trials.

Although both the central and peripheral test components were "active" throughout the trial, neither accumulated its score for the full trial duration. The devices had been designed so that tracking error was accumulated for (approximately) the first 12 seconds of the trial, and responses to the first 5 numeric signals did not contribute to the integrated reaction time. Naturally, no Subject was informed of this fact; rather, Subjects were instructed always to perform both tasks. The error score was based on responses to all 20 numeric signals.

1.3 Major Variables of the Study

Each Subject participated in the study on a total of six evenings. The first three evenings were devoted to training. The last three were testing sessions. There was a standard one evening interval between consecutive training and testing sessions. The following variables were manipulated to determine their effects on the Subjects' performance on the devices:

(1) Variables associated with alcohol

- Beverage (within-Subjects variable)

  On two of his testing sessions, a Subject consumed alcohol (A) doses. On the remaining session, he consumed placebo (P) doses. Only one type of beverage was consumed by any given Subject on any given session.

- Cycle (within-Subjects variable)

  During each testing session, a Subject completed five cycles on the devices. Six trials were taken on each device during each cycle. The first cycle preceeded consumption of any beverage dose; consumption of one beverage dose followed each of the first four cycles. Thus, during sessions when alcohol was consumed, cycle number was directly related to BAC.

(2) Variable associated with DAT design parameters

- Device (within-Subjects variable)

  All Subjects were tested on both the DAT-2 and DAT-3. The two devices presented alternate peripheral task paradigms.

(3) Control variables

- Session Order (between-Subjects variable)

  Half of the Subjects completed their testing sessions in the sequence P, A, A and half in the sequence A, A, P. Assignment to these sequences was randomly determined. Tests of the significance of the effect of session order were intended to determine the presence of carry-over effects.

- Trial (within-Subjects variable)

  As previously described, Subjects completed six trials on each device during every cycle. Tests of the significance of any differences in Subjects' performance among the trials also were conducted to determine the presence of carry-over effects.

One additional control condition, viz., the sequence in which Subjects tested on the DAT-2 and DAT-3, was counterbalanced between Subjects. That is, half of the Subjects always began each cycle by completing six trials on the DAT-2 followed by six trials on the DAT-3, while the remaining half always followed the reverse order. Assignments to device sequences were randomly selected within each session order (AAP vs. PAA) group.

2. Experimental Procedures

2.1 Subject Selection

The Contract Statement of Work called for completion of testing by a minimum of 12 Subjects, to be selected in accordance with the following criteria:

- males only
- age 21 to 45 years
- 20/20 or 20/20 corrected vision
- possession of a valid driver's license
- quantity/frequency of alcohol consumption equal to or surpassing the "heavy drinker" threshold, as measured by the Subject Screening Instrument (Oates and McCay, 1972).

Further, it was required that, if any Subject became ill or was for any other reason unable to complete testing, his data would be removed from the experiment and he would be replaced by another Subject.

A total of 17 Subjects participated in the experiment. Of these, three became ill during an alcohol session, and so their data were deleted from the experiment. Thus, the final data base was obtained from 14 individuals. These Subjects had been instructed to abstain from alcohol and drugs for 24 hours prior to every session, and to abstain from food for three hours prior to testing sessions.

2.2 Training

Each Subject's three training sessions averaged six hours duration. The first session commenced with orientation to the experiment. The Subjects were informed of the nature of the study and provided with a brief, verbal description of the ASIS concept as a drinking-driving countermeasure. Members of the experimental staff then conducted a detailed "hands on" demonstration of

the DAT-2 and DAT-3, with emphasis on trial operational procedures. A staff member demonstrated one trial on each device, after which each Subject performed one familiarization trial. The staff encouraged and answered Subjects' questions, and ensured that all fully understood procedures and requirements before training formally commenced.

The basic unit of training was the cycle, during which Subjects completed six trials on each device for a total of 12 trials per cycle. At any given time, two Subjects were in the process of taking trials, one on the DAT-2 test bucket, the other on the DAT-3. Remaining Subjects rested until a test bucket was free. On the average, Subjects rested for approximately 30 minutes out of every training hour. Midway through each training session, a light meal was served to the Subjects.

During each of the three training sessions, each Subject completed 10 cycles (60 trials) on each device. For the first training session, Subjects were instructed to perform only the central (tracking) task during Cycle No. 1, and only the peripheral (reaction time) task during Cycles 2 and 3. Thereafter, simultaneous performance of both tasks always was required.

Subjects were rewarded during training whenever their trial scores satisfied pre-defined criteria. For the first two training sessions, criteria for reward were set at 2.9 volts or less for the tracking score and 7.9 volts or less for the reaction time score. These criteria applied to both the DAT-2 and DAT-3. These criteria were the median scores produced during approximately 600 trials taken by four male Subjects recruited exclusively for this purpose*. In order to qualify for reward on a given trial, a Subject was required to satisfy both the central and peripheral criteria. Further, no reward was made if the

*These four Subjects satisfied all selection criteria enumerated in Section 2.1, but they did not participate in the formal testing conducted for this experiment.

Subject made three or more errors in the trial (in this case, "missed signals" also were considered errors). The standard reward was $0.25 per trial; however, this was doubled whenever the criteria were satisfied and the trial was error-free.

For the third training session, criteria for reward were assigned individually to each Subject on each device. These criteria were the median scores produced by the Subject during his last four cycles (24 trials) of his second training session. The reward value and error requirements remained the same.

The primary objective of training was to ensure that the Subjects achieved stable performance on each device by the completion of the third session (by which time they had taken 180 trials on each device). For each Subject, mean central and peripheral scores were computed across three successive training cycles. A total of 25 three-cycle means were computed for each Subject; the first of these was based on Cycles 4, 5 and 6 of the first training session*, the second on Cycles 5, 6 and 7, the third on Cycles 6, 7 and 8, and so forth. Successive mean scores computed in this fashion are termed moving averages; each score in the series is based on two-thirds of the data forming the preceeding score and on two-thirds of the data of the succeeding score. The moving average technique tends to smooth out chance variation in the raw data and thus provides a potentially better measure of the underlying trends in the data than do the raw scores themselves.

The mean moving average scores across all Subjects on the central and peripheral tasks of the DAT-2 and DAT-3 are shown in Table 1. As can be seen in this Table, scores generally decreased (i.e., improved) throughout the first and second training sessions; however, the moving averages essentially are stable across the last five terms in the series (spanning Cycles 4 through

*Cycles 1, 2 and 3 of the first training session were excluded from this analysis since the Subjects were not performing both tasks simultaneously during those times.

Table 1. Mean Central and Peripheral Scores During Training

All Subjects

	DAT-2		DAT-3	
Series No.	Central	Peripheral	Central	Peripheral
1	3.833	7.555	3.550	8.332
2	3.675	7.457	3.413	8.286
3	3.523	7.448	3.303	8.296
4	3.429	7.456	3.197	8.294
5	3.367	7.455	3.142	8.307
6	3.288	7.405	3.104	8.266
7	3.176	7.310	3.005	8.135
8	3.074	7.193	2.888	8.016
9	3.057	7.170	2.799	7.923
10	3.019	7.182	2.795	7.918
11	3.005	7.203	2.769	7.931
12	2.952	7.232	2.765	7.950
13	2.948	7.215	2.755	7.975
14	2.965	7.239	2.732	7.954
15	2.963	7.227	2.754	7.946
16	2.921	7.216	2.726	7.905
17	2.838	7.144	2.688	7.873
18	2.738	7.048	2.584	7.819
19	2.703	6.976	2.526	7.793
20	2.683	6.976	2.522	7.797
21	2.717	6.985	2.542	7.800
22	2.714	7.011	2.550	7.815
23	2.712	7.006	2.541	7.820
24	2.697	7.045	2.525	7.837
25	2.716	7.058	2.524	7.876

10 of the third training session). Individual Subjects' moving average scores on the central and peripheral tasks are presented in Appendix A of this report. Figures 2 and 3 illustrate the mean moving average scores computed across all Subjects.

The Subjects' error scores during training were examined in an analogous fashion. A distribution of error scores across three successive training cycles was prepared for each Subject; these distributions also are shown in Appendix A. The distributions then were summed across all Subjects. The results are shown in Table 2. Figure 4 exhibits the percentage of trials in successive three-cycle series that produced error scores of two or greater.

Across all Subjects, the mean central and peripheral scores on the two devices appeared to reach a stable plateau by the completion of the third training session. However each of the learning curves shown in Figures 2 and 3 exhibit earlier plateaus from the 11th through 15th moving average series numbers. Those scores correspond to the second half of the second training session. The "flattening" of the curves in that range probably can be attributed to fatigue. It remains possible that fatigue effects occurring near the end of the third training session may also have contributed to the plateaus exhibited at that time. However, the relative stability of scores between the 21st and 25th moving average series numbers was considered sufficient grounds for termination of training upon the completion of the third session.

Throughout training, peripheral scores averaged across all Subjects consistently were higher (worse) on the DAT-3 than on the DAT-2. As a group, Subjects also committed more errors on the DAT-3. These results had been anticipated since the DAT-3's peripheral task was felt to be more difficult than the DAT-2's. It was also found that the mean central score consistently was higher on the DAT-2 than on the DAT-3, a result which had not been expected.

Figure 2. Mean Central Training Scores

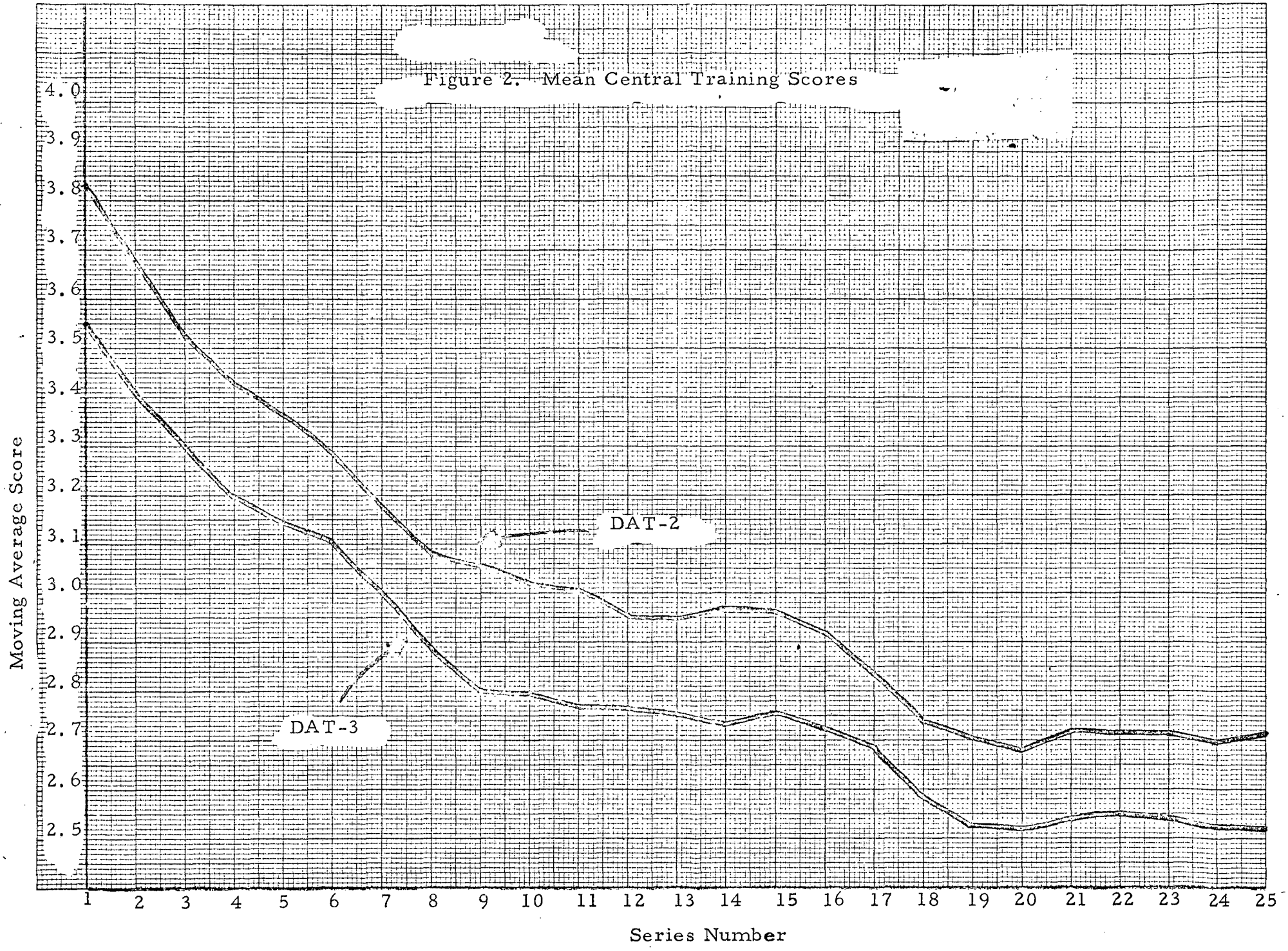


Figure 3. Mean Peripheral Training Scores

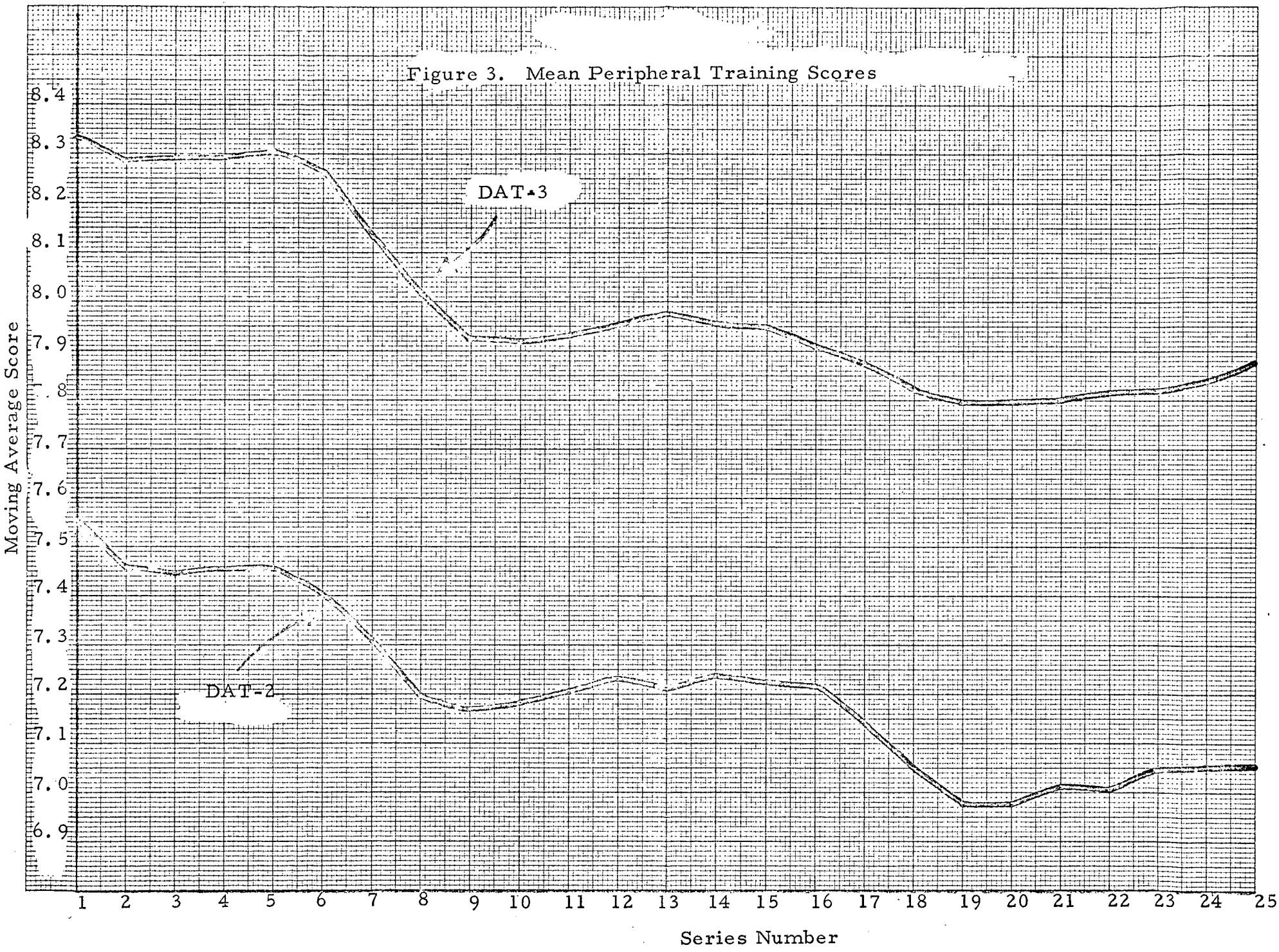


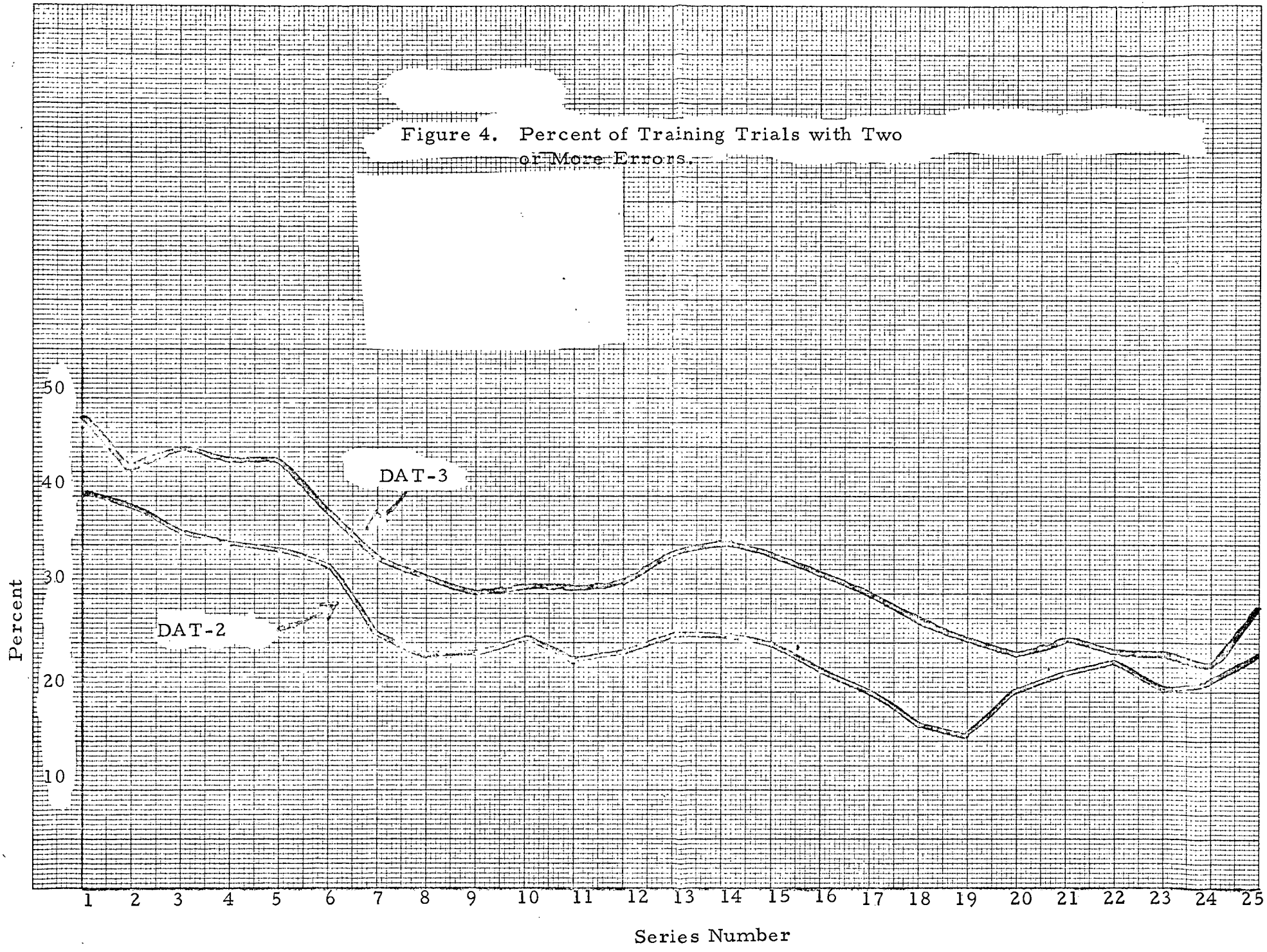
Table 2. Distribution of Error Scores During Training

