LEVELS OF AROUSAL: A COMPARISON OF CONDITIONS OF INTEREST AND BOREDOM

By

JOE POWELL BAILEY

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

1970

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
July, 1975

LEVELS OF AROUSAL: A COMPARISON OF CONDITIONS

OF INTEREST AND BOREDOM

Thesis Approved:

Joseph Pearl
Thesis Advisor

Richard L. Thackray

N N Durham
Dean of the Graduate College

PREFACE

The principal concern of this thesis was an attempt to investigate the physiological and psychological correlates of the related constructs of monotony and boredom and to define them in terms of levels of arousal. While quite a bit of performance data was available from vigilance studies, there was a definite lack of psychophysiological information regarding boredom which often accompanies monotonous vigilance-type tasks. Since boredom is an unpleasant state produced by monotony, which is insufficient stimulation, a condition expected to produce interest was devised against which to test both constructs. The problem of devising a task which would prove to be interesting for two hours was probably the most difficult chore that I encountered in designing the experiment and success in that endeavor was limited.

A rapidly expanding technology is reducing many previously active tasks into passive vigilance-type tasks. In industry, machine operators have become machine monitors; in business, highly skilled clerical work is done automatically and requires minimal but necessary attention; and the field of education is rapidly being invaded by all manner of machinery. Such then is the present and future and here we are with just a smattering of the knowledge we need to cope with the problem. I hope that the information presented herein is an appropriate step in the right direction.

Acknowledgements for this type of project are difficult as there is a deep fear of leaving someone out! A good place to begin is, of

course, with committee members who, in this case, are: Dr. Joseph Pearl, who was most generous with both patience and pragmaticism; Dr. Thomas Parish, for technical advice and concern for propriety; and, Dr. Richard I. Thackray, who not only was instrumental in the conception of the project, but provided thoughtful good humor which aided in its completion. Also of first rate importance are Dr. Robert E. Mangum, who had faith, and Dr. William E. Collins, who provided impetus.

In addition, I would like to thank Dorothy Gay and Jean Grimm who spent a lot of time hovering over hot typewriters.

Special thanks are in order for Dr. Earl Folk and the staff of the Biostatistical Section of the Civil Aeromedical Institute.

Of course, there were my parents and a number of friends for whose help and advice I am grateful, but most of all I want to thank my wife, Janet, for tangible and intangible support. Then, there are my children, Bobbi and Eric, and all the children of the world for whom I would like to make a better place.

Finally, I must list a few extremely important individuals: R. Mark Touchstone, Bill Bloodworth, Sgt. James A. Ford, and Orville and Wilbur Wright.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

In 1937, Barmack published the results of his systematic experimental investigation into the nature of boredom. Since that time, almost no research has been conducted to specifically further knowledge of that subjective state. Much of our recent information on boredom has been indirect and incidental, coming from studies in vigilance, attention, and from industrial observations (Baker, 1962; Fiske and Maddi, 1961; Mackworth, 1970). Of the few recent studies which have attempted to investigate boredom, most have yielded inconsistent or contradictory findings.

While it is generally agreed that boredom is an unpleasant state produced by monotony, which is insufficient stimulation, there is disagreement as to whether it is a condition of heightened autonomic arousal or, instead, a condition of low or declining arousal (Berlyne, 1960; Thackray, 1974). Proponents of the low arousal hypothesis include Hebb (1955), Fiske and Maddi (1961), Geiwitz (1966), and Barmack (1937), while research by Berlyne (1960) and London, Schubert, and Washburn (1972) supports the contention that boredom is a state of heightened arousal. Those who favor an interpretation of low arousal point to the tendencies toward inattention, daydreaming, performance errors, irritation, and sleep by persons in a boring situation. Those favoring an interpretation of heightened arousal point to restlessness,

irritation, and emotional upset as principal components of boredom. (Note that each side uses irritation as an element in their hypotheses.)

As noted previously, the work by Barmack (1937) was the first major attempt to examine the physiological and psychological correlates of boredom. The main experiment of that early work consisted of subjects performing two tasks, one of which involved adding for 90 minutes pairs of six place numbers, and the other was taking a series of five higher forms of the Otis Self Administering Tests for 90 minutes. The first task was expected to be boring and the second task interesting. Among the trends Barmack noted were a depression of work output, blood pressure, and heart rate in the boring situation. The subjectively reported psychological tendencies included increases in irritation, fatigue, inattentiveness, and sleepiness. Barmack also reported a correlation between oxygen consumption and attention, in which declining attention was accompanied by declining oxygen usage. With the possible exception of the increase in irritation, these findings support a hypothesis that boredom is a state of low or declining arousal.