(Table entries are numbers of trials producing the indicated error scores)

ALL SUBJECTS

	DAT-2					DAT-3				
N.	ZERO	ONE	TWO	THREE	FOUR+	ZERO	ONE	TWO	THREE	FOUR+
1	51	100	62	31	8	45	66	31	30	10
2	58	96	65	24	9	46	98	66	31	11
3	53	106	57	23	11	42	97	74	21	15
4	61	103	58	16	14	55	87	68	26	21
5	66	99	52	17	18	64	78	62	24	24
6	71	98	50	18	15	79	76	54	24	19
7	83	104	39	15	11	82	85	48	24	13
8	89	103	41	13	6	83	89	44	24	12
9	96	96	37	17	6	80	88	30	22	14
10	95	93	36	26	6	93	81	43	17	18
11	97	97	33	21	4	98	77	46	17	14
12	94	97	39	19	3	89	84	52	15	12
13	93	94	44	17	4	83	83	57	16	11
14	96	91	42	16	7	82	81	55	17	13
15	103	86	43	12	8	88	78	49	18	19
16	105	91	37	12	7	90	81	51	14	16
17	117	84	35	13	3	91	85	43	18	15
18	126	94	26	14	2	88	95	44	16	9
19	145	68	25	12	2	87	101	37	18	9
20	136	65	36	12	3	92	100	35	16	9
21	133	64	41	12	2	95	93	37	16	11
22	115	79	45	11	2	102	99	37	13	11
23	112	89	38	8	5	109	83	41	11	8
24	107	92	33	12	8	114	81	44	8	5
25	103	85	32	17	11	108	72	45	13	10

Figure 4. Percent of Training Trials with Two or More Errors.



12-1-83

Med exam

↓

Cycle 1 — Breath Test (0.0 BAC) + 6 Trials on DAT 2 and 6 on DAT 3

↓

Drink 1 (Placebo drink or Alcohol drink)

↓ 35 min

Cycle 2 — Breath Tests (2) + 6 Trials on DAT 2 and 6 on DAT 3

↓

Drink 2

↓ 35 min

Cycle 3 — Breath Tests + Testing on DAT 2 + 3

Drink 3

↓

cycle 4 — Breath Tests + Testing on DAT 2 + 3

Drink 4

↓ 35 min

cycle 5 — Breath Tests + Testing on DAT 2 + 3

TSC personnel examined the two test buckets and found that the randomized forcing functions driving the respective central task displays were not precisely equivalent. Thus, it would appear that the central task was more difficult on the DAT-2 than on the DAT-3.

2.3 Testing

Each Subject participated in three testing sessions averaging four hours duration. During his placebo session, a Subject received a total of four drinks. Each contained a total volume of 9 ounces and consisted of orange juice diluted with water, with 2 milliliters of 95% grain alcohol floated on top to convey the odor and taste of ethanol. This placebo dose had been employed in previous experiments conducted in this laboratory (Oates et al., 1975); in the present experiment, as in the past, it proved sufficient to mask the fact that placebos were being administered. However, Subjects occasionally remarked that the drinks seemed fairly "light" in alcohol content. During each of his two alcohol sessions, a Subject also received four drinks, each containing 9 ounces of fluid. These drinks consisted of orange juice diluted with water and an appropriate volume (as indicated in Table 3) of 95% grain alcohol based on the Subject's body weight.

All testing sessions began with brief medical examinations of the Subjects conducted by the attending physician. Occasional re-examinations were conducted during the sessions, whenever the physician deemed necessary. Following the medical examination, a breath test was conducted to verify that the Subject's BAC was 0.00%.

During a session, 15 minutes were permitted for the ingestion of each drink. This was followed by a 20 minute waiting period to allow for absorption of alcohol into the bloodstream and dissipation of residual alcohol from the mucous membranes of the mouth. At the end of the 20 minute period, the Subject was required to rinse his mouth with water to ensure elimination of

Table 3. Drink Assignments

Weight (lbs.)	Volume of 95% Grain Alcohol	
	Each Drink (ml.)	Total Amount (ml.)
120-130	29	116
131-140	31	124
141-150	33	132
151-160	35	140
161-170	37	148
171-180	39	156
181-190	41	164
191-200	43	172
201-210	45	180
211-220	47	188

residual alcohol. The Subject then submitted to two breath tests.* The two breath tests were separated by one minute to allow the alcohol concentrations of the blood and alveoli to re-establish equilibrium. Subjects were not given the results of these breath tests.

All testing on the DAT-2 and DAT-3 took place during five cycles; on each cycle, the Subject completed six trials on each device. The first cycle took place immediately after the medical examination, i.e., prior to consumption of a drink. Ingestion of one drink preceeded each of the last four cycles.

Subjects received a reward for each testing trial on which the scores satisfied the individualized criteria that had been established for the third training session. If a Subject satisfied the score criteria without committing an error, he received $1.50; a reward of $1.00 was issued if he committed one or two errors while satisfying the score criteria. Trials on which three or more errors were committed were not eligible for reward. During testing sessions, trial scores were not reported to Subjects; rather, they were told simply whether they had earned a reward and, if so, the amount of reward.

Subjects were permitted to play cards, read magazines, and take part in similar diversions during their drinking/waiting periods. Smoking was permitted only during the 15 minute periods when drinks were being consumed. No eating was permitted at any time during a testing session.

The DAT-2 and DAT-3 test buckets were located in separate rooms for all training and testing sessions. A lounge area was provided in which Subjects consumed their drinks and observed their waiting periods. One additional room was devoted to breath testing. All breath tests were conducted on the Omicron Intoxilyzer.

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*If the two test results differed by more than 10%, a third test was taken, and the two closest of the three results were averaged to estimate the Subject's BAC.

3. Results

This section documents data analyses that were conducted to address the three research questions posed in Section 1.1. The issues of concern to those questions and the analytic techniques employed to address these issues were as follows:

(1) The effects of the modified DAT design parameters, alcohol and the control variables on Subjects' performance--This issue involved determination of the significance of the relationships between scores on the DAT devices and the experimental and control variables enumerated in Section 1.3. The analysis of variance technique (ANOVA) was chosen to address this issue. The dependent variables in these analyses were the raw scores on the two devices. The independent variables were:

- Beverage (placebo versus 1st alcohol session versus 2nd alcohol session)
- Cycle (1st through 5th)
- Device (DAT-2 versus DAT-3)
- Session Order (AAP versus PAA)
- Trial (1st through 6th)

(2) The sober versus intoxicated discrimination of the two devices--This issue involved selection of alternate test score criteria on which assessment of intoxication may be based, determination of the "hit" and "false alarm" rates associated with these criteria, and identification of the criterion producing the optimum combination of "hits" and "false alarms" for each device. To identify alternate criteria, regression analyses of BAC versus score were

conducted. Analyses of hit versus false alarm receiver operating characteristics were employed to assess these criteria and to identify the optimum criterion.

(3) Comparison of the intoxication detection rates produced by the modified DAT devices with the performance of the original DAT configurations--From previous experiments conducted in this laboratory, the intoxication detection rates (as a function of BAC) of the original DAT-1 were known. From the present experiment, the comparable rates for the DAT-2 and DAT-3 were determined. Chi-squared tests were conducted to determine whether the intoxication detection rates of any one of these devices were significantly different from those of the other two.

The final conclusions of the study and recommendations for further research also are presented in this section.

3.1 Effects of the Study's Variables on Subjects' Performance

All test session data produced by 12 of the 14 Subjects were analyzed using the ANOVA technique to determine the significance of the associations between scores and the study's variables and their interactions. Exclusion of the data of two Subjects was necessitated by the fact that unequal numbers of individuals completed testing under the two session orders; six had tested under the sequence PAA, eight under the sequence AAP.* Accordingly, two members of the latter group were selected randomly for exclusion from the ANOVAs. However, a decision was made to employ their data in subsequent analyses of intoxication detection rates, provided that the ANOVAs disclosed no significant effect of session order on score.

*This situation arose when several individuals assigned to the former sequence became ill during testing and, therefore, were deleted from the experiment.

The ANOVA technique allows for a relatively precise examination of the magnitude of each main effect, each interaction and the overall effect of alcohol. The following paragraphs discuss the results of two analyses of variance applied to these data. The first analysis worked with central and peripheral scores on a trial by trial basis. Error scores could not be analyzed trial by trial since their distribution is not at all normal. Simply, a large number of trials produced only 0 or 1 error (see Table 9, Section 3.2) leading to a highly skewed distribution. The second analysis worked with mean central, peripheral and error scores on a cycle by cycle basis (i.e., across successive six-trial cycles). While error scores are not normally distributed trial by trial, they do approach a normal distribution when averaged across trials.

3.1.1 Analysis of Central and Peripheral Scores

The dependent variables in the first analysis were central score (tracking) and peripheral score (reaction time). Central and peripheral scores were each converted to standard or Z scores. Thus, in this analysis, the mean across all central scores was 0 with a standard deviation of one and the mean of all peripheral scores was 0 with a standard deviation of one. This was necessary since the variance associated with the central score was somewhat lower than the variance associated with the peripheral score (see Appendix B) and thus the assumption of homogeneity of variance would have been violated had the raw scores been used. The specific format for this analysis was as follows:

Between Subjects Variables	Levels
Session Order (Placebo-Alcohol-Alcohol versus Alcohol - Alcohol - Placebo)	2
Within Subjects Variables	
Device (DAT-2 versus DAT-3)	2
Beverage (Placebo, First Alcohol Session, Second Alcohol Session)	3
Cycle (each Subject in each session performed under five six-trial cycles)	5
Trial (there were six trials during each cycle)	6
Score (central versus peripheral)	2

This design is a full factorial 2x2x3x5x6x2 design with six replications for a total of 4,320 data points.

The complete summary table for this analysis is shown in Appendix C. Table 4 is a summary of the full summary table. Shown in this Table are the results for all main effect terms and for all significant interactions. In this and succeeding tables, the interactions shown are significant at the .001 level. Interactions significant at the .05 and .01 levels are referenced in the text. However, terms significant at the .05 and .01 levels may not represent real effects since nearly one hundred interaction and main effect terms were tested in this and the succeeding ANOVA and, thus, several terms would be expected to be significant at these levels by chance alone.

As shown in Table 4, the between Subjects variable "Test Order" did not produce statistically significant effects. Of the five within Subjects variables, Device, Beverage and Cycle produced significant effects. The effect of Trial

Table 4. Analysis of Variance Summary Table for DAT-2 and DAT-3 Central and Peripheral Scores (Main Effects and Significant Interactions Only)

Between Subjects	d.f.	Mean Square	F	% of Total Sum of Squares
Session Order	1	50.18	.56	1.16
(Subjects)	(10)	(89.79)	--	(20.81)
Within Subjects				
Device	1	165.16	33.31*	3.83
(Device x Subjects)	(10)	(4.96)	--	(1.15)
Beverage	2	78.20	24.89*	3.62
(Beverage x Subjects)	(20)	(3.14)	--	(1.46)
Cycle	4	101.3	44.06*	9.37
(Cycle x Subjects)	(40)	(2.29)	--	(2.13)
Trial	5	.41	.66	.05
(Trial x Subjects)	(50)	(.62)	--	(.72)
Score	1	.00	.00	.00
(Score x Subjects)	(10)	32.44	--	(7.52)
Beverage x Cycle	8	27.17	14.65*	5.04
(Beverage x Cycle x Subjects)	(80)	(1.86)	--	(3.44)
Session Order x Device x Trial	5	1.51	5.45*	.17
(Device x Trial x Subjects)	(50)	(.28)	--	(.32)
Device x Score	1	308.92	86.27*	7.16
(Device x Score x Subjects)	(10)	3.58	--	(.83)
All Other Terms	4,011	--	--	31.22
TOTAL	4,319	1.00	--	100.00

NOTE: Error terms shown in parentheses. Full summary table may be seen in Appendix C.

* $p < .001$

was not significant, and since all scores were standardized, the effect of Score was negligible. In addition to the main effects, there was a significant Beverage by Cycle interaction and a significant Device by Score interaction. Each of these effects will be discussed in detail as part of the next analysis (Section 3.1.2).

The last significant term in this analysis was the Session Order by Device by Trial interaction. The data forming this three-way interaction are shown in Table 5. These data appear to show that Subjects working under the Placebo-Alcohol-Alcohol session order performed more poorly across succeeding trials on the DAT-2 (-.22 on Trial 1 to -.06 on Trial 6) and performed better across succeeding trials on the DAT-3 (.45 on Trial 1 to .29 on Trial 6). Alternatively, Subjects working under the Alcohol-Alcohol-Placebo session order performed better across succeeding trials on DAT-2 (-.14 on Trial 1 to -.36 on Trial 6) and remained the same across succeeding trials on DAT-3 (.05 on Trial 1 to .05 on Trial 6). There is no readily apparent explanation for these findings. However, it should be pointed out that this effect accounts for only 0.17% of the total variance in this design, thus, while it is statistically significant, it has little effect on the overall design.

In addition to the above effects, there were two interactions significant at the .05 level. Together, these two interactions accounted for 0.60% of the total variance. The specific interactions and their associated F values may be seen in Appendix C. However, it should be reiterated that these effects are not necessarily reliable since several terms were tested in this design and these two effects could have been significant by chance alone.

The primary purpose for conducting this analysis was to determine whether or not it was reasonable to sum across trials. Summation across trials is necessary if errors are to be included as a dependent measure. These results

Table 5. Session Order by Device by Trial Interaction

Trial	Session Order: Placebo-Alcohol-Alcohol DAT-2	Placebo-Alcohol-Alcohol DAT-3	Session Order: Alcohol-Alcohol-Placebo DAT-2	Alcohol-Alcohol-Placebo DAT-3
1	-.22*	.45	-.14	.05
2	-.13	.33	-.22	.08
3	-.17	.34	-.30	.08
4	-.11	.31	-.30	-.02
5	-.07	.31	-.28	.06
6	-.06	.29	-.36	.05

* Entry is Z score (central and peripheral); lower scores indicate better performance (i.e., more accurate tracking and faster reaction time).

suggest that there is no main effect due to Trial and there are no significant two-way interactions involving Trial as a variable. There was one significant ($p < .001$) three-way interaction involving Trial, but this interaction accounts for only 0.17% of the total variance. Therefore, it appears that summing across trials should not mask any important effects or otherwise bias the conclusions.

3.1.2 Analysis of Central, Peripheral and Error Scores

The second analysis of variance dealt with central, peripheral and error scores as the dependent measures. Each individual datum was the mean for six trials (i.e., cycle mean) and all scores were converted to standard or Z scores for the reasons discussed above. The specific format for this analysis was as follows:

Between Subjects Variables	Levels
Session Order (Placebo-Alcohol-Alcohol versus Alcohol-Alcohol-Placebo)	2
Within Subjects Variables	
Device (DAT-2 versus DAT-3)	2
Beverage (Placebo, First Alcohol Session Second Alcohol Session)	3
Cycle	5
Score (Central, Peripheral, Error)	3

This design is a full factorial 2x2x3x5x3 design with six replications for a total of 1,080 data points.

The complete summary table for this analysis is shown in Appendix C. Table 6 is a summary of the full summary table. As with Table 4, Table 6 shows all main effect terms and all interactions significant at the .001 level. The first

Table 6. Analysis of Variance Summary Table for DAT-2 and DAT-3 Central, Peripheral and Error Scores

(Main Effects and Significant Interactions Only)

	d.f.	Mean Square	F	% of Total Sum of Squares
Between Subjects				
Session Order	1	16.95	.76	1.57
(Subjects)	(10)	22.29	-	20.70
Within Subjects				
Device	1	36.84	35.76*	3.42
(Device x Subjects)	(10)	(1.03)	-	(.96)
Beverage	2	25.03	18.03*	4.65
(Beverage x Subjects)	(20)	(1.39)	-	(2.58)
Cycle	4	28.96	31.04*	10.76
(Cycle x Subjects)	(40)	(.93)	-	(3.47)
Score	2	.00	.00	.00
(Score x Subjects)	(20)	(5.60)	-	(10.40)
Beverage x Cycle	8	8.90	9.88*	6.61
(Beverage x Cycle x Subjects)	(80)	.90	-	(6.70)
Device x Score	2	32.86	49.21*	6.10
(Device x Score x Subjects)	(20)	(.67)	-	(1.24)
All Other Terms	220	-	-	20.84
Total	1,079	1.00	-	100.00

*$p < .001$

Note: Error terms shown in parentheses. Full summary table may be seen in Appendix C

term shown is the main effect for "Session Order." This was not statistically significant, and, since all scores were standardized, the main effect of "Score" was also not significant. The main effect for "Device," "Beverage," and "Cycle" and the "Beverage by Cycle" and "Device by Score" interactions were all significant at the .001 level. In addition to these terms, there were three interactions significant at the .05 level and three interactions significant at the .01 level. Together, these additional terms accounted for 2.93% of the variance and may be seen in Appendix C.

Table 7 shows the main effect for "Beverage," the main effect for "Cycle" and the "Beverage by Cycle" interaction. Concerning Beverage, it can be seen that mean performance in the Placebo condition (-.30) was markedly better than mean performance during the Alcohol sessions (+.12 and +.18). For "Cycle" mean performance ranged from -.22 and -.30 on Cycles one and two up to +.59 on Cycle five. Thus, a significant effect due to "Cycle." This degradation in performance across cycles, however, occurred only in the Alcohol sessions. Performance during the First Alcohol Session ranged from -.19 and -.26 on Cycles one and two to +.85 on Cycle five. Performance during the Second Alcohol Session ranged from -.26 and -.34 on Cycles one and two to +1.23 on Cycle five. Performance during the Placebo Session, on the other hand, remained relatively constant ranging only from -.23 to -.36 across all cycles, thus, a significant Beverage by Cycle interaction. Together, these three terms represent the effect of alcohol on performance. They account for 22.02% of the total variance in the design.

Table 8 shows the main effect for "Device" and the "Device by Score" interaction. As shown in this Table, DAT-2 produced a mean score across all cycles, all sessions, all Subjects, etc., of -.18, while DAT-3 produced a mean score of +.18. This difference indicates that overall the DAT-2 task was easier for the Subjects than the DAT-3 task. It does not necessarily mean, however,

Table 7. Beverage by Cycle Interaction

Cycle	First Alcohol Session	Second Alcohol Session	Placebo	Cycle Mean
1	-.19*	-.26	-.23	-.22
2	-.26	-.34	-.30	-.30
3	-.14	-.10	-.32	-.19
4	.33	.38	-.36	.12
5	.85	1.23	-.32	.59
Session Mean	.12	.18	-.30	

*entry is mean Z score (central, peripheral and error); lower scores indicate better performance.

Table 8. Device x Score Interaction

	DAT-2	DAT-3
Central Score	.08*	-.09
Peripheral Score	-.51	.51
Error Score	-.13	.13
Device Mean	-.18	.18

*entry is mean Z score; lower scores indicate better performance.

that performance on either device is more (or less) affected by alcohol. The "Device by Score" interaction appears to be largely due to differences in the peripheral score. Mean performance for DAT-2, peripheral score, was -.51 as compared with +.51 for DAT-3. This compares with mean central scores of -.13 and +.13 for DAT-2 and DAT-3 respectively and mean error scores of +.08 and -.09. Clearly, while DAT-2 was easier than DAT-3 overall, this difference between the two devices primarily is in the peripheral score. Thus, there is a significant "Device by Score" interaction. It is felt that these results are consistent with the fact that the DAT-2 peripheral task required Subjects to simply recognize a single number and make the appropriate response while the DAT-3 peripheral task involved recognition of two numbers and the addition of these numbers prior to making the appropriate response.

In general, these results are quite consistent with the pattern of results found for other devices during other phases of this research. The absence of a Session Order main effect as well as the general absence of triple and higher order interactions (with one minor exception) suggests that the remainder of this report may treat the data in a relatively straightforward manner. The important terms are Device, Beverage, Cycle and Score and the Beverage by Cycle and Device by Score interactions. It should also be noted that none of these results suggest a significant effect of "learning" across this experiment, nor differential "learning" across Alcohol and Placebo conditions. First, with respect to overall learning, it can be seen in Table 7 that performance during the First Alcohol Session was actually slightly better than during the Second Alcohol Session. With respect to differential "learning," the absence of a significant "Session Order by Beverage" interaction suggests that differential "learning" (e.g., learned more during a Placebo session than during an Alcohol session) also did not occur. Thus, it would appear that the training procedures utilized prior to the experimental sessions did bring the Subjects close to asymptotic performance on these devices and thus, learning was not a significant factor in these results.

3.2 Intoxication Detection Rates

Analyses discussed above indicate that scores on the DAT-2 and DAT-3 are significantly associated with alcohol. This section focuses on the quantification of the BAC-score relationships. In particular, the following issues are addressed:

- To what degree do the DAT-2 and DAT-3 discriminate between intoxicated and non-intoxicated Subjects, i.e., can their scores be used reliably to distinguish Subjects whose BACs are less than 0.10% from those whose BACs equal or exceed that value?
- What is the optimum discrimination possible with these devices, and what percentage of intoxicated Subjects can be detected at this optimum discrimination?
- How do the intoxication detection rates produced by the DAT-2 and DAT-3 compare with one another, and how do they compare with the intoxication detection rates produced by the original divided attention task (DAT-1)?

Answers to these questions require examination of each test score. The examination must lead to a classification of the test as a "pass" or "fail". The relative rates of "fail" experienced by intoxicated and non-intoxicated Subjects will enable evaluation of the device's discrimination.

Classification of test scores as "passed" or "failed" is a two-step process:

(1) First, it is necessary to define a "test". In the simplest case, the test could consist of a single trial. Alternatively, the test could incorporate multiple trials, some minimum

number of which must be performed successfully if the test is to be passed. The definition of an ASIS test can be termed the scoring strategy. The general form of a strategy is represented by N/M, where M is the number of trials permitted and N is the minimum number that must be performed successfully in order to "pass".

(2) Next, it is necessary to establish a criterion by which it will be determined whether a trial is "performed successfully". For the DAT devices, the criterion can be expressed as some combination of the three scores that establishes the pass/fail threshold. Then, the scores on any given trial can be combined in the prescribed fashion and the result compared with the criterion value: if the result exceeds the criterion, the trial will be judged to have been failed.

Following the approach employed in all previous ASIS testing programs conducted in this laboratory, the six trials taken on each cycle were considered to constitute two blocks of three trials (i.e., trials 1, 2 and 3 constituted block #1, trials 4, 5 and 6 block #2). Each 3-trial block was taken to represent a separate test, and was subjected to pass/fail analysis relative to strategies 1/3, 2/3 and 3/3. Next, the last trial of each block was discounted, and the resulting 2-trial blocks were analyzed relative to strategies 1/2 and 2/2. Finally, each of the six trials was treated as a separate test and was analyzed relative to the 1/1 strategy. Thus, six distinct strategies were examined for each device.

Selection of pass/fail criteria required identification of an appropriate technique for combining the three scores (central, peripheral and error). For the original DAT-1, no error score had been defined. The central and peripheral scores were combined in a linear equation, the output of which was a predicted BAC value for the trial in question. This equation was of the following form:

$$BAC = k_1 T + k_2 R + k_3$$

where T is the tracking (central) score, R the reaction time (peripheral) score, and k_1, k_2, and k_3 are constants. The pass/fail criterion then was defined as a predicted BAC limit, e.g., the trial was deemed to have been failed if the predicted BAC obtained by transforming its scores by the above equation equaled or exceeded a specified value. The transforming equation was obtained as the output of a multiple regression analysis of actual BAC versus central and peripheral scores.

It is possible to compute corresponding equations for the DAT-2 and DAT-3 that theoretically would predict BAC from a linear combination of the tracking, reaction time and error scores, i.e., equations of the form:

$$BAC = k_1 T + k_2 R + k_3 E + k_4$$

However, it should be recognized that the error score (unlike the central and peripheral scores) is a discrete rather than continuous variable. Further, the distribution of error scores across all testing trials (discussed subsequently in this section) is skewed heavily toward zero. Thus, the statistical validity of combining error score into a multiple regression analysis is at least questionable As an alternative approach, error score can be assessed separately from a central/peripheral combination, using a bi-conditional criterion. This approach would proceed as follows:

(1) A multiple regression analysis of BAC versus central and peripheral scores would be conducted, producing an equation of the form

$$BAC = k_1 T + k_2 R + k_3;$$

(2) a predicted BAC pass/fail threshold would be selected;

(3) a maximum acceptable error limit would be selected;

(4) then, the trial would be judged as a "fail" if the predicted BAC derived from its central and peripheral scores equals or exceeds the threshold or if its error score exceeds the prescribed limit.

A decision was made to examine both approaches. To conduct the necessary regression analyses, a data set for each device was obtained for every Subject on every cycle of his two alcohol sessions. The data set can be represented by (B, T, R, E), where, for a particular Subject, session and cycle,

B denotes the mean BAC of the two breath tests

T denotes the mean tracking score across the six trials

R denotes the mean reaction time score across the six trials

E denotes the mean error score across the six trials.

Regression analyses applied to these data produced the following equations and multiple correlation coefficients (r)*:

DAT-2

T/R/E Regression: BAC = .00168T + .00413R + .00304E - .2775 (r = .663)

T/R Regression: BAC = .00191T + .00425R - .2888 (r = .662)

DAT-3

T/R/E Regression: BAC = .00093T + .00390R + .00711E - .2710 (r = .596)

T/R Regression: BAC = .00167T + .00395R -.2853 (r = .588).

In the above equations, T and R are expressed in decivolts.

The next step in preparation for pass/fail analyses entailed examination of the error score distributions. These are shown in Table 9 . Again, as was noted in Section 3.1, it is evident that errors were recorded more frequently

*These regression analyses are each based on 140 data points (14 Subjects, 2 alcohol sessions, 5 cycles per session).

Table 9 . Distribution of Error Scores During Testing Sessions

(Table entries are the numbers of trials producing the indicated numbers of errors)

	DAT-2 No. of Errors					DAT-3 No. of Errors				
	0	1	2	3	4+	0	1	2	3	4+
1st Alcohol Session	(x^2 = 63.25, 12dof, p < .001)					(x^2 = 21.12, 12dof, p < .05)				
Cycle 1	40	27	13	4	0	25	35	17	4	3
Cycle 2	52	17	8	5	2	31	32	16	4	1
Cycle 3	47	30	6	1	0	29	31	18	3	3
Cycle 4	24	27	22	5	6	25	29	14	11	5
Cycle 5	20	25	20	10	9	20	29	15	11	9
2nd Alcohol Session	(x^2 = 44.69, 12dof, p <.001)					(x^2 = 33.58, 12dof, p < .001)				
Cycle 1	43	24	15	1	1	28	32	18	5	1
Cycle 2	43	25	13	2	1	37	24	21	1	1
Cycle 3	41	29	11	2	1	30	33	9	6	6
Cycle 4	32	28	11	5	8	21	30	17	8	8
Cycle 5	22	21	23	8	10	16	21	22	3	12
Placebo Session	(x^2 = 3.44, 8dof, N.S.)					(x^2 = 19.04, 12dof, N.S.)				
Cycle 1	41	31	10	1	1	38	24	14	5	3
Cycle 2	45	30	9	0	0	34	29	11	6	4
Cycle 3	42	32	8	0	2	29	34	19	1	1
Cycle 4	42	32	5	5	0	44	29	8	3	0
Cycle 5	40	28	11	4	1	41	26	12	4	1

on the DAT-3 than on the DAT-2. For the DAT-3, 56% of placebo trials and 69% of alcohol session trials had one or more errors; the corresponding figures for the DAT-2 are 50% and 57% respectively. With both devices, the error score distribution was significantly associated with cycle number (i.e., BAC) on both alcohol sessions, but no significant association occurred during the placebo session.

Based upon the data in Table 9 , a decision was made to conduct pass/fail analyses under alternate acceptable error limits of 2, 3 and 4. Examination of more stringent limits (i.e., 0 or 1) was rejected since these would produce failure of 14% or more of sober (placebo) trials, almost certainly resulting in unacceptably high false alarm rates under all scoring strategies. Limits above four were rejected since it is evident that these would apply to only relatively few trials.

Having selected scoring strategies, regression equations, and error limits for pass/fail analyses, it remained to determine the sober versus intoxicated discrimination possible with all combinations of these factors and to identify the combination providing optimum discrimination. To do so, the following steps were taken:

(1) Each trial's scores were transformed into a predicted BAC value using the appropriate T/R/E regression equation for the device in question.

(2) Alternate pass/fail criteria were defined as predicted BAC limits, at or above which the trial would be deemed a failure. The limits used were 0.07%, 0.08%, 0.09%, 0.10% and 0.11%.

(3) Fail rates then were computed, across all Subjects, for each testing session cycle and for each scoring strategy. Statistical

comparison of the sober versus intoxicated fail rates then permitted determination of the discrimination provided by each strategy under the T/R/E prediction model.

(4) Next, each trial's scores were transformed into a predicted BAC value using the appropriate T/R regression equation for the device in question.

(5) The same alternate pass/fail criteria (.07 - .11) employed in Step (2) were employed to identify failed trials.

(6) Additional failed trials were identified by assessing their error scores relative to the alternate error limits (2, 3 and 4).

(7) Fail rates then were computed, across all Subjects, for every testing session cycle and for every combination of scoring strategy and error limit. Statistical comparison of the sober versus intoxicated fail rates then permitted determination of the discrimination provided by each combination of strategy/error limit under the T/R prediction model.

The statistical comparisons of fail rates alluded to above were based on analyses of receiver operating characteristics, and, in particular, on the single parameter d'. This parameter is defined as the difference between the means of the "signal-plus-noise" (hits) and "noise-alone" (false alarms) distributions divided by the standard deviation of the noise distribution. The higher the value of d', the greater is the hit versus false alarm discrimination. For these analyses, "false alarms" included all tests failed during the placebo session; "hits" included all tests failed during the fourth and fifth cycles of alcohol sessions (over which mean actual BAC was 0.122%). Thus, a d' value was computed for each device for:

- every combination of strategy and predicted BAC criterion using the T/R/E model; and
- every combination of strategy, error limit and predicted BAC criterion using the T/R model.

These data are presented in Tables 10 through 13 . Table 14 exhibits the mean values of d' (across all predicted BAC criteria) for each strategy and prediction model.

The optimum strategy/prediction model combination for each device is the combination producing the greatest sober versus intoxicated discrimination, or the highest mean value of d'. From Table 14, it can be seen that the optimum combination for the DAT-2 is the 1/2 strategy under the T/R regression with error limit = 2 (d' = 1.89). For the DAT-3, the 2/3 strategy under the T/R regression with error limit = 2 is optimum (d' = 1.46).

Having selected the optimum strategy/prediction model for each device, it remains to choose the optimum predicted BAC criterion for pass/fail analyses. This choice is a hit versus false alarm trade-off decision requiring definition of the maximum acceptable false alarm rate. In previous tests of the original DAT-1 device, the optimum criterion was defined as that which produced a 5% fail rate at BAC = 0.00% (placebo fail rate). To ensure comparability of the present results, this same definition was adopted. The appropriate criteria for the DAT-2 and DAT-3 were found by iterating predicted BAC in 0.001 steps and interpolating until a 5% placebo fail rate was found under the optimum strategy/prediction model. Through this process, the following predicted BAC criteria were selected:

DAT-2: 0.0735%

DAT-3: 0.110%

Table 10. DAT Discrimination Using The T/R/E Regression Model

Strategy		DAT-2 Predicted BAC Criterion .07	.08	.09	.10	.11	DAT-3 Predicted BAC Criterion .07	.08	.09	.10	.11
1/1	Hit Rate	.718	.598	.458	.33	.25	.72	.565	.435	.328	.21
	False Alarm	.144	.072	.052	.040	.011	.19	.116	.064	.048	.038
	d'	1.64	1.70	1.51	1.31	1.64	1.46	1.38	1.37	1.28	1.00
1/2	Hit Rate	.625	.48	.358	.248	.18	.618	.43	.338	.215	.133
	False Alarm	.072	.016	.016	.008	.008	.116	.078	.050	.028	.014
	d'	1.78	2.14	1.82	1.64	1.44	1.51	1.24	1.22	1.14	1.14
2/2	Hit Rate	.82	.715	.59	.463	.375	.813	.688	.498	.44	.285
	False Alarm	.206	.122	.088	.058	.016	.236	.136	.072	.064	.052
	d'	1.74	1.73	1.58	1.54	1.88	1.63	1.60	1.46	1.40	1.06
1/3	Hit Rate	.555	.423	.303	.163	.125	.58	.365	.285	.17	.10
	False Alarm	.052	.016	.008	.008	.008	.086	.070	.038	.022	.014
	d'	1.77	2.00	1.82	1.37	1.19	1.56	1.12	1.26	1.07	1.00
2/3	Hit Rate	.725	.608	.438	.333	.233	.75	.59	.418	.323	.188
	False Alarm	.128	.064	.052	.031	.008	.172	.092	.064	.044	.038
	d'	1.75	1.80	1.47	1.44	1.62	1.61	1.59	1.32	1.28	0.95
3/3	Hit Rate	.868	.77	.633	.50	.393	.828	.74	.598	.493	.34
	False Alarm	.252	.13	.102	.080	.024	.314	.178	.094	.078	.064
	d'	1.78	1.87	1.61	1.40	1.76	1.42	1.57	1.56	1.43	1.08

Table 11. DAT Discrimination Using the T/R Regression Model with Error Limit = 2

Strategy		DAT-2 Predicted BAC Criterion .07	.08	.09	.10	.11	DAT-3 Predicted BAC Criterion .07	.08	.09	.10	.11
1/1	Hit Rate	.74	.638	.503	.423	.323	.735	.66	.538	.430	.363
	False Alarm	.176	.108	.088	.066	.046	.250	.168	.128	.102	.096
	d'	1.57	1.59	1.38	1.33	1.28	1.30	1.37	1.25	1.08	0.97
1/2	Hit Rate	.688	.563	.40	.295	.225	.66	.553	.413	.303	.225
	False Alarm	.084	.016	.016	.008	.008	.122	.100	.064	.028	.028
	d'	1.87	2.32	1.90	1.80	1.58	1.57	1.42	1.32	1.39	1.17
2/2	Hit Rate	.84	.74	.633	.58	.483	.813	.768	.663	.563	.483
	False Alarm	.264	.186	.144	.108	.064	.370	.236	.172	.172	.148
	d'	1.62	1.53	1.41	1.44	1.49	1.22	1.44	1.36	1.10	1.02
1/3	Hit Rate	.608	.473	.313	.215	.143	.635	.483	.348	.250	.170
	False Alarm	.072	.016	.016	.008	.008	.086	.064	.064	.022	.022
	d'	1.73	2.10	1.75	1.55	1.28	1.72	1.50	1.13	1.35	1.07
2/3	Hit Rate	.743	.645	.50	.42	.295	.73	.68	.528	.42	.358
	False Alarm	.144	.072	.060	.038	.016	.192	.116	.070	.058	.05
	d'	1.73	1.83	1.55	1.59	1.67	1.48	1.66	1.53	1.37	1.27
3/3	Hit Rate	.878	.795	.688	.633	.535	.848	.810	.730	.615	.555
	False Alarm	.322	.236	.192	.156	.116	.472	.320	.244	.23	.214
	d'	1.63	1.54	1.36	1.36	1.29	1.10	1.35	1.30	1.03	0.94