In his study of the structure of boredom, Geiwitz (1966) examined several possible factors of boredom; specifically, arousal, constraint, subjective repetitiveness, and unpleasantness. A training session resulted in the subjects being able to reliably identify various degrees of boredom and interest and three degrees of each were induced by means of posthypnotic cues. The different degrees were evoked during a simple performance task. The subjects were required to make checkmarks at a predetermined rate and give time lapse estimations. During task performance, the subjects were given a cue which resulted

in maintenance of mental state level of one of the factors under consideration, while the others were held constant. Greater performance decrement, rated by judges, was associated with higher boredom as measured with self-rating scales. Additionally, as boredom increased, self-reported arousal decreased, while feelings of constraint, unpleasantness, and repetitiveness increased. All four parameters under investigation contributed to a state of boredom and were interrelated; however, no single factor was sufficiently causative unless the others were held constant.

Fiske and Maddi (1961) developed a low arousal hypothesis of boredom based on an intensive review of the literature on vigilance and attention. In their view, understimulation is a stress-producing situation, but not in the usual sense as the external stimuli are not intense, noxious, or fear producing. They note that kinesthetic feedback, which seems to have a steady, unobtrusive, but significant effect on an organism's ability to maintain action readiness, is often restricted in boredom producing circumstances. Therefore, it is reasonable to conclude that increased body movement is a boring situation in a kinesthetic reaction to low stimulus stress, rather than an indicator of increased physiological arousal.

Although developed along different theoretic lines, Hebb (1955) came to much the same conclusion as did Fiske and Maddi (1961). He speaks of an arousal system that delivers messages indiscriminately to wide cortical areas and has the function of providing necessary tone or conditioning, analogous to exercising muscles, without which the higher cortical centers would not function. In later work (Hebb, 1958), he also discusses the function of variety in maintaining arousal without

which the organism discontinues seeking a moderate level of arousal and, instead, seeks a minimal level of arousal leading to sleep. In other words, monotonous stimulation produces boredom which leads to diminished arousal.

From the same research cited by Hebb (1955) and Fiske and Maddi (1961), Berlyne (1960) draws a contradictory opinion and conclusion. To support his hypothesis, he points out, first, that restlessness, agitation, and emotional upset are factors which coincide with high arousal. Next, these factors are characteristic reactions to monotonous, repetitive situations. And last, he cites literature showing evidence that inhibitory impulses from the cortex restrict arousal while inaction of the cortex, caused by monotony, releases the reticular activating system from such restraint and thereby increases arousal.

Experimental support for Berlyne's (1960) hypothesis of increased arousal associated with boredom was provided by London, Schubert, and Washburn (1972). In the first of two experiments, one group of subjects performed a simple vigilance task which required a button push response to an irregular light stimulus, while the other group wrote stories in response to Thematic Apperception Test cards. Arousal was measured by means of the galvanic skin potential (GSP) level and a postexperimental questionnaire. Both tasks were 40 minutes in duration. The results showed that the vigilance task resulted in a significantly higher GSP and was perceived by the subjects to be more boring and less interesting than the story writing task. In the second experiment, the interesting task was the same while the boring task consisted of writing the letters "CD" repeatedly. Unlike the first experiment, all subjects

performed both tasks, each of which was 30 minutes in duration. Heart rate and skin conductance level were recorded and a posttask questionnaire given. Although the difference was only one beat per minute, heart rate was only one beat per minute, heart rate was reported as significantly higher for the boring task. There was no significant difference between skin conductive levels. The questionnaire showed that the letter writing task was perceived to be the more boring.

The purpose of the present study was to investigate and extend the concepts studied by London et al. (1972) in the hopes of clarifying the subjective and physiological correlates of boredom. The specific approach was to make a comparison of conditions of interest and boredom and to ascertain the levels of arousal of each condition through physiological recordings and subjective questionnaires.

In order to make the present study relevant to work being conducted at the Civil Aeromedical Institute of the Federal Aviation Administration, where it was carried out, certain elements of the project were given an aviation orientation. The experiment consisted of two tasks, one of which was designed to evoke feelings of boredom and monotony and the other to be interesting. The boring task was a stylized and simplified version of duties which may be performed by air traffic controllers. In essence, it was a vigilance-type task with low response frequency. The interesting task, which consisted of reading magazine advertisements, was designed to use the same equipment and recording devices as the boring task. This was done in order to control for confounding variables.