Table 12. DAT Discrimination Using the T/R Regression Model with Error Limit = 3

Strategy		DAT-2 Predicted BAC Criterion .07	.08	.09	.10	.11	DAT-3 Predicted BAC Criterion .07	.08	.09	.10	.11
1/1	Hit Rate	.728	.618	.468	.385	.273	.723	.63	.498	.365	.283
	False Alarm	.156	.086	.064	.046	.024	.21	.132	.088	.066	.058
	d'	1.63	1.66	1.45	1.44	1.43	1.39	1.44	1.34	1.18	1.06
1/2	Hit Rate	.66	.535	.383	.278	.205	.653	.528	.358	.23	.17
	False Alarm	.084	.016	.016	.008	.008	.116	.094	.064	.028	.028
	d'	1.79	2.24	1.90	1.74	1.52	1.61	1.40	1.17	1.20	1.00
2/2	Hit Rate	.833	.725	.59	.528	.408	.785	.733	.628	.483	.378
	False Alarm	.234	.156	.116	.080	.036	.306	.172	.100	.100	.080
	d'	1.70	1.62	1.42	1.47	1.61	1.31	1.56	1.60	1.24	1.09
1/3	Hit Rate	.588	.463	.313	.215	.143	.625	.455	.313	.205	.14
	False Alarm	.072	.016	.016	.008	.008	.086	.064	.064	.022	.022
	d'	1.67	2.09	1.69	1.55	1.28	1.69	1.42	1.04	1.20	0.97
2/3	Hit Rate	.723	.615	.458	.358	.24	.723	.66	.488	.338	.26
	False Alarm	.128	.064	.052	.030	.008	.178	.108	.070	.058	.05
	d'	1.75	1.83	1.51	1.52	1.64	1.53	1.65	1.44	1.19	1.00
3/3	Hit Rate	.878	.778	.633	.58	.438	.823	.778	.688	.545	.455
	False Alarm	.274	.176	.136	.100	.058	.372	.214	.128	.114	.098
	d'	1.74	1.69	1.46	1.48	1.46	1.25	1.55	1.65	1.32	1.21

Table 13. DAT Discrimination Using the T/R Regression Model with Error Limit = 4

Strategy		DAT-2 Predicted BAC Criterion .07	.08	.09	.10	.11	DAT-3 Predicted BAC Criterion .07	.08	.09	.10	.11
1/1	Hit Rate	.728	.615	.458	.37	.26	.723	.628	.485	.343	.263
	False Alarm	.150	.076	.056	.036	.014	.204	.122	.076	.050	.042
	d'	1.64	1.76	1.51	1.48	1.56	1.43	1.46	1.40	1.24	1.11
1/2	Hit Rate	.66	.535	.375	.268	.198	.623	.518	.338	.223	.16
	False Alarm	.064	.016	.016	.008	.008	.116	.094	.056	.028	.028
	d'	1.93	2.27	1.93	1.71	1.48	1.54	1.36	1.18	1.19	0.93
2/2	Hit Rate	.833	.715	.583	.50	.385	.785	.733	.618	.455	.348
	False Alarm	.212	.136	.096	.058	.016	.29	.158	.086	.072	.052
	d'	1.76	1.67	1.54	1.57	1.95	1.34	1.63	1.64	1.32	1.23
1/3	Hit Rate	.588	.463	.313	.208	.143	.625	.455	.295	.198	.133
	False Alarm	.072	.016	.016	.008	.008	.086	.064	.056	.022	.022
	d'	1.63	2.10	1.70	1.52	1.28	1.70	1.40	1.06	1.44	1.18
2/3	Hit Rate	.723	.615	.44	.358	.233	.723	.65	.488	.32	.233
	False Alarm	.128	.064	.052	.030	.008	.178	.108	.070	.052	.044
	d'	1.75	1.83	1.47	1.52	1.62	1.53	1.63	1.44	1.15	1.01
3/3	Hit Rate	.878	.768	.625	.545	.40	.823	.778	.673	.51	.42
	False Alarm	.252	.148	.108	.072	.032	.35	.184	.100	.080	.066
	d'	1.82	1.78	1.57	1.58	1.60	1.31	1.66	1.73	1.42	1.30

Table 14. Mean Values of d' for Each Strategy and Pass/Fail Criterion Model

DAT-2

Criterion Model	Strategy 1/1	1/2	2/2	1/3	2/3	3/3
T/R/E Regression (no error limit)	1.56	1.76	1.69	1.63	1.62	1.68
T/R Regression (error limit = 2)	1.43	1.89	1.50	1.68	1.67	1.44
T/R Regression (error limit = 3)	1.52	1.84	1.56	1.66	1.65	1.57
T/R Regression (error Limit = 4)	1.59	1.86	1.70	1.65	1.64	1.67

DAT-3

Criterion Model	Strategy 1/1	1/2	2/2	1/3	2/3	3/3
T/R/E Regression (no error limit)	1.30	1.25	1.43	1.20	1.35	1.41
T/R Regression (error limit = 2)	1.19	1.37	1.23	1.35	1.46	1.14
T/R Regression (error limit = 3)	1.28	1.28	1.36	1.26	1.36	1.40
T/R Regression (error limit = 4)	1.33	1.24	1.43	1.36	1.35	1.48

The respective combinations of strategy, prediction model, and predicted BAC criterion selected for each device will produce the optimum intoxication detection rates for those devices, assuming that the 5% false alarm rate is the maximum acceptable value. These combinations were applied to all testing session scores to determine how fail rate varied as a function of actual BAC. Results are shown in Table 15. For purposes of comparison, the intoxication detection rates obtained with the original DAT-1 under its optimum strategy/criterion also are depicted in Table 15. These intoxication detection rates are graphically depicted in Figure 5 .

The curves shown in Figure 5 appear to have essentially the same shape for all three devices. Statistical testing of the differences between the DAT-1 and the two modified devices is impeded by the fact that the former instrument was tested at BAC levels that are different from those recorded during testing of the DAT-2 and DAT-3. Estimates of the DAT-1 fail rates corresponding to the BAC levels at which the latter two devices were tested were obtained by interpolation from the DAT-1 curve in Figure 5 . These estimated rates also have been included in Table 15.

Chi-squared tests were employed to determine the significance of any differences among the intoxication detection curves. The contingency tables for these tests are shown below (entries represent the number of test blocks passed during the indicated alcohol session cycle)*:

*For the DAT-2 and DAT-3, a total of 56 test blocks were taken during each cycle (14 Subjects; 2 alcohol sessions; 2 test blocks per cycle for each session; for the DAT-1, 96 test blocks were taken (24 Subjects). The numbers of test blocks passed on the DAT-1 were derived by multiplying 96 by 1 minus the interpolated failure rates.

Table 15. Intoxication Detection Rates Corresponding To Optimum Strategy and Criterion
(Table Entries are Percent Fails)

Alcohol Sessions

	DAT-2	DAT-3	DAT-1**		DAT-1***
Cycle 1 (0.00%)*	9.0	5.5	3.0	(0.00%)*	3.0
Cycle 2 (0.035%)	9.0	0.0	2.3	(0.047%)	2.0
Cycle 3 (0.069%)	17.5	7.5	11.0	(0.086%)	18.0
Cycle 4 (0.108%)	46.5	21.5	33.4	(0.126%)	46.0
Cycle 5 (0.137%)	77.0	50.0	55.5	(0.155%)	71.0

Placebo Sessions

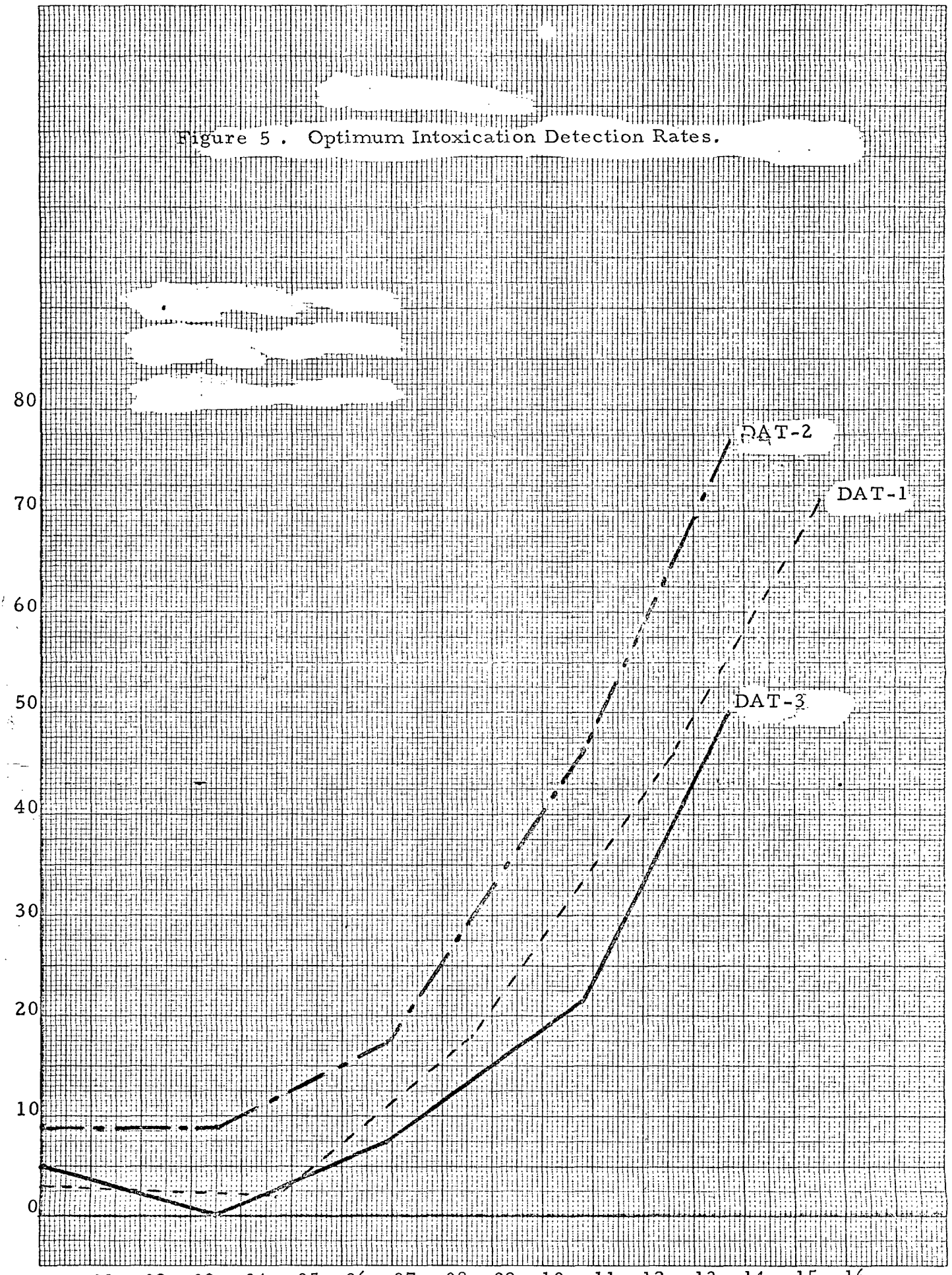
	DAT-2	DAT-3		DAT-1
Cycle 1 (0.00%)	11.0	7.0	(0.00%)	2.0
Cycle 2 (0.00%)	0.0	4.0	(0.00%)	5.0
Cycle 3 (0.00%)	7.0	0.0	(0.00%)	2.0
Cycle 4 (0.00%)	7.0	7.0	(0.00%)	4.0
Cycle 5 (0.00%)	0.0	7.0	(0.00%)	9.5

*Mean Actual BAC for each cycle is shown in parentheses.

**Entries in this column are interpolated (i.e., estimated) fail rates.

***Entries in this column are the actual fail rates obtained during previous testing of the DAT-1.

Figure 5 . Optimum Intoxication Detection Rates.



Cycle No.	DAT-1	DAT-2	DAT-3
1	93	51	53
2	94	51	56
3	85	46	52
4	64	30	44
5	43	13	28

Separate chi-squared tests were conducted for each pair of the three devices. Results were as follows:

- DAT-1 versus DAT-2

  $x^2 = 3.34$, 4 degrees of freedom, not significant

- DAT-1 versus DAT-3

  $x^2 = 0.61$, 4 degrees of freedom, not significant

- DAT-2 versus DAT-3

  $x^2 = 4.66$, 4 degrees of freedom, not significant

Thus, there is no significant difference between any two of the three devices relative to their intoxication detection rates as a function of BAC.

The findings presented and discussed above provide answers to the three questions posed at the beginning of this subsection. First, the scores recorded on the DAT-2 and DAT-3 do correlate significantly with BAC and thus provide a means of distinguishing between intoxicated and sober Subjects. Secondly, the optimum discrimination available with each device is obtained with a prediction model that estimates BAC from a linear combination of the central and peripheral scores, and that establishes a maximum allowable error limit of two; using this prediction model, optimum discrimination is obtained with the DAT-2 under the 1/2 scoring strategy, and with the DAT-3 under the 2/3 strategy. For the DAT-2, optimum discrimination entails detection of 77% of intoxicated Subjects at the highest level of BAC tested (0.137%); the

corresponding figure for the DAT-3 is 50%. In both cases, a 5% false alarm rate at BAC = 0.00% is maintained. Lastly, although there is some variation in the intoxication detection rates produced by these devices, their performance is not significantly different, nor is there a significant difference in intoxication detection between either of these devices and the DAT-1 previously tested.

3.3 Conclusions

The analyses described above provide answers to the three research questions posed in Section 1.1:

What are the effects of the modified DAT design parameters on the susceptibility of the Subjects' performance to alcohol?

The ANOVAs disclosed that there were significant main effects produced by "beverage" and "cycle", and the "beverage by cycle" interaction also was significant. These findings show that Subjects' performance on the DAT-2 and DAT-3 indeed is significantly affected by alcohol. There also was a significant main effect due to "device", indicating that the DAT-2 and DAT-3 presented distinctly different tasks to the Subjects; further, the significance of the "device x score (test component)" interaction disclosed that the two instruments, as expected, differed primarily with respect to the peripheral task. More importantly, however, the absence of significant effects due to the "device by beverage," "device by cycle," and "device by beverage by cycle" interactions suggests that alcohol does not affect scores on the two devices in a significantly different fashion.

To what degree do measures of Subjects' performance on these devices discriminate between intoxicated and sober individuals?

For both the DAT-2 and DAT-3, maximum sober versus intoxicated discrimination is achieved when the central and peripheral scores are

combined in a linear regression equation to predict BAC and when an error score of three or more is considered to indicate intoxication. That is, on any given trial, intoxication is indicated if either of the following conditions holds:

(1) the error score exceeds 2; or,

(2) the linear combination of central and peripheral scores produces a predicted BAC that equals or exceeds a specific criterion value.

With respect to this general model, the DAT-2 provides its greatest hit versus false alarm discrimination ($d' = 1.89$) under the 1/2 scoring strategy. Optimum discrimination for the DAT-3 ($d' = 1.46$) occurs under the 2/3 strategy. When the false alarm rate (percent fails during placebo session) is fixed at 5%, the DAT-2 detects as intoxicated 77% of Subjects at a mean BAC of 0.137% and 46.5% of Subjects at a mean BAC of 0.108%; the corresponding detection rates for the DAT-3 are 50% and 21.5%, respectively.

Are the intoxication detection rates produced by these modified DAT devices significantly better than those produced by the original DAT configurations?

Chi-squared tests disclosed no significant differences among the DAT-1, DAT-2 and DAT-3 with respect to their intoxication detection rates. Thus, it is concluded that all three devices provide essentially equivalent discrimination between sober and intoxicated individuals.

3.4 Recommendations for Further Research

In this and previous experiments conducted under Contract No. DOT-TSC-857, various DAT configurations have been subjected to in excess of 230 Subject-days of controlled drinking experimentation.

These tests consistently have shown that these devices are capable of detecting as intoxicated a majority of individuals whose BACs are at or near 0.15%, provided one accepts a false alarm rate of 5% at zero BAC. At this point, it is felt that there exist sufficient data on which to base at least a tentative decision concerning the feasibility of a DAT ignition interlock. This decision must take into account factors of a socio-political-economic nature, in addition to the findings of these experiments. Thus, it is inappropriate for the authors of this report to suggest the outcome of the decision, or even to attempt to enumerate all factors that should be considered in the decision-making process. Instead, the authors simply recommend that DOT initiate no further development or testing of the DAT devices unless and until a decision is reached that they provide sufficient sober versus intoxicated discrimination to justify their continued consideration as drinking-driving countermeasures.

Assuming that the available data are felt to support the feasibility of the DAT devices, it is recommended that the following four steps be taken:

1. Selection of one specific DAT configuration for further development and testing.

   Experiments to date have disclosed no significant differences among the several DAT configurations tested with respect to their intoxication detection rates. Thus, selection of one specific configuration for further research can be based on considerations dealing with their respective costs, component reliability, and practicality, i.e., the relative ease with which they can be installed in motor vehicles.

2. Modification of the selected configuration to provide a "true" divided attention test.

In Section 1.2 of this report it was noted that the central and peripheral task components operated simultaneously for only a relatively brief portion of each trial. Knowledge of this fact was withheld from Subjects, apparently successfully. However, it is possible that some Subjects may have developed a strategy wherein they concentrated primarily on the central task during the early period of each trial, and shifted their attention to the peripheral task during the closing seconds, and thus succeeded in passing tests at relatively high BAC. Certainly, it is likely that if the device were actually employed as a drinking-driving countermeasure, knowledge of its design characteristics would become available and its effectiveness would be seriously degraded.

Thus, before any further testing is initiated, the design should be modified so that both task components are active throughout the entire trial. This modification undoubtedly would permit trial duration to be shortened, perhaps to 12 or 15 seconds. This, in turn, might help to diminish any confounding effects of fatigue on Subjects' performance.

3. The conduct of a larger-scale controlled drinking experiment.

All previous experiments have employed relatively small and homogeneous Subject populations. As a result, the "optimum" criteria derived for these devices might not be generalizable to the total drinking-driving population. Further, the DAT device might prove to be more (or less) effective when applied to certain segments of this population not represented in previous experiments.

Accordingly, it is recommended that a relatively large-scale laboratory experiment be conducted, once a DAT device has been selected and modified as suggested above. This experiment should employ approximately 100-200 Subjects, chosen to provide adequate representation of (at least) the age-sex distribution of the total drinking-driving population. The experiment would seek to determine the validity of previous findings, and additionally would ascertain the significance of any effects on performance attributible to age, sex, or other demographic variables. Finally, the recommended experiment would be expected to permit identification of the most appropriate criterion and scoring strategy for the device.

4. Implementation of DAT Field Tests

Results of laboratory experiments perhaps provide an "idealistic" view of DAT effectiveness. The device tested is maintained in a controlled and carefully supervised environment, and so undoubtedly is less susceptible to malfunctions than it would be if installed and operated in motor vehicles. Laboratory Subjects tend to maintain a positive attitude toward the device, both because it represents a source of income and because a test failure does not result in a loss of transportation. Were they actually exposed to instances where the device thwarted their travel plans, their attitutde undoubtedly would change and attempts to tamper with the instrument almost certainly would occur.

Simply stated, there are numerous factors that could affect ASIS effectiveness which cannot be tested in the laboratory. Evaluation of such factors requires field testing. Dunlap and Associates, Inc., recommends that a three-stage field test be implemented:

Stage 1--the DAT device would be installed in a fleet of vehicles assigned to volunteer drivers for their personal transportation needs. The primary purpose of Stage 1 would be to evaluate the electro-mechanical reliability of the device under field use conditions. Provision would be made to encourage use of the test vehicles by the volunteers (e.g., by defraying the cost of gasoline, etc.) to maximize the in-service time of the DAT devices. Volunteers participating in Stage 1 would be light to moderate drinkers since, at this stage of experimentation, it would be neither necessary nor advisable to entrust "unproven" ASIS devices to individuals likely to commit drinking-driving offenses.

Stage 1 should be designed to provide approximately 100 vehicle-months of operation to ensure adequate evaluation of DAT reliability. A fleet of 25 test vehicles and a four month experimental period should prove sufficient.

Stage 2--the test vehicles employed in Stage 1 would be assigned to volunteer Subjects satisfying the "heavy drinker" criterion employed in this and previous laboratory tests. The primary purposes of Stage 2 would be to evaluate the field effectiveness (intoxication detection rates) of the devices and to measure user attitude. A breath testing device would be installed in the vehicles, along with appropriate data recording instrumentation, so that a BAC measurement will be associated with each DAT test. At regular intervals throughout the Stage 2 experiment the data records would be accessed, test vehicles and DAT devices inspected, and users' attitude measured.

Stage 2 should be designed to provide approximately 150 vehicle-months of operation. Two groups of 25 volunteers might participate, with each assigned to a test vehicle for a three month period.

Stage 3--in the final stage of field testing, DAT-equipped vehicles would be offered to convicted drinking-drivers as a condition for license reinstatement/retention. Implementation of this stage would require the consent and cooperation of courts and licensing agencies. The purposes of Stage 3 essentially would be identical to those of Stage 2. In this case, however, testing conditions would be totally representative of the application of ASIS as a drinking-driving countermeasure.

A field test similar to Stages 1 and 2 described above previously was conducted for a breath-test ASIS (Jacobs and Oates, 1973). The experience gained in that effort should facilitate implementation of the recommended field test.

DUNLAP and ASSOCIATES, INC.

EXECUTIVE OFFICES

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8 January 1976

Dr. Anne W. Story
Contract Technical Manager
U.S. Department of Transportation
Transportation Systems Center
TIF
Kendall Square
Cambridge, Massachusetts 02142

Reference: Contract No. DOT-TSC-857

Dear Anne:

Enclosed please find one reproducible plus six (6) copies of the Report Laboratory Testing of Alcohol Safety Interlock Systems Employing Divided Attention Tests. This Report documents results of the testing of the DAT-2 and DAT-3 conducted during September 1975.

This is the third and final report required under the referenced contract. Previous reports (submitted during November and December, 1975) dealt with testing of the DAT-1 and CTT.

Dunlap and Associates, Inc., has been pleased to participate in this program and looks forward to assisting TSC in future research efforts.

Sincerely,

Jack

John F. Oates, Jr.
Project Director

njt

Enclosures

REFERENCES

Oates, J. and McCay, R., Experimental Evaluation of Alcohol Safety Interlock Systems; 1972.

Jacobs, H. and Oates, J., Final Report for Alcohol Safety Interlock System Field Test; 1973.

Oates, J., Preusser, D., Blomberg, R., and Orban, M., Laboratory Testing of Alcohol Safety Interlock Systems; 1975.

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APPENDIX A

TRAINING DATA FOR INDIVIDUAL SUBJECTS

This Appendix presents training data for each of the 14 Subjects. The data are arrayed by "moving average series number".

Table A-1. Mean Central Training Scores on DAT-2

Series Number	Subjects 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	33.39	42.67	37.67	47.89	64.94	35.61	28.33	43.06	39.28	30.22	34.61	31.61	31.83	35.50
2	32.72	40.05	36.56	43.61	63.06	34.22	28.06	40.67	37.88	29.33	33.28	30.39	30.50	34.11
3	31.95	38.16	35.94	41.61	57.61	32.11	27.72	38.50	33.44	29.11	32.61	31.50	30.06	32.83
4	31.61	37.61	34.66	37.39	53.50	32.11	28.06	36.94	32.89	29.39	32.05	31.83	30.00	32.06
5	30.56	37.83	34.50	39.00	50.83	32.06	27.39	33.33	31.34	28.94	32.28	32.05	30.22	31.11
6	30.22	37.28	32.11	40.67	46.56	32.00	28.11	33.11	30.50	27.94	31.22	30.50	28.44	31.72
7	30.06	35.78	30.94	39.78	41.84	30.67	27.83	31.67	29.34	27.05	30.61	30.33	27.56	31.22
8	30.11	35.06	29.83	35.28	38.00	29.33	27.83	31.33	29.00	26.61	29.33	30.22	27.61	30.78
9	29.56	33.72	29.00	34.72	39.39	29.72	27.50	29.50	29.22	26.61	29.61	30.06	27.83	31.55
10	29.61	32.89	28.11	34.50	37.00	29.72	27.72	29.33	29.11	27.44	28.34	29.78	27.50	31.55
11	29.06	31.84	27.39	35.06	36.78	30.33	27.94	29.83	27.61	27.22	29.34	30.22	26.33	31.72
12	27.95	31.95	27.33	33.95	34.06	30.67	27.28	31.28	27.17	27.22	28.84	29.61	25.67	30.39
13	27.06	32.33	27.28	33.61	35.50	30.67	26.00	31.89	26.72	26.72	29.50	29.72	26.11	29.61
14	26.67	31.94	27.56	35.89	34.50	30.33	26.17	33.83	27.22	26.67	29.11	28.78	26.56	29.89
15	26.83	32.05	28.00	34.95	35.94	30.33	26.61	32.39	27.00	26.39	29.89	28.39	26.45	29.61
16	26.67	31.44	27.33	35.39	34.61	30.28	26.45	30.78	26.83	26.28	30.56	27.78	25.45	29.11
17	26.56	31.55	26.83	33.17	33.05	30.39	25.22	28.22	26.38	25.95	29.78	27.56	24.22	28.39
18	25.56	30.83	25.89	32.72	30.83	28.50	23.83	26.61	25.78	25.89	28.84	27.00	23.22	27.78
19	23.95	31.06	25.89	31.33	31.72	28.56	23.11	26.78	25.28	25.44	27.50	26.89	23.06	27.83
20	23.56	30.95	25.89	31.05	31.44	28.11	22.61	26.56	25.33	24.94	27.61	26.50	23.56	27.56
21	23.78	31.50	25.28	31.39	32.50	29.22	22.89	26.83	25.39	24.78	27.72	26.83	24.00	28.28
22	24.22	30.33	24.67	30.83	32.00	29.72	23.50	27.11	25.28	25.17	27.78	26.56	23.83	29.00
23	24.33	29.44	24.06	30.33	31.33	30.05	23.67	26.55	26.06	25.28	27.28	27.11	24.22	30.05
24	23.72	29.22	24.72	29.17	31.06	29.67	23.39	26.22	27.11	24.94	27.17	26.89	24.89	29.50
25	23.39	29.33	25.61	29.33	33.78	29.72	23.17	25.72	26.94	24.00	27.67	26.83	25.33	29.44

Table A-2. Mean Peripheral Training Scores on DAT-2

Series Number	Subjects 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	73.11	77.89	71.39	75.17	87.11	76.45	74.61	74.67	64.83	74.89	77.50	82.45	73.44	74.17
2	72.89	76.94	70.33	73.89	86.28	75.89	73.95	72.06	65.89	73.39	76.05	80.61	71.17	74.67
3	72.89	77.67	71.17	72.28	87.61	74.22	74.28	71.94	66.50	73.95	76.50	79.34	70.22	74.22
4	72.89	77.83	71.28	70.89	86.67	74.89	73.72	74.50	67.78	75.11	75.78	77.84	70.22	74.50
5	73.00	77.94	73.28	71.22	85.22	75.06	74.11	74.50	67.55	75.00	75.06	76.95	70.89	73.89
6	72.61	78.72	72.72	73.00	82.00	73.89	73.72	74.16	67.94	73.22	72.94	76.33	70.50	75.00
7	71.49	78.78	72.50	72.33	78.61	72.78	72.89	73.66	66.83	72.17	71.89	75.83	69.83	73.84
8	68.82	76.72	72.33	72.44	77.44	70.56	71.33	72.11	65.06	73.06	71.67	74.67	68.72	72.11
9	68.32	75.00	72.39	72.78	75.94	69.67	69.56	73.11	64.50	75.00	72.67	75.45	68.78	70.67
10	68.00	73.61	73.44	74.56	75.78	69.33	69.56	73.33	64.89	75.00	72.33	75.39	68.56	71.67
11	68.83	75.50	72.00	72.33	75.28	69.61	70.11	75.17	65.22	74.72	72.61	76.33	68.61	72.17
12	69.39	75.55	70.89	71.06	76.06	71.00	71.28	77.33	65.05	73.89	72.33	76.11	68.61	73.89
13	70.05	75.00	68.78	69.39	77.00	70.50	72.11	77.11	64.67	74.72	72.00	76.17	68.78	73.89
14	71.16	74.33	67.61	70.78	76.72	70.61	72.00	78.66	65.22	74.89	71.44	76.28	69.06	74.67
15	70.94	74.45	67.72	70.89	76.11	70.33	71.44	76.78	65.45	75.67	72.28	76.11	69.94	73.67
16	70.05	73.28	68.22	71.22	75.89	69.78	70.17	78.44	65.95	75.61	72.78	76.17	69.28	73.50
17	68.17	71.95	67.78	69.67	76.61	68.72	69.33	78.22	65.61	74.94	73.22	75.78	68.83	71.39
18	66.95	70.17	66.06	67.95	77.11	67.61	68.83	77.22	63.84	76.33	71.72	75.11	67.22	70.56
19	66.56	70.89	64.33	66.56	76.39	67.50	68.89	75.28	62.67	75.06	71.11	74.11	66.89	70.39
20	67.56	72.22	64.22	66.78	77.89	67.56	67.72	74.50	61.95	74.50	70.22	73.44	66.95	71.11
21	67.45	72.22	65.11	67.11	79.22	67.45	67.11	74.33	62.89	71.72	69.72	74.00	67.50	72.06
22	67.17	71.44	65.00	68.22	80.39	68.00	67.56	75.72	63.22	72.06	70.00	73.61	67.67	71.50
23	66.89	70.17	65.67	68.50	78.72	68.50	69.28	75.22	63.22	71.95	70.50	73.61	66.84	71.78
24	67.28	70.06	65.83	68.44	79.67	68.33	70.34	76.11	63.28	72.95	70.33	73.83	68.67	71.17
25	67.94	70.67	67.05	68.00	79.39	70.67	70.11	74.16	62.50	72.95	69.72	75.00	68.89	71.06

Table A-3. Mean Central Training Scores on DAT-3

Series Number	Subjects 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	29.22	36.00	31.67	42.33	62.06	36.50	27.78	37.78	34.17	26.28	32.05	34.39	31.39	35.44
2	28.62	32.22	28.95	42.83	62.45	34.56	27.33	35.34	32.05	25.56	31.28	33.56	29.33	33.94
3	27.61	32.11	27.72	41.89	55.78	33.22	27.00	34.11	30.44	24.89	33.17	32.45	28.39	33.66
4	26.78	30.83	26.50	41.56	52.45	31.72	26.33	31.89	27.33	24.78	34.06	31.56	28.39	33.39
5	26.83	30.39	25.94	41.17	49.11	30.28	25.78	30.83	26.22	25.06	34.56	32.50	28.33	32.83
6	26.89	30.44	26.11	41.22	47.28	29.89	26.61	29.89	25.67	24.78	32.33	32.78	28.83	31.89
7	27.11	29.72	25.78	39.89	43.17	29.44	26.72	28.22	25.39	23.94	30.33	31.83	28.06	31.11
8	26.28	29.95	25.05	38.94	37.50	28.61	27.17	27.22	25.33	22.83	28.83	29.72	26.72	30.17
9	25.05	29.00	24.00	36.61	36.78	29.11	26.28	26.00	24.33	22.72	27.94	29.00	25.78	29.22
10	24.72	29.28	23.28	35.55	37.39	30.06	25.95	26.33	24.33	23.06	27.83	29.00	24.56	29.89
11	24.55	28.22	22.94	32.50	37.22	30.95	25.72	26.06	23.61	23.56	28.50	29.56	24.22	30.00
12	24.72	27.50	22.28	33.55	36.67	32.06	25.83	27.78	23.50	23.11	28.83	28.72	23.28	29.34
13	24.72	27.78	22.50	32.94	36.61	31.17	26.28	28.00	23.28	23.39	29.05	29.00	23.33	27.72
14	24.94	28.33	22.39	34.39	35.33	29.72	25.50	28.11	22.89	23.11	28.22	29.05	23.61	26.94
15	25.17	28.94	23.28	33.83	36.22	29.11	25.22	28.33	22.83	23.89	27.89	29.72	23.67	27.55
16	24.72	28.39	23.00	34.94	34.83	29.45	25.17	28.11	22.06	23.28	27.72	28.66	23.39	28.00
17	23.95	27.72	22.11	34.72	34.89	30.45	24.67	27.50	21.67	22.72	27.28	28.00	22.55	28.11
18	22.67	26.78	20.94	33.89	32.17	29.06	23.50	25.28	21.61	21.95	27.17	27.05	21.83	27.84
19	21.83	25.83	20.33	31.78	31.50	28.78	21.78	24.61	21.61	22.39	26.95	27.28	21.55	27.39
20	21.17	25.72	20.72	30.11	32.28	28.61	21.06	24.78	22.89	22.05	27.67	26.94	21.72	27.33
21	21.67	25.89	20.78	30.39	32.89	29.00	20.94	24.50	23.50	22.44	27.50	27.05	21.67	27.61
22	21.06	26.11	20.61	31.00	34.00	29.11	20.61	24.67	24.56	21.89	27.22	27.05	21.17	28.00
23	21.06	25.72	20.33	32.33	34.11	28.67	20.50	24.39	23.89	22.56	26.05	27.50	21.28	27.33
24	20.67	25.56	20.44	31.72	34.83	28.11	20.50	24.33	23.50	22.17	25.39	27.89	21.39	26.94
25	21.39	25.45	20.33	32.17	33.44	29.11	20.72	24.17	23.39	22.00	25.33	27.50	21.89	26.50

Table A-4. Mean Peripheral Training Scores on DAT-3

Series Number	Subjects 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	84.33	83.55	78.78	75.28	95.16	88.17	82.56	86.39	75.95	83.00	81.34	88.11	77.94	85.95
2	85.11	82.72	78.06	75.83	96.39	85.78	81.17	84.61	75.39	82.45	80.50	88.61	77.39	86.06
3	85.50	81.89	78.00	76.56	98.50	84.94	80.83	85.11	76.61	81.72	79.78	89.06	76.56	86.33
4	85.28	82.78	78.17	77.17	99.11	83.11	79.55	84.39	77.61	81.83	80.06	89.28	76.78	86.00
5	83.94	83.33	78.94	77.39	98.72	84.61	79.44	86.28	77.61	81.83	81.28	87.22	77.05	85.33
6	82.44	83.95	79.50	78.78	97.33	83.50	78.94	84.39	76.22	81.28	81.44	85.83	78.28	85.39
7	79.83	83.11	77.89	78.72	94.50	82.05	78.33	83.61	74.50	80.06	80.44	83.11	78.33	84.33
8	78.72	81.78	77.06	79.28	90.95	80.28	76.94	80.78	73.45	79.17	78.11	82.78	78.44	84.56
9	77.89	80.17	76.06	78.67	87.67	79.83	75.50	81.56	72.95	79.72	77.22	81.06	77.67	83.33
10	77.83	79.33	76.28	79.44	88.34	80.50	75.17	81.06	73.22	80.39	76.83	81.06	77.44	82.06
11	78.17	80.17	76.28	78.28	88.11	82.44	76.17	81.39	73.28	81.00	76.94	80.22	76.83	81.11
12	78.22	80.33	75.00	78.00	89.00	82.78	78.06	81.39	72.89	80.11	77.61	81.11	76.72	81.89
13	79.05	80.94	74.50	77.55	88.39	82.94	79.06	81.11	72.67	80.50	78.33	82.28	76.05	83.22
14	79.11	80.78	73.83	76.28	88.66	81.28	77.83	80.83	73.06	79.72	79.55	83.06	75.66	83.93
15	79.56	80.78	74.05	75.33	87.61	82.83	76.67	81.28	73.33	79.67	79.17	83.56	75.83	82.8?
16	78.50	80.06	73.39	74.78	88.44	82.44	75.44	82.28	73.17	79.28	78.94	81.72	75.50	82.78
17	77.61	79.50	72.22	75.39	89.78	81.28	74.56	82.78	72.89	80.39	77.50	81.50	75.55	81.28
18	76.22	77.78	70.61	73.78	90.61	79.50	73.83	83.06	72.34	81.50	77.50	81.28	75.50	81.17
19	76.17	77.78	70.33	72.89	91.39	78.44	73.39	83.22	71.45	81.50	76.28	81.56	75.56	81.06
20	76.44	77.22	71.22	71.94	91.95	78.89	73.83	83.61	70.56	80.00	76.56	81.22	76.06	82.11
21	76.83	78.22	72.06	73.17	92.45	78.56	73.93	83.28	70.28	79.72	75.94	80.11	75.83	81.67
22	76.72	78.78	71.33	73.61	92.67	78.61	74.28	82.67	71.22	79.94	76.78	80.45	75.93	81.11
23	76.22	78.83	70.72	74.67	91.39	80.28	74.67	82.17	71.39	81.78	76.78	80.45	75.11	80.39
24	76.67	78.89	70.78	74.06	93.00	80.72	75.00	81.33	71.67	82.83	77.17	80.17	74.50	80.39
25	76.89	78.72	71.11	73.95	94.72	82.72	74.28	82.22	70.72	82.78	77.00	81.17	74.50	81.89