The boring and interesting tasks were administered during both morning and afternoon sessions. There were, then, four groups, each of

which was identified by task and time of day: AMATC - air traffic control task, morning; PMATC - air traffic control task, afternoon; AMAD - advertising task, morning; and PMAD - advertising task, afternoon.

CHAPTER II

METHOD

Subjects

Thirty-two paid male subjects recruited by the University of Oklahoma Research Institute were used. All of the subjects were right-handed and between the ages of 18 and 30 ($\bar{X}$ = 22.96; S.D. 2.57). The majority of the subjects were full- or part-time students and the remainder were from the general population of central Oklahoma.

Apparatus

A simulated air traffic control radar console was used for stimulus presentation in both experimental tasks. The console, which was 155 CM wide and 151 CM tall, had two vertical panels and a desk. A 40 CM diameter polacoat rear projection screen and a small red light on the left panel were used for stimulus presentation while three buttons on the right panel were used to record subject responses.

Due to differences in presentation, two types of projectors were used for stimulus presentation. For the ATC (boring) task, image projection was done with a Graflex model 750 School master filmstrip projector. The projector was encased in a sound-damping cabinet which had a shutter to prevent the subject from seeing or hearing the filmstrip advance. Stimulus presentation for the AD (interesting) task was accomplished with a Kodak Carousel model 800 slide project with optional

140 slide capacity tray.

The filmstrip consisted of 480 frames of animated images, with alphanumeric (letters and numbers) designations, which approximated targets of aircraft as seen on computer-generated radar screens. The program was designed to present a vigilance task and several events were included in the filmstrip to provide flexibility. Although the task in this experiment only required the subject to attend to alphanumeric changes, other stimuli included aircraft targets entering and turning. An alphanumeric change consisted of the letter "C" changing to a letter "N" meaning some change in altitude had occurred. As an example, a target designated MH 157C changed to MH 157N, for one frame, and back to MH 157C. There were 10 randomized but nonsimultaneous changes per half-hour period in the two-hour program.

Stimuli for the interesting task were 120, 35 mm, color slides, 60 of which were reproductions of full-page magazine advertisements (see Appendix F), while the other half of the slides were a repeat, or copy, of a questionnaire pertaining to the content of the advertisement (see Appendix C). A questionnaire slide followed each advertisement. The advertisements were divided into three approximately equal categories: (1) male orientation, (2) female orientation, (3) nonspecific as to orientation. The process of selection involved obtaining the advertisements from several issues of various national magazines. The advertisements were then presented individually to a volunteer panel of staff members from the Aviation Psychology Laboratory who were instructed to place them in one of the three categories which were not defined. Five men and five women participated in the categorization and only those advertisements placed in the same categories by seven or

panelists were used.

A number of sensing devices were used to report the physiological responses of the subjects. An E&M Instrument Company electrosphygmograph was used to obtain systolic and diastolic blood pressure. Beckman biopotential skin electrodes were used to obtain heart rate and skin conductance level. In addition to the direct physiological measures, a piezoelectric sensor was placed under the cushion in a swivel chair to record body movement.

Each of the various sensors and electrodes led to a Beckman Type R Dynograph, an eight-channel polygraph used to record the analog physiological data. In addition to this analog data, two of the measures, heart rate and body movement, were converted from analog to digital form by means of a cardiotachometer and pulse integrator, respectively, and these led to a Welford Mark IV Serial Event Timer and Recorder (SETAR) to be processed for later computer analysis.

In addition to the electromechanical recording equipment, pre- and post experimental questionnaires for gathering subjective evaluations and personality variables, were also used. The Eysenck Personality Inventory (EPI) and the Zuckerman Sensation Seeking Scale (SSS) were given before the experiment to evaluate possible difference in boredom susceptibility between groups (Eysenck and Eysenck, 1968; Zuckerman, 1972). A subjective rating scale, derived from one used by Barmack (1937), had two forms, A and B, each of which asked the subject to rate his levels of attentiveness, energy, relaxation, boredom, and irritation. The post experimental form (B) had an additional scale for monotony (see Appendix B).

Actual control of stimulus presentation was achieved through a

series of DSI timers (Time Interval Generator, model D501) which operated advancement of the projectors and activation and release of the shutter in the ATC task. In addition, a BRS/Foringer TRS-3 punched tape reader system handled the red light presentation.

Procedure

Due to the fact that the subjects were paid volunteers recruited by the Research Institute of the University of Oklahoma, a true claim of random selection cannot be made; however, the subjects were naive as to the nature of the experiment and were assigned, alternately, to one of the two tasks during both morning and afternoon sessions. Therefore, there were 16 subjects per task, with half performing in the morning and half in the afternoon.

The initial procedure was the same for all subjects, regardless of task or time of day. Each subject was met and taken to an office where the EPI and SSS questionnaires were administered. The subject was then taken to the experimental room where he listened to a tape recorded introductory message describing the physiological measures to be used. The experimenter then attached the biosensors and explained each to the subject. The subject was also asked to surrender any timepiece he may have had.

Electrodes charged with Sanborn Redux electrode paste, for recording heart rate, were attached to either side of the subject's torso below the anterior serratus muscles. Next, a ground connection plate was attached to the left wrist and skin conductance electrodes were secured to the first two fingers of the left hand. Isopropyl alcohol was used to clean the skin for the finger and wrist connections. The

last connection was of a blood pressure cuff which was placed around the upper left arm with a microphone pickup in the vicinity of the brachial artery. Great care was taken to ensure that the subject was not exposed to any potential shock hazard.

At the completion of all biosensor attachments, the subject was given a form A subjective questionnaire, after which the taped instructions were played and three consecutive blood pressure readings were taken. The task began immediately thereafter.

The ATC (boring) task was designed to produce feelings of boredom resulting from the monotonous stimulation. As noted earlier, it was basically a vigilance task in which the subject viewed a series of simulated radar images and the problem was to detect and respond to, with a 15-second presentation, any changes in the alphanumeric designation of the targets, by pressing a button. In addition, the subject was to watch for a small red light to come on, the responses to which was recorded by pushing another button. If the red light and alphanumeric change occurred simultaneously, the subject responded by pressing three buttons and writing the target identification number. The purpose of the red light was to keep the subject attending to the task at all times. Since performance data obtained are not relevant to this study, further details concerning the task will not be reported here. (See Appendix A for instructions.)

In the AD (interesting) task which was designed, hopefully, to maintain a relatively high level of interest, the subject read full-page, color magazine advertisements and responded to questions about them. Both the advertisement and the questionnaire were rear projected slides which remained on the screen for 60 seconds. The instructions

(see Appendix B) implied that short-term memory analysis was the purpose of the task.

At the end of both two-hour tasks, three more blood pressure readings were taken, another questionnaire was given (form B), and the subject was debriefed with the admonition that he not discuss the particulars of the experiment with any prospective subject.

CHAPTER III

RESULTS

To compare the mean scores by task assignment and time period, a one-way analysis of variance was done on the preexperimental scores on the EPI extraversion scale and the SSS boredom subscale. The results of these analyses may be found in Table I. No significant differences were found between groups on either the extraversion scale or the boredom subscale.

TABLE I

A COMPARISON OF MEAN SUBJECT SCORES
ON THE EPI AND SSS QUESTIONNAIRES

	Group						
Questionnaire	AMATC	PMATC	AMAD	PMAD	F	df	p
EPI Extraversion scale	11.00	13.88	12.13	11.25	1.408	31	ns
SSS Boredom subscale	6.75	7.63	6.00	8.25	0.943	31	ns

Percentile norms, for American college students, for the EPI show a mean of 13.1 and an S.D. of 4.1 on the extraversion scale (Eysenck and

Eysenck, 1968). On the boredom subscale of the SSS, a mean of 7.9 and an S.D. of 3.1 are reported (Zuckerman, 1972). The mean scores of all subject groups in this experiment fall within one S.D.

Analysis of variance was used to evaluate the subjective rating scales. The monotony scale, which evaluated the subject's impression of the task and was given at the completion of the task, showed no significant differences between tasks or sessions, but there was a significant task by time of day interaction. Inspection of the summary table shown in Table II reveals that the boring (ATC) task was judged to be more monotonous than the interesting (AD) task in the afternoon, while the reverse was true for the morning session.

When applied to the boredom data, analysis of variance revealed a significant increase in boredom when pretask and posttask responses were compared. The greatest change in mean group scores was found for the PMATC group which declined from 7.75 to 2.75 on the boredom scale. The next largest change in mean scores was in the AMAD group with a difference of 4.13 (pretask $\overline{X}$ = 7.13; posttask $\overline{X}$ = 3.00), followed by the AMATC group (pretask $\overline{X}$ = 7.63; posttask $\overline{X}$ = 4.50) and lastly, the PMAD group with a change of 2.75 in mean scores (pretask $\overline{X}$ = 7.63; posttask $\overline{X}$ = 4.88). These interactions between tasks and time of day were significant as shown by the significant AB and ABC interactions (see Table III). Examination of the posttask group means indicates that the boredom ratings were essentially the same as the monotony ratings for all groups.