ERROR DISTRIBUTIONS

SUBJECT NO. 1

N.	JAT-2 ZERO	JAT-2 ONE	JAT-2 TWO	JAT-2 THREE	JAT-2 FOUR+	JAT-3 ZERO	JAT-3 ONE	JAT-3 TWO	JAT-3 THREE	JAT-3 FOUR+
1	2	8	5	3	0	1	3	11	2	1
2	4	7	6	2	0	1	5	7	4	1
3	4	8	4	2	0	1	4	8	4	1
4	5	5	5	3	0	1	4	7	5	1
5	5	5	4	3	1	2	5	7	4	0
6	4	4	5	3	2	2	5	5	5	1
7	2	8	3	3	2	2	7	5	3	1
8	1	8	3	3	1	2	6	6	3	0
9	3	8	3	3	0	2	5	5	4	0
10	4	5	3	3	0	2	5	4	3	1
11	5	6	4	3	0	3	4	3	2	1
12	7	5	4	3	0	3	5	4	2	1
13	9	5	3	1	0	4	6	4	1	1
14	9	5	2	1	1	5	4	5	1	1
15	9	6	2	0	1	5	5	4	1	2
16	7	5	2	0	1	5	6	4	2	1
17	7	5	3	0	0	5	5	4	2	2
18	8	5	2	0	0	6	5	3	2	2
19	11	5	1	1	0	6	4	4	2	2
20	11	3	2	1	1	6	6	4	1	1
21	8	3	2	1	1	5	5	5	3	1
22	**6**	**3**	**7**	**1**	**1**	**4**	**9**	**3**	**2**	**0**
23	7	3	5	1	0	4	6	4	2	0
24	10	4	3	1	0	5	10	3	0	0
25	8	7	3	0	0	5	7	5	0	0

ERROR DISTRIBUTIONS

SUBJECT NO. 2

N.	DAT-2 ZERO	ONE	TWO	THREE	FOUR+	DAT-3 ZERO	ONE	TWO	THREE	FOUR+
1	11	4	2	1	0	7	7	4	0	0
2	10	6	1	1	0	6	8	4	0	0
3	7	10	1	0	0	5	8	5	0	0
4	6	10	1	0	1	9	5	4	0	0
5	7	8	2	0	1	10	5	2	0	0
6	9	6	2	0	1	13	2	1	1	0
7	12	4	2	0	0	14	2	1	1	0
8	13	3	2	0	0	10	5	2	1	0
9	12	4	2	0	0	8	6	4	0	0
10	12	5	1	0	0	7	7	4	0	0
11	10	7	1	0	0	11	4	3	0	0
12	10	6	2	0	0	11	6	1	0	0
13	8	8	2	0	0	10	6	4	0	0
14	9	8	1	0	0	10	8	0	0	0
15	9	8	1	0	0	11	7	0	0	0
16	10	6	1	1	0	13	5	0	0	0
17	12	4	1	1	0	13	5	0	0	0
18	14	3	0	1	0	14	4	0	0	0
19	14	4	0	0	0	11	7	0	0	0
20	13	5	0	0	0	12	6	0	0	0
21	13	5	0	0	0	12	6	0	0	0
22	13	5	0	0	0	15	3	0	0	0
23	12	5	1	0	0	14	3	1	0	0
24	12	5	1	0	0	14	3	1	0	0
25	10	5	2	1	0	13	3	2	0	0

ERROR DISTRIBUTIONS

SUBJECT NO. 3

N.	DAT-2 ZERO	ONE	TWO	THREE	FOUR+		DAT-3 ZERO	ONE	TWO	THREE	FOUR+
1	7	5	4	1	1	:	3	7	6	1	1
2	7	6	3	1	1	:	2	9	5	1	1
3	4	11	2	1	0	:	3	8	5	2	0
4	2	14	2	0	2	:	3	6	7	2	0
5	3	10	3	2	2	:	3	7	7	1	0
6	4	7	5	2	2	:	3	6	8	1	0
7	5	8	3	2	2	:	4	7	6	1	0
8	5	11	2	0	2	:	7	7	6	1	0
9	7	11	0	0	0	:	8	6	4	0	0
10	7	10	1	0	0	:	12	4	5	0	0
11	10	7	1	0	0	:	11	5	3	0	0
12	10	7	1	0	0	:	8	8	2	0	0
13	**12**	**5**	**1**	**0**	**0**	**:**	**4**	**12**	**2**	**0**	**0**
14	10	6	2	0	0	:	6	11	1	0	0
15	10	4	3	1	0	:	9	3	5	1	0
16	8	4	3	2	1	:	10	4	3	2	0
17	7	6	2	2	1	:	9	3	4	1	0
18	8	6	1	2	1	:	7	6	4	1	0
19	12	5	0	1	0	:	8	7	2	1	0
20	13	4	0	1	0	:	8	7	2	1	0
21	13	5	0	0	0	:	9	6	2	1	0
22	11	7	0	0	0	:	10	6	1	1	0
23	9	9	0	0	0	:	10	8	0	0	0
24	8	9	1	0	0	:	10	8	0	0	0
25	8	7	2	1	0	:	9	9	0	0	0

ERROR DISTRIBUTIONS

SUBJECT NO. 4

N.	DAT-2 ZERO	ONE	TWO	THREE	FOUR+		DAT-3 ZERO	ONE	TWO	THREE	FOUR+
1	0	5	9	3	1	:	0	9	6	3	6
2	1	5	9	3	0	:	0	9	6	3	0
3	1	8	6	3	0	:	1	8	8	1	0
4	1	10	8	1	0	:	2	8	7	1	0
5	3	10	8	0	0	:	3	7	5	2	0
6	4	11	8	0	0	:	3	9	4	0	0
7	5	9	4	0	0	:	5	9	2	0	0
8	5	8	5	0	0	:	5	9	2	1	1
9	7	5	5	1	0	:	5	8	3	1	1
10	9	5	3	1	0	:	5	7	4	1	1
11	8	4	5	1	0	:	7	5	6	0	0
12	6	7	5	0	0	:	8	4	4	2	0
13	5	8	7	0	0	:	7	4	5	2	0
14	5	8	5	0	0	:	5	5	6	2	0
15	5	9	4	1	0	:	5	5	7	1	0
16	4	10	3	1	0	:	5	5	7	1	0
17	6	8	2	0	0	:	5	8	3	0	0
18	7	7	3	1	0	:	5	9	3	1	0
19	10	3	4	1	0	:	4	12	1	1	0
20	10	2	5	0	0	:	4	10	3	0	1
21	12	2	4	0	0	:	3	11	3	0	1
22	12	3	2	1	0	:	6	7	4	0	1
23	11	3	2	1	1	:	6	7	3	0	0
24	10	5	1	1	1	:	11	4	3	0	0
25	10	6	1	0	1	:	9	5	4	0	0

ERROR DISTRIBUTIONS

SUBJECT NO. 5

N.	DAT-2 ZERO	ONE	TWO	THREE	FOUR+	DAT-3 ZERO	ONE	TWO	THREE	FOUR+
1	2	7	5	1	0	1	4	7	4	2
2	1	5	8	4	0	0	3	6	4	3
3	1	6	7	4	0	0	2	6	7	0
4	1	6	7	2	1	0	1	4	2	11
5	1	5	7	1	6	0	0	2	2	14
6	1	4	8	4	6	0	1	2	0	12
7	0	5	7	3	6	0	0	2	3	9
8	0	6	7	4	1	0	0	3	0	6
9	0	5	7	4	2	1	0	3	1	7
10	0	6	8	4	2	1	1	2	1	9
11	0	6	4	6	3	2	0	2	1	7
12	1	7	4	4	2	1	0	2	0	6
13	0	7	7	3	2	1	0	2	1	5
14	0	6	10	3	2	1	1	2	1	7
15	0	2	11	1	4	1	1	2	0	9
16	0	3	6	2	3	2	0	3	0	8
17	3	7	7	2	2	1	4	2	0	6
18	4	9	1	4	3	1	4	4	0	4
19	4	8	2	4	3	0	4	4	0	4
20	3	6	5	4	3	0	4	4	0	5
21	4	4	7	3	3	0	5	4	0	3
22	3	5	8	2	3	0	7	5	0	3
23	4	6	7	1	3	0	8	5	0	2
24	2	6	7	2	3	0	7	5	0	4
25	1	5	5	3	4	0	4	6	0	5

ERROR DISTRIBUTIONS

SUBJECT NO. 6

N.	DAT-2 ZERO	DAT-2 ONE	DAT-2 TWO	DAT-2 THREE	DAT-2 FOUR+	DAT-3 ZERO	DAT-3 ONE	DAT-3 TWO	DAT-3 THREE	DAT-3 FOUR+
1	6	8	0	1	0	5	10	2	1	0
2	7	9	2	0	0	4	12	1	1	0
3	8	9	1	0	0	5	13	0	0	0
4	9	8	1	0	0	5	13	0	0	0
5	10	7	1	0	0	7	10	1	0	0
6	8	10	0	0	0	9	6	3	0	0
7	7	11	0	0	0	10	4	4	0	0
8	7	11	0	0	0	9	6	3	0	0
9	10	7	1	0	0	7	10	1	0	0
10	10	7	1	0	0	7	8	1	0	1
11	10	6	2	0	0	6	8	3	0	1
12	9	7	2	0	0	5	7	5	0	1
13	7	9	2	0	0	6	6	5	1	0
14	8	9	1	0	0	7	6	4	1	0
15	6	10	2	0	0	7	4	5	2	0
16	8	8	2	0	0	8	5	4	1	0
17	7	8	3	0	0	8	5	3	1	1
18	8	9	1	0	0	8	7	1	1	1
19	8	8	2	0	0	6	8	2	1	1
20	8	9	1	0	0	6	9	2	1	0
21	8	7	3	0	0	10	7	1	0	0
22	9	8	2	0	0	9	6	3	0	0
23	4	8	6	0	0	10	5	3	0	0
24	4	10	4	0	0	8	6	4	0	0
25	5	9	3	2	0	10	5	3	0	0

ERROR DISTRIBUTIONS

SUBJECT NO. 7

	DAT-2					DAT-3				
N.	ZERO	ONE	TWO	THREE	FOUR+	ZERO	ONE	TWO	THREE	FOUR+
1	7	9	1	1	0	8	7	2	0	1
2	4	10	3	1	0	10	6	1	0	1
3	4	9	4	1	0	8	8	2	0	0
4	6	6	4	1	1	7	6	4	1	0
5	10	3	8	1	1	6	5	6	1	0
6	9	4	8	1	1	8	5	4	1	0
7	10	6	2	0	0	7	5	6	0	0
8	6	8	4	0	0	8	5	5	0	0
9	5	8	4	1	0	9	4	5	0	0
10	4	8	5	1	0	9	6	3	0	0
11	4	9	2	3	0	6	7	5	0	2
12	4	10	2	2	0	7	7	5	1	0
13	6	7	8	0	0	7	5	5	1	0
14	7	7	4	0	0	8	7	2	1	0
15	9	5	4	0	0	8	8	2	0	0
16	5	8	5	0	0	7	7	3	1	0
17	4	7	5	0	0	5	8	4	1	0
18	3	6	6	3	0	5	8	4	1	0
19	8	4	3	3	0	5	10	2	1	0
20	12	3	2	1	0	10	5	2	1	0
21	12	5	1	0	0	10	5	2	1	0
22	10	7	1	0	0	12	5	1	0	0
23	9	7	1	0	1	12	5	1	0	0
24	10	7	0	0	1	11	4	3	0	0
25	10	5	2	0	1	11	3	4	0	0

ERROR DISTRIBUTIONS

SUBJECT NO. 8

N.	DAT-2 ZERO	ONE	TWO	THREE	FOUR+	DAT-3 ZERO	ONE	TWO	THREE	FOUR+
1	0	9	6	3	2	1	6	8	2	1
2	1	7	6	3	1	2	4	10	2	0
3	4	7	4	2	1	2	4	8	4	0
4	4	4	6	3	1	4	3	4	3	0
5	3	7	4	4	0	3	6	3	6	0
6	1	9	4	4	0	4	6	5	3	0
7	4	10	2	0	0	4	7	5	2	0
8	6	9	3	0	0	6	6	4	2	0
9	9	6	2	0	0	6	5	3	3	1
10	8	7	2	0	0	6	4	4	2	1
11	10	5	2	1	0	5	5	3	3	1
12	7	5	3	3	0	4	7	4	3	0
13	6	5	3	4	0	3	8	4	3	0
14	3	6	3	4	0	1	8	6	3	0
15	5	2	1	2	2	2	7	4	3	0
16	8	7	0	1	0	3	7	4	2	0
17	12	6	0	0	0	5	8	2	1	0
18	13	5	0	0	0	7	8	2	1	0
19	14	4	0	0	0	6	8	1	2	1
20	10	6	1	1	0	5	7	3	4	0
21	7	8	2	1	0	5	7	3	3	0
22	4	9	4	1	0	4	7	2	3	1
23	6	8	4	0	0	4	7	3	1	1
24	8	6	3	1	0	3	7	3	1	0
25	8	7	2	1	0	3	7	3	1	0

ERROR DISTRIBUTIONS

SUBJECT NO. 9

	DAT-2					DAT-3				
N.	ZERO	ONE	TWO	THREE	FOUR+	ZERO	ONE	TWO	THREE	FOUR+
1	1	6	0	2	1	1	7	7	2	1
2	1	6	7	1	0	1	10	5	2	0
3	1	8	5	1	0	2	8	6	2	0
4	4	8	4	0	0	5	7	5	1	0
5	6	9	0	0	0	9	5	3	1	0
6	8	8	2	0	0	11	5	2	0	0
7	9	8	1	0	0	10	6	1	1	0
8	11	7	0	0	0	11	5	1	1	0
9	11	7	0	0	0	11	6	0	1	0
10	10	6	1	1	0	10	8	0	0	0
11	7	8	2	1	0	7	11	0	0	0
12	7	6	3	2	0	7	9	2	0	0
13	6	8	2	2	0	9	6	3	0	0
14	9	5	1	2	0	10	8	0	0	0
15	10	5	1	2	0	12	2	4	0	0
16	11	5	1	1	0	9	5	4	0	0
17	12	5	1	0	0	10	5	3	0	0
18	10	7	1	0	0	6	10	2	0	0
19	9	7	2	0	0	7	9	2	0	0
20	7	7	4	0	0	6	9	3	0	0
21	9	6	3	0	0	6	6	5	0	1
22	10	4	4	0	0	8	5	4	0	1
23	10	5	3	0	0	9	6	3	0	1
24	9	4	4	1	0	11	5	3	0	0
25	8	7	2	1	0	7	4	3	2	2

ERROR DISTRIBUTIONS

SUBJECT NO. 10

	DAT-2					DAT-3				
N.	ZERO	ONE	TWO	THREE	FOUR+	ZERO	ONE	TWO	THREE	FOUR+
1	6	9	3	0	0	2	5	6	4	1
2	7	7	4	0	0	3	6	4	4	1
3	6	7	4	0	1	1	5	9	3	0
4	4	6	5	0	2	1	4	8	2	1
5	3	7	6	0	2	1	3	7	1	1
6	4	8	5	0	1	1	6	4	0	1
7	6	7	4	1	0	1	8	4	0	1
8	9	5	3	1	0	1	10	2	1	1
9	9	5	3	1	0	1	9	1	1	1
10	10	6	2	0	0	1	8	1	2	1
11	9	7	2	0	0	1	7	3	2	1
12	9	8	1	0	0	1	7	5	2	1
13	8	6	4	0	0	1	6	6	1	0
14	11	4	3	0	0	1	7	6	0	0
15	14	1	3	0	0	1	8	4	1	0
16	12	4	2	0	0	1	6	5	1	0
17	11	4	3	0	0	1	6	5	1	0
18	10	5	2	0	0	1	5	7	0	0
19	14	3	1	0	0	1	7	6	0	0
20	14	3	1	0	0	1	8	5	0	0
21	13	3	2	0	0	1	7	6	0	0
22	12	4	2	0	0	1	7	5	2	0
23	11	6	1	0	0	1	6	5	2	0
24	10	8	0	0	0	1	7	5	2	0
25	8	10	0	0	0	1	7	7	1	0

ERROR DISTRIBUTIONS

SUBJECT NO. 11

	DAT-2					DAT-3				
N.	ZERO	ONE	TWO	THREE	FOUR+	ZERO	ONE	TWO	THREE	FOUR+
1	3	10	9	2	0	5	5	8	8	0
2	6	7	4	1	0	6	7	5	0	0
3	5	7	3	2	1	5	7	6	0	0
4	7	7	2	1	1	5	10	3	0	0
5	6	7	3	1	1	3	11	4	0	0
6	8	6	4	0	0	8	8	2	0	0
7	10	5	3	0	0	10	6	2	0	0
8	10	7	1	0	0	11	6	1	0	0
9	8	8	0	2	0	11	6	1	0	0
10	8	7	0	3	0	11	6	1	0	0
11	10	5	0	3	0	14	2	1	1	0
12	11	5	1	1	0	12	5	0	1	0
13	11	6	1	0	0	12	5	0	1	0
14	12	5	1	0	0	10	6	2	0	0
15	14	4	0	0	0	9	6	3	0	0
16	13	5	0	0	0	8	7	3	0	0
17	14	4	0	0	0	8	8	2	0	0
18	14	3	1	0	0	9	5	4	0	0
19	16	1	1	0	0	12	2	4	0	0
20	15	2	1	0	0	12	3	3	0	0
21	15	3	0	0	0	13	5	0	0	0
22	14	4	0	0	0	10	7	1	0	0
23	12	6	0	0	0	12	5	1	0	0
24	11	7	0	0	0	12	5	1	0	0
25	11	7	0	0	0	12	5	1	0	0

ERROR DISTRIBUTIONS

SUBJECT NO. 12

N.	DAT-2 ZERO	ONE	TWO	THREE	FOUR+	DAT-3 ZERO	ONE	TWO	THREE	FOUR+
1	2	9	4	3	0	6	6	4	2	0
2	3	8	8	2	0	5	6	5	2	0
3	2	4	7	4	1	1	8	5	3	1
4	0	5	7	2	2	1	7	5	2	2
5	2	5	6	2	2	2	9	3	2	2
6	2	7	5	2	2	2	9	5	1	1
7	2	7	5	2	2	10	8	3	0	3
8	2	7	6	1	2	2	8	4	3	1
9	1	9	5	2	1	4	6	4	2	2
10	0	9	4	4	1	5	6	5	0	2
11	0	11	2	5	0	5	7	5	0	1
12	2	10	3	3	0	4	7	6	0	1
13	3	10	3	1	1	3	7	6	3	1
14	4	8	5	5	1	4	4	5	4	1
15	3	7	6	1	1	6	5	2	4	1
16	6	6	5	1	0	7	8	1	1	1
17	7	8	2	1	0	8	8	1	0	1
18	10	7	1	0	0	8	8	2	0	0
19	9	6	2	1	0	8	7	3	0	0
20	7	4	6	1	0	7	9	2	0	0
21	5	4	6	2	0	8	9	1	0	0
22	3	8	5	2	0	8	9	1	0	0
23	5	7	3	0	0	9	5	3	1	0
24	4	7	3	2	1	8	8	1	1	0
25	5	4	4	3	2	8	9	4	2	1

ERROR DISTRIBUTIONS

SUBJECT NO. 13

N.	SAT-2 ZERO	SAT-2 ONE	SAT-2 TWO	SAT-2 THREE	SAT-2 FOUR+	SAT-3 ZERO	SAT-3 ONE	SAT-3 TWO	SAT-3 THREE	SAT-3 FOUR+
1	2	6	5	3	2	5	6	2	5	0
2	4	7	4	3	0	5	8	2	3	0
3	4	7	4	2	1	7	8	3	2	0
4	7	5	4	1	1	7	7	3	1	0
5	6	6	4	1	1	9	4	4	1	0
6	2	6	4	1	0	8	5	5	2	0
7	6	7	3	2	0	7	6	3	2	0
8	8	5	3	1	1	5	8	2	2	0
9	8	6	2	1	1	5	7	3	1	0
10	7	8	2	0	1	5	8	3	0	0
11	6	8	4	0	0	8	7	0	0	0
12	5	7	5	0	1	8	8	0	0	0
13	6	6	4	1	1	9	5	3	0	1
14	4	9	3	1	1	6	7	3	0	1
15	4	10	3	1	0	5	6	6	0	1
16	4	10	4	0	0	4	7	6	1	0
17	6	7	5	0	0	5	6	6	1	0
18	9	6	3	0	0	4	7	6	1	0
19	9	4	4	0	1	4	7	7	0	0
20	9	3	4	1	1	3	7	6	2	0
21	8	3	5	1	1	3	6	7	2	0
22	8	4	4	1	1	5	6	4	2	1
23	7	6	3	0	2	6	5	4	2	1
24	6	5	2	2	3	9	5	1	2	1
25	6	5	2	3	2	10	4	2	2	0

ERROR DISTRIBUTIONS

SUBJECT NO. 14

N.	DAT-2 ZERO	DAT-2 ONE	DAT-2 TWO	DAT-2 THREE	DAT-2 FOUR+	DAT-3 ZERO	DAT-3 ONE	DAT-3 TWO	DAT-3 THREE	DAT-3 FOUR+
1	2	5	4	1	2	6	4	8	4	2
2	2	6	3	0	4	1	5	5	5	7
3	2	7	5	1	3	1	6	3	3	6
4	2	6	5	2	3	1	4	4	3	6
5	1	7	6	1	3	1	3	4	3	7
6	**2**	**8**	**5**	**1**	**2**	**1**	**2**	**6**	**5**	**4**
7	3	9	4	0	1	2	6	4	3	2
8	4	8	3	1	1	3	6	5	3	1
9	4	7	3	2	2	4	7	2	4	1
10	4	8	2	2	2	4	4	4	5	1
11	5	8	2	1	1	3	5	3	5	2
12	6	8	3	1	0	3	4	7	2	2
13	6	8	2	1	0	2	5	7	1	3
14	5	8	1	1	0	2	5	7	1	3
15	5	8	2	0	0	2	7	4	1	4
16	7	8	3	0	0	3	7	3	0	4
17	9	5	4	0	0	3	7	3	2	3
18	8	6	3	0	1	3	7	3	3	2
19	7	6	4	1	1	3	9	2	3	1
20	4	7	4	2	1	3	9	3	1	0
21	5	5	3	4	0	5	7	3	0	3
22	4	8	3	3	0	5	5	5	0	3
23	5	8	2	2	1	5	6	4	0	3
24	3	9	4	1	1	5	6	7	0	2
25	5	6	4	2	1	4	6	5	1	2

APPENDIX B

TESTING DATA FOR INDIVIDUAL SUBJECTS

The tables in this Appendix present the means and standard deviations of central and peripheral scores for each of the 14 Subjects on each cycle of each session. Each computation was based on the six trials taken during each cycle.

Subjects 1 through 6 completed their three sessions in the sequence PAA, Subjects 7 through 14 in the sequence AAP. Data provided by Subjects 13 and 14 did not enter into the ANOVAs discussed in Section 3.1.

SCORE: CENTRAL

DAT-2

SESSION: 1ST ALCOHOL

1	23.500	2.510	30.833	1.329	20.500	1.517	22.667	2.160	26.833	3.817
2	26.333	1.366	26.500	0.548	28.833	2.317	30.000	1.789	35.167	3.601
3	21.500	1.517	23.000	2.449	23.333	2.503	26.000	1.789	33.667	3.670
4	27.833	3.251	31.167	7.083	31.167	3.430	31.500	1.517	38.167	3.710
5	28.000	1.549	28.000	4.195	29.000	1.265	33.000	3.633	44.167	4.997
6	24.833	2.137	25.667	1.966	27.833	0.753	29.833	2.401	32.167	3.764
7	22.000	1.789	22.333	1.862	24.000	2.449	25.833	2.639	27.167	2.137
8	23.667	1.211	22.833	0.983	24.000	0.894	25.167	1.722	26.833	1.169
9	23.333	1.211	26.000	2.280	29.000	3.033	30.167	2.229	35.667	4.676
10	22.833	1.602	22.667	1.033	23.833	1.722	25.500	2.811	28.333	2.066
11	26.667	1.366	25.333	2.251	30.167	3.189	28.667	3.266	37.000	3.464
12	25.667	1.751	25.167	2.639	25.500	1.975	27.833	3.189	26.833	3.061
13	24.333	1.751	23.667	1.862	26.500	0.548	25.667	2.733	44.000	7.623
14	35.667	12.987	26.000	2.280	27.167	2.483	30.500	3.209	31.500	3.709

SESSION: 2ND ALCOHOL

1	22.333	1.211	20.333	1.966	20.500	0.837	23.167	2.639	24.333	1.366
2	28.833	1.169	27.167	1.941	27.833	2.858	29.500	2.588	39.500	4.970
3	22.167	2.041	22.333	2.160	24.333	2.733	24.500	1.517	26.333	3.011
4	27.500	1.049	26.833	2.041	26.833	1.602	30.833	3.371	47.667	11.057
5	26.167	2.229	25.167	1.602	31.667	2.658	61.000	10.953	51.167	17.198
6	26.167	2.229	25.000	2.608	25.500	1.761	31.833	3.764	54.000	20.871
7	22.833	0.753	23.667	2.422	24.500	2.074	26.667	3.327	29.333	6.022
8	25.167	1.169	23.500	1.517	27.000	2.191	26.167	1.472	33.833	5.076
9	25.000	3.033	26.000	2.449	30.500	5.010	27.167	0.983	29.333	1.966
10	23.667	1.366	22.333	1.506	23.333	1.211	24.000	1.549	27.667	3.559
11	24.833	1.602	25.500	2.665	26.500	1.761	29.500	1.643	34.500	6.686
12	26.000	1.549	24.000	1.673	25.500	4.231	25.667	2.582	28.167	3.835
13	23.667	1.366	23.500	1.643	24.500	2.074	30.333	3.630	26.167	2.927
14	27.833	1.722	24.667	1.033	26.000	1.414	29.167	2.994	31.000	2.828

SESSION: PLACEBO

1	21.833	1.169	21.500	1.643	22.167	1.941	21.833	0.753	21.333	1.751
2	27.833	3.312	26.167	2.563	28.000	2.608	27.833	2.401	28.000	1.549
3	24.833	3.312	24.167	1.472	22.833	0.983	23.500	1.517	22.833	1.329
4	30.000	4.604	31.667	2.733	32.667	2.338	31.000	2.098	31.667	2.582
5	29.500	4.637	27.833	2.137	31.167	4.262	31.333	2.805	30.333	5.279
6	26.500	2.950	24.667	1.211	25.833	1.472	26.333	2.422	27.000	2.683
7	22.167	0.983	21.667	1.033	21.000	1.414	22.333	1.966	21.833	2.639
8	24.500	2.074	23.500	1.049	23.333	1.033	24.667	1.506	24.167	3.125
9	24.000	2.828	26.000	5.367	22.167	1.941	25.667	3.266	23.167	2.639
10	22.500	0.837	23.167	2.714	21.500	1.225	21.833	1.722	21.333	2.160
11	25.333	1.633	23.833	0.753	24.000	1.095	23.333	1.211	22.833	1.169
12	24.500	1.517	25.667	2.160	25.667	1.633	23.167	3.125	24.667	2.160
13	22.833	1.169	22.000	1.265	22.000	1.673	23.167	2.317	22.000	1.673
14	26.000	1.789	26.167	1.722	25.000	1.414	24.000	1.414	24.833	2.401

SCORE: PERIPHERAL

SESSION: 1ST ALCOHOL

DAT-2

1	66.833	2.137	65.167	0.983	65.333	4.412	69.167	5.565	73.000	2.608
2	70.667	2.805	69.500	2.588	72.000	1.265	75.167	1.722	79.000	5.477
3	62.333	3.204	67.000	2.280	67.833	2.639	66.500	3.450	76.000	3.899
4	63.667	0.816	66.500	2.665	65.667	2.582	73.833	3.061	75.333	2.733
5	75.333	6.250	74.333	5.279	73.000	2.530	77.167	2.639	81.167	9.152
6	66.000	1.095	67.833	5.913	69.167	2.714	71.000	3.950	74.667	3.327
7	66.333	1.862	65.333	1.033	70.500	1.643	70.667	1.966	72.167	3.312
8	73.000	2.000	73.500	5.357	71.167	3.656	70.333	3.983	78.000	4.282
9	65.500	3.728	62.833	2.483	65.833	1.835	69.333	2.805	70.667	3.011
10	72.833	3.061	73.833	2.137	77.000	2.449	78.500	3.450	81.333	3.266
11	66.500	1.049	70.500	2.074	72.500	3.564	75.500	1.761	83.000	5.797
12	75.500	2.950	74.500	3.271	75.833	3.869	80.000	4.858	82.500	4.183
13	66.500	3.017	67.833	3.545	68.833	3.656	73.000	3.347	86.833	7.757
14	73.000	3.406	71.333	1.966	72.333	2.338	74.167	2.714	77.667	1.966

SESSION: 2ND ALCOHOL

1	55.333	2.582	65.667	3.204	65.500	2.258	69.167	1.835	71.333	1.506
2	68.833	2.401	71.500	2.345	72.833	3.251	75.667	2.251	79.000	3.742
3	64.833	2.137	64.167	3.430	63.833	3.251	66.667	2.422	68.833	3.488
4	62.833	1.329	63.333	1.033	66.333	1.033	69.500	2.074	80.333	5.125
5	68.500	3.002	71.500	2.739	78.167	5.154	92.167	5.636	96.667	9.266
6	66.000	5.514	63.167	2.041	65.667	2.422	72.333	5.164	79.667	8.287
7	63.167	1.941	65.833	1.722	66.167	2.858	71.000	2.000	71.500	2.345
8	72.167	4.491	72.833	5.636	74.167	4.119	75.667	4.844	82.000	8.438
9	60.500	1.871	62.667	2.160	69.000	1.673	68.333	4.590	71.667	2.338
10	70.000	2.098	73.000	4.195	70.833	2.137	73.333	2.066	77.000	2.608
11	65.833	2.714	71.000	2.898	72.667	3.011	74.500	2.345	79.333	2.733
12	76.833	3.312	75.333	3.266	73.500	3.728	79.667	2.658	86.167	3.371
13	67.333	2.503	69.000	3.098	69.667	2.805	75.833	1.722	73.833	3.869
14	69.500	3.017	73.500	4.231	75.333	2.338	77.167	1.941	79.833	1.722

SESSION: PLACEBO

1	66.333	2.582	66.500	1.643	66.500	2.665	66.500	1.761	68.167	3.061
2	69.833	3.125	69.333	1.966	69.167	1.472	70.333	2.875	69.833	2.483
3	64.500	2.510	66.000	5.177	66.000	3.225	63.167	1.941	68.833	3.764
4	65.833	2.041	64.833	1.941	63.833	1.835	64.833	1.602	67.333	2.066
5	75.833	4.167	75.333	4.502	75.667	4.320	80.000	4.472	75.500	4.970
6	65.333	2.251	64.500	1.517	66.167	3.312	65.833	2.229	63.167	2.041
7	63.167	3.430	63.167	2.229	61.833	1.941	63.667	0.816	64.667	1.862
8	70.667	4.719	70.167	3.189	68.667	1.211	72.500	5.891	68.833	3.710
9	62.167	1.472	62.667	3.011	62.667	1.211	63.500	2.074	64.000	1.789
10	70.167	3.061	68.667	3.266	67.833	3.601	70.500	1.517	70.833	1.722
11	67.000	2.366	67.333	1.506	66.500	2.665	65.667	2.875	68.000	1.897
12	77.333	5.538	73.000	2.449	74.667	4.412	72.167	3.061	73.500	1.037
13	66.833	2.041	66.667	2.805	65.333	4.274	67.167	4.355	66.833	4.262
14	69.167	1.329	70.167	2.563	69.833	3.545	68.667	0.816	70.167	1.941

SCORE: CENTRAL

DAT-3

SESSION: 1ST.ALCOHOL

1	19.500	1.643	19.833	1.169	20.500	2.429	20.333	1.366	24.167	1.835
2	23.333	1.211	24.333	1.033	26.333	3.077	27.667	2.582	31.833	1.835
3	20.667	3.266	19.833	1.722	19.667	2.160	20.667	1.966	30.333	4.320
4	32.167	2.927	32.500	3.564	32.167	2.787	36.000	6.419	33.000	5.865
5	26.667	1.966	26.167	1.941	32.833	4.119	36.667	5.422	38.333	4.885
6	30.167	2.787	28.667	2.875	30.000	2.280	30.333	1.751	36.500	3.937
7	21.500	2.074	20.333	1.506	22.167	1.329	22.167	0.753	25.167	2.563
8	23.000	2.000	21.833	2.317	24.333	2.503	24.167	3.189	27.833	4.446
9	23.667	1.366	22.333	1.506	23.167	2.483	27.000	3.225	28.167	9.806
10	19.167	1.602	20.500	1.643	21.167	1.602	26.167	3.061	26.000	3.162
11	28.167	1.329	26.167	0.983	28.000	1.549	31.333	1.633	36.667	1.211
12	28.667	1.966	24.000	5.477	26.500	3.017	29.333	1.506	31.000	3.225
13	23.000	1.265	22.167	1.835	25.333	2.582	26.667	2.658	49.667	6.890
14	29.500	3.886	29.333	3.266	29.667	1.751	29.500	2.168	31.500	4.183

SESSION: 2ND ALCOHOL

1	20.500	0.548	19.000	2.000	19.500	2.881	20.833	1.602	25.000	2.683
2	24.833	1.472	24.333	1.633	24.333	2.251	26.667	3.559	33.000	4.243
3	21.000	2.000	19.500	1.378	19.667	1.033	20.333	1.633	22.167	1.941
4	29.833	7.782	31.667	2.658	27.833	1.835	30.500	2.665	41.167	4.834
5	31.333	3.266	28.333	2.875	30.000	2.530	42.500	6.473	49.833	10.732
6	30.333	3.266	26.667	2.658	30.667	3.204	33.167	3.371	78.667	36.593
7	20.333	1.366	20.667	1.366	20.833	1.602	23.333	2.503	22.333	1.211
8	23.833	3.251	21.833	2.401	22.833	2.483	25.000	2.000	30.167	2.137
9	21.333	1.966	25.167	3.251	21.333	3.386	20.833	0.753	26.500	4.324
10	20.667	2.160	20.333	1.033	23.500	1.761	23.333	1.633	26.667	3.502
11	26.667	1.033	25.000	1.673	31.000	1.789	31.333	2.160	37.000	6.270
12	27.500	2.345	24.333	1.633	26.167	3.189	26.333	3.445	27.000	3.347
13	21.500	1.761	22.167	1.472	22.667	2.338	26.667	2.805	28.167	2.483
14	27.167	1.472	27.333	2.066	27.500	3.391	31.333	3.933	35.000	5.060

SESSION: PLACEBO

1	21.667	2.582	19.833	1.602	21.667	2.503	19.667	1.211	20.500	1.643
2	25.500	1.643	24.167	3.125	24.333	1.751	24.167	2.317	23.667	1.633
3	19.833	1.602	20.167	1.722	20.333	1.211	19.500	2.258	19.000	1.265
4	32.667	4.227	32.833	4.262	31.500	3.507	29.833	4.070	29.667	2.422
5	33.833	4.535	30.167	1.722	29.333	2.944	29.167	2.563	31.333	2.733
6	28.333	2.875	28.333	2.422	27.667	1.033	26.833	1.329	29.333	3.011
7	18.333	1.506	19.167	1.329	19.333	1.033	17.667	1.366	18.333	1.211
8	23.833	1.329	23.500	1.517	21.000	1.673	21.167	2.137	22.667	1.633
9	20.500	2.665	21.500	3.209	18.500	0.548	20.333	3.559	20.833	2.714
10	19.500	1.049	21.833	2.137	20.167	1.602	18.833	1.722	19.333	5.816
11	25.833	2.317	25.833	1.941	24.833	1.722	25.833	1.472	25.667	0.816
12	25.833	1.941	25.333	3.386	26.333	2.733	25.667	1.366	27.833	2.229
13	22.167	1.472	22.500	1.225	22.333	1.211	22.333	2.160	22.667	2.422
14	27.500	2.739	27.000	3.347	25.167	1.835	23.833	1.941	26.000	2.757

SCORE: PERIPHERAL

SESSION: 1ST ALCOHOL

1	74.667	2.422	74.500	3.937	76.333	2.582	76.667	1.211	81.667	2.658
2	75.000	1.414	75.333	2.658	78.333	2.944	85.333	1.966	85.500	2.345
3	71.833	3.125	68.000	4.193	73.833	4.401	74.500	3.271	00.833	6.145
4	71.167	2.401	72.500	2.258	73.833	2.994	77.833	2.994	81.000	2.898
5	86.167	3.971	86.000	4.899	83.500	5.010	89.333	3.386	88.000	6.693
6	73.667	2.944	73.667	2.944	78.167	1.169	80.500	2.588	84.667	3.266
7	72.167	3.189	74.167	2.483	72.500	3.391	75.333	1.366	78.000	2.280
8	78.167	4.579	80.333	1.862	80.833	2.714	85.833	3.480	85.667	4.457
9	71.000	2.000	72.667	2.658	72.167	3.125	74.000	0.894	77.167	3.371
10	76.833	5.154	77.833	3.061	79.667	2.160	80.667	5.164	86.833	6.616
11	74.333	2.066	75.000	3.578	78.500	3.082	80.500	2.168	88.167	2.401
12	78.667	3.266	79.500	3.271	79.167	2.317	82.333	2.658	86.167	4.021
13	75.000	3.286	75.833	4.355	79.333	4.676	79.000	2.966	97.167	7.626
14	83.833	3.545	80.833	2.639	80.167	2.317	86.333	2.338	83.833	2.317

SESSION: 2ND ALCOHOL

1	74.167	3.371	75.500	1.975	77.667	1.366	80.000	3.098	78.000	2.098
2	75.000	3.098	74.833	2.483	78.833	2.563	80.000	1.789	86.667	3.630
3	69.000	2.828	64.833	3.869	69.833	2.639	71.833	2.483	71.000	3.406
4	69.333	2.503	70.000	2.828	70.000	2.449	74.500	4.324	77.833	2.714
5	85.167	4.167	83.833	3.430	87.667	1.862	00.667	6.439	90.333	10.558
6	72.667	4.121	74.667	2.658	75.000	4.099	80.000	3.225	78.833	16.881
7	69.667	3.011	72.667	1.506	73.833	2.317	74.833	3.061	76.000	1.789
8	80.167	3.920	77.000	3.688	78.833	3.545	79.667	6.470	87.167	4.875
9	70.500	2.258	70.333	2.658	74.500	2.429	73.000	2.757	77.833	2.127
10	76.500	2.074	77.667	2.160	78.333	2.658	81.667	3.933	87.667	2.160
11	76.167	1.722	76.500	2.168	78.833	2.229	79.667	1.862	81.333	1.366
12	80.000	2.966	80.167	2.714	80.167	3.480	84.500	3.782	88.167	4.262
13	74.333	2.422	74.333	3.615	77.167	3.312	83.333	2.503	82.500	3.271
14	78.667	3.204	77.167	3.545	82.333	1.862	84.500	3.450	86.833	3.430

SESSION: PLACEBO

1	77.000	4.561	75.833	1.941	75.333	5.279	72.667	3.141	78.167	2.563
2	76.167	3.764	76.167	2.787	74.667	3.777	77.667	2.160	77.833	1.329
3	71.833	1.722	73.333	1.366	71.833	2.787	71.167	3.312	71.667	1.862
4	72.333	4.502	70.333	2.875	70.167	2.229	72.000	3.578	70.333	1.033
5	89.333	3.502	86.667	5.465	85.667	2.805	90.000	3.225	86.500	5.891
6	78.500	3.507	77.833	2.229	79.000	2.608	76.833	2.483	78.500	2.258
7	71.667	3.204	69.500	2.345	68.333	2.338	67.667	3.266	70.167	1.835
8	80.167	3.617	78.167	3.312	76.333	5.317	81.000	2.530	76.333	2.338
9	68.167	2.137	70.333	2.422	70.000	1.095	70.000	1.673	70.333	3.830
10	79.333	2.160	77.667	1.211	75.667	1.751	76.500	4.087	76.000	1.673
11	72.833	1.329	75.000	3.742	75.000	1.414	74.333	1.211	73.333	1.966
12	80.000	3.847	74.667	2.422	75.667	2.338	80.167	1.835	76.000	2.098
13	72.000	2.966	71.500	3.082	74.667	3.204	72.333	3.933	74.000	3.688
14	75.667	3.559	77.000	2.280	78.000	3.033	79.333	3.445	81.667	2.503

APPENDIX C

ANOVA SUMMARY TABLES

Two analyses of variance were reported in Section 3.1 of this report. Results of those analyses were discussed in the text only for main effects and interactions significant at the .001 level. In this Appendix, complete summary tables--including all interaction terms--are presented.

Table C-1 summarizes the trial-by-trial ANOVA of central and peripheral scores. Table C-2 summarizes the ANOVA of mean central, peripheral, and error scores.

ANALYSIS OF VARIANCE TABLE FOR MEASURE(1) DAT2-DAT3 ZSCORE

CLASSIFYING FACTORS

SESORD	SES ORDER
DEV	DEVICE
BEV	BEVERAGE
CYC	CYCLE
TRI	TRIAL
SCO	SCORE
UNIT	SUBJECTS OR UNITS OF ANALYSIS

	SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F-TEST	SIGNIFICANCE	PERCENT OF TOTAL SUM OF SQUARES
	SESORD (SES)	50.178	1	50.178	0.559	0.472	1.16
*	UNIT	897.883	10	89.788	NOT TESTED		20.81
	DEV	165.165	1	165.165	33.308***	UNDER 0.001	3.83
	SES X DEV	5.877	1	5.877	1.185	0.302	0.14
*	DEV X UNIT	49.588	10	4.959	NOT TESTED		1.15
	BEV	156.406	2	78.203	24.888***	UNDER 0.001	3.62
	SES X BEV	12.312	2	6.156	1.959	0.168	0.29
*	BEV X UNIT	62.844	20	3.142	NOT TESTED		1.46
	CYC	404.114	4	101.029	44.061***	UNDER 0.001	9.37
	SES X CYC	23.572	4	5.893	2.570	0.053	0.55
*	CYC X UNIT	91.716	40	2.293	NOT TESTED		2.13
	TRI	2.048	5	0.410	0.655	OVER 0.500	0.05
	SES X TRI	1.793	5	0.359	0.574	OVER 0.500	0.04
*	TRI X UNIT	31.243	50	0.625	NOT TESTED		0.72
	SCO	0.000	1	0.000	VERY SMALL		0.00
	SES X SCO	66.957	1	66.957	2.064	0.182	1.55
*	SCO X UNIT	324.391	10	32.439	NOT TESTED		7.52
	DEV X BEV	1.922	2	0.961	2.150	0.143	0.04
	SES X DEV X BEV	0.303	2	0.152	0.339	OVER 0.500	0.01
*	DEV X BEV X UNIT	8.940	20	0.447	NOT TESTED		0.21
	DEV X CYC	5.181	4	1.295	2.056	0.105	0.12
	SES X DEV X CYC	1.739	4	0.435	0.690	OVER 0.500	0.04
*	DEV X CYC X UNIT	25.203	40	0.630	NOT TESTED		0.58
	BEV X CYC	217.366	8	27.171	14.647***	UNDER 0.001	5.04
	SES X BEV X CYC	24.534	8	3.067	1.653	0.124	0.57
*	BEV X CYC X UNIT	148.406	80	1.855	NOT TESTED		3.44
	DEV X TRI	1.180	5	0.236	0.854	OVER 0.500	0.03
	SES X DEV X TRI	7.533	5	1.507	5.450***	UNDER 0.001	0.17
*	DEV X TRI X UNIT	13.820	50	0.276	NOT TESTED		0.32
	BEV X TRI	2.012	10	0.201	0.795	OVER 0.500	0.05
	SES X BEV X TRI	3.242	10	0.324	1.281	0.252	0.08
*	BEV X TRI X UNIT	25.319	100	0.253	NOT TESTED		0.59
	CYC X TRI	7.688	20	0.384	1.302	0.181	0.18
	SES X CYC X TRI	9.610	20	0.480	1.628*	0.050	0.22

	DEV X SCO	308.917	1	308.917	86.270***	UNDER 0.001	7.16
	SES X DEV X SCO	1.080	1	1.080	0.302	OVER 0.500	0.03
*	DEV X SCO X UNIT	35.808	10	3.581	NOT TESTED		0.83
	BEV X SCO	5.111	2	2.556	1.718	0.205	0.12
	SES X BEV X SCO	8.462	2	4.231	2.844	0.082	0.20
*	BEV X SCO X UNIT	29.758	20	1.488	NOT TESTED		0.69
	CYC X SCO	5.574	4	1.394	1.368	0.263	0.13
	SES X CYC X SCO	9.925	4	2.481	2.435	0.063	0.23
*	CYC X SCO X UNIT	40.761	40	1.019	NOT TESTED		0.94
	TRI X SCO	1.478	5	0.296	1.011	0.421	0.03
	SES X TRI X SCO	0.435	5	0.087	0.298	OVER 0.500	0.01
*	TRI X SCO X UNIT	14.614	50	0.292	NOT TESTED		0.34
	DEV X BEV X CYC	3.371	8	0.421	1.176	0.324	0.08
	SES X DEV X BEV X CYC	2.034	8	0.254	0.710	OVER 0.500	0.05
*	DEV X BEV X CYC X UNIT	28.651	80	0.358	NOT TESTED		0.66
	DEV X BEV X TRI	2.573	10	0.257	1.332	0.225	0.06
	SES X DEV X BEV X TRI	1.299	10	0.130	0.672	OVER 0.500	0.03
*	DEV X BEV X TRI X UNIT	19.325	100	0.193	NOT TESTED		0.45
	DEV X CYC X TRI	2.515	20	0.126	0.562	OVER 0.500	0.06
	SES X DEV X CYC X TRI	5.381	20	0.269	1.202	0.256	0.12
*	DEV X CYC X TRI X UNIT	44.761	200	0.224	NOT TESTED		1.04
	BEV X CYC X TRI	10.658	40	0.266	1.042	0.406	0.25
	SES X BEV X CYC X TRI	9.144	40	0.229	0.894	OVER 0.500	0.21
*	BEV X CYC X TRI X UNIT	102.310	400	0.256	NOT TESTED		2.37
	DEV X BEV X SCO	1.998	2	0.999	2.024	0.159	0.05
	SES X DEV X BEV X SCO	1.787	2	0.893	1.809	0.190	0.04
*	DEV X BEV X SCO X UNIT	9.874	20	0.494	NOT TESTED		0.23
	DEV X CYC X SCO	2.530	4	0.633	1.767	0.155	0.06
	SES X DEV X CYC X SCO	1.628	4	0.407	1.137	0.354	0.04
*	DEV X CYC X SCO X UNIT	14.317	40	0.358	NOT TESTED		0.33
	BEV X CYC X SCO	10.149	8	1.269	1.567	0.149	0.24
	SES X BEV X CYC X SCO	16.527	8	2.066	2.552*	0.016	0.38
*	BEV X CYC X SCO X UNIT	64.769	80	0.810	NOT TESTED		1.50
	DEV X TRI X SCO	1.097	5	0.219	0.911	0.482	0.03
	SES X DEV X TRI X SCO	1.204	5	0.241	0.999	0.428	0.03
*	DEV X TRI X SCO X UNIT	12.047	50	0.241	NOT TESTED		0.28
	BEV X TRI X SCO	2.804	10	0.280	1.060	0.400	0.06
	SES X BEV X TRI X SCO	3.327	10	0.333	1.258	0.265	0.08
*	BEV X TRI X SCO X UNIT	26.448	100	0.264	NOT TESTED		0.61
	CYC X TRI X SCO	6.297	20	0.315	1.203	0.255	0.15
	SES X CYC X TRI X SCO	4.055	20	0.203	0.774	OVER 0.500	0.09
*	CYC X TRI X SCO X UNIT	52.359	200	0.262	NOT TESTED		1.21
	DEV X BEV X CYC X TRI	10.359	40	0.259	1.106	0.310	0.24
	SES X DEV X BEV X CYC X TRI	7.814	40	0.195	0.834	OVER 0.500	0.18
*	DEV X BEV X CYC X TRI X UNIT	93.688	400	0.234	NOT TESTED		2.17
	DEV X BEV X CYC X SCO						

* / X [redacted] X X X			[redacted]			
UNIT	33.404	80	0.418	NOT TESTED		0.77
DEV X BEV X TRI X SCO	2.831	10	0.283	0.956	0.487	0.07
SES X DEV X BEV X TRI X SCO	1.644	10	0.164	0.555	OVER 0.500	0.04
* DEV X BEV X TRI X SCO X UNIT	29.616	100	0.296	NOT TESTED		0.69
DEV X CYC X TRI X SCO	6.279	20	0.314	1.214	0.246	0.15
SES X DEV X CYC X TRI X SCO	5.218	20	0.261	1.009	0.453	0.12
* DEV X CYC X TRI X SCO X UNIT	51.711	200	0.259	NOT TESTED		1.20
BEV X CYC X TRI X SCO	7.791	40	0.195	0.840	OVER 0.500	0.18
SES X BEV X CYC X TRI X SCO	9.979	40	0.249	1.075	0.354	0.23
* BEV X CYC X TRI X SCO X UNIT	92.798	400	0.232	NOT TESTED		2.15
DEV X BEV X CYC X TRI X SCO	10.519	40	0.263	1.104	0.312	0.24
SES X DEV X BEV X CYC X TRI X SCO	8.516	40	0.213	0.894	OVER 0.500	0.20
* DEV X BEV X CYC X TRI X SCO X UNIT	95.243	400	0.238	NOT TESTED		2.21
TOTAL	4314.688	4319	0.999			100.00

AN ASTERISK (*) MARKS THE EFFECT USED IN TESTING THE PRECEDING EFFECTS

12 UNITS WERE READ IN FOR THIS ANALYSIS.
12 UNITS WERE USED IN THIS ANALYSIS.

ANALYSIS OF VARIANCE TABLE FOR MEASURE(1) DAT2-DAT3 ZSCORE

CLASSIFYING FACTORS

SESORD	SES ORDER
DEV	DEVICE
BEV	BEVERAGE
CYC	CYCLE
SCO	SCORE
UNIT	SUBJECTS OR UNITS OF ANALYSIS

	SOURCE	SUM OF SQUARES	DF	MEAN SQUARE	F-TEST	SIGNIFICANCE	PERCENT OF TOTAL SUM OF SQUARES
	SESORD (SESO)	16.951	1	16.951	0.761	0.404	1.57
*	UNIT	222.874	10	22.287	NOT TESTED		20.70
	DEV	36.841	1	36.841	35.758***	UNDER 0.001	3.42
	SESO X DEV	0.687	1	0.687	0.666	0.434	0.06
*	DEV X UNIT	10.303	10	1.030	NOT TESTED		0.96
	BEV	50.062	2	25.031	18.030***	UNDER 0.001	4.65
	SESO X BEV	3.856	2	1.928	1.389	0.273	0.36
*	BEV X UNIT	27.766	20	1.388	NOT TESTED		2.58
	CYC	115.848	4	28.962	31.037***	UNDER 0.001	10.76
	SESO X CYC	14.398	4	3.599	3.857**	0.010	1.34
*	CYC X UNIT	37.325	40	0.933	NOT TESTED		3.47
	SCO	0.001	2	0.000	VERY SMALL		0.00
	SESO X SCO	14.464	2	7.232	1.292	0.297	1.34
*	SCO X UNIT	111.959	20	5.598	NOT TESTED		10.40
	DEV X BEV	0.022	2	0.011	0.050	OVER 0.500	0.00
	SESO X DEV X BEV	0.011	2	0.005	0.025	OVER 0.500	0.00
*	DEV X BEV X UNIT	4.457	20	0.223	NOT TESTED		0.41
	DEV X CYC	2.305	4	0.576	2.810*	0.039	0.21
	SESO X DEV X CYC	0.441	4	0.110	0.537	OVER 0.500	0.04
*	DEV X CYC X UNIT	8.203	40	0.205	NOT TESTED		0.76
	BEV X CYC	71.222	8	8.903	9.877***	UNDER 0.001	6.61
	SESO X BEV X CYC	10.530	8	1.316	1.460	0.186	0.98
*	BEV X CYC X UNIT	72.109	80	0.901	NOT TESTED		6.70
	DEV X SCO	65.719	2	32.860	49.210***	UNDER 0.001	6.10
	SESO X DEV X SCO	0.718	2	0.359	0.538	OVER 0.500	0.07
*	DEV X SCO X UNIT	13.355	20	0.668	NOT TESTED		1.24
	BEV X SCO	1.592	4	0.398	0.745	OVER 0.500	0.15
	SESO X BEV X SCO	6.082	4	1.520	2.846*	0.037	0.56
*	BEV X SCO X UNIT	21.371	40	0.534	NOT TESTED		1.98
	CYC X SCO	3.266	8	0.408	1.411	0.205	0.30
	SESO X CYC X SCO	4.552	8	0.569	1.968	0.062	0.42
*	CYC X SCO X UNIT	23.138	80	0.289	NOT TESTED		2.15
	DEV X BEV X CYC	0.585	8	0.073	0.447	OVER 0.500	0.05
	SESO X DEV X BEV X CYC	2.084	8	0.261	1.591	0.141	0.19

[redacted]	1[redacted]	4	0.[redacted]	2.[redacted]	2	).1
SESD X DEV X BEV X SCD	0.626	4	0.157	1.178	0.336	0.06
* DEV X BEV X SCD X UNIT	5.314	40	0.133	NOT TESTED		0.49
DEV X CYC X SCD	1.600	8	0.200	2.241*	0.033	0.15
SESD X DEV X CYC X SCD	0.887	8	0.111	1.242	0.286	0.08
* DEV X CYC X SCD X UNIT	7.138	80	0.089	NOT TESTED		0.66
BEV X CYC X SCD	5.317	16	0.332	1.389	0.154	0.49
SESD X BEV X CYC X SCD	4.526	16	0.283	1.182	0.288	0.42
* BEV X CYC X SCD X UNIT	38.292	160	0.239	NOT TESTED		3.56
DEV X BEV X CYC X SCD	3.501	16	0.219	2.117**	0.010	0.33
SESD X DEV X BEV X CYC X SCD	3.616	16	0.226	2.186**	0.008	0.34
* DEV X BEV X CYC X SCD X UNIT	16.539	160	0.103	NOT TESTED		1.54
TOTAL	1076.917	1079	0.998			100.00

AN ASTERISK (*) MARKS THE EFFECT USED IN TESTING THE PRECEDING EFFECTS

12 UNITS WERE READ IN FOR THIS ANALYSIS.
12 UNITS WERE USED IN THIS ANALYSIS.

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