While there was a significant general decline in reported level of energy during all sessions, the decline was greater for the ATC group than for the AD group (see Table IV). The remaining variables, levels

of irritation, relaxation, and attentiveness, were almost totally consistent in their direction and magnitude of change and were significantly different only in pre- to posttask changes. With the single exception of a very negligible decrease in irritation by the PMAD group, all three variables, for all subjects, changed in a direction consistent with declining interest, even though the changes were small. The directions of change were a slight increase in levels of irritation and a decrease in levels of attentiveness and relaxation (see Tables IV through VII).

Several physiological measures were recorded. Of these, systolic and diastolic blood pressure were measured just prior to and at the conclusion of the test run. The other measures, body movement, conductance, heart rate, and heart rate variability, were monitored throughout the course of the test run.

Analysis of variance was also used to evaluate the physiological information and these results may be found in Tables VIII through XIII. To summarize briefly, the only consistent and significant physiological changes were related to time, that is, from the beginning to the end of the test run. There were significant declines, from the first to the second hour, in conductance, heart rate, and systolic blood pressure ($p < .01$), conversely, signigicant ($p < .01$) increases were found for heart rate variability and body movement. No significant changes were found for diastolic blood pressure.

TABLE II

SUBJECTIVE QUESTIONNAIRE ANALYSIS
MONOTONY

Source of Variation	Sum of Squares	df	Mean Square	F	P
A(ATC vs AD)	.250	1	.250	< 1	
B(AM vs PM)	1.125	1	1.125	<1	
AB	28.125	1	28.125	7.39	$.05 > p > .01$
SUBJECTS WITHIN GROUPS	106.500	28	3.804		
TOTAL	135.875	31			

MEANS AND S.D.'s

	N	Mean	S.D.	N	Mean	S.D.
AM	8	4.50	2.78	8	2.75	1.49
PM	8	2.25	1.16	8	4.25	1.98

TABLE III

SUBJECTIVE QUESTIONNAIRE ANALYSIS
BOREDOM

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	117.44	31			
A (ATC vs AD)	0.00	1	0.00	0.00	
B (AM vs PM)	0.56	1	0.56	0.16	
AB	16.00	1	16.00	4.44	<.05
SUBJECTS WITHIN GROUPS	100.88	28	3.60		
WITHIN SUBJECTS	277.00	32			
C (PRE vs POST)	225.00	1	225.00	158.99	<.01
AC	1.56	1	1.56	1.10	
BC	0.25	1	0.25	0.18	
ABC	10.56	1	10.56	7.46	<.05
C x SUBJECTS WITHIN GROUPS	39.63	28	1.42		
TOTAL	394.44	63			

GROUP MEANS

		PRE (C1)		POST (C2)		
		MEAN	S.D.	MEAN	S.D.	N
A1 ATC	AM (B1)	7.63	1.30	4.50	2.07	8
	PM (B2)	7.75	1.49	2.75	0.71	8
A2 AD	AM (B1)	7.13	1.55	3.00	2.20	8
	PM (B2)	7.63	1.19	4.88	1.64	8

TABLE IV

SUBJECTIVE QUESTIONNAIRE ANALYSIS
LEVEL OF ENERGY

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	80.94	31			
A (ATC vs AD)	3.06	1	3.06	1.26	
B (AM vs PM)	1.00	1	1.00	0.41	
AB	9.00	1	9.00	3.71	
SUBJECTS WITHIN GROUPS	67.88	28	2.42		
WITHIN SUBJECTS	123.00	32			
C (PRE vs POST)	76.56	1	76.56	55.14	$<.01$
AC	7.56	1	7.56	5.45	$<.05$
BC	0.00	1	0.00	0.00	
ABC	0.00	1	0.00	0.00	
C x SUBJECTS WITHIN GROUPS	38.88	28	1.39		
TOTAL	203.94	63			

GROUP MEANS

		PRE (C1)		POST (C2)		
		MEAN	S.D.	MEAN	S.D.	N
A1 ATC	AM (B1)	3.75	1.91	6.63	1.30	8
	PM (B2)	4.75	1.75	7.63	1.06	8
A2 AD	AM (B1)	4.75	0.46	6.25	1.75	8
	PM (B2)	4.25	1.16	5.75	1.04	8

TABLE V

SUBJECTIVE QUESTIONNAIRE ANALYSIS
LEVEL OF IRRITATION

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	131.61	31			
A (ATC vs AD)	0.39	1	0.39	0.09	
B (AM vs PM)	1.89	1	1.89	0.44	
AB	9.77	1	9.77	2.29	
SUBJECTS WITHIN GROUPS	119.56	28	4.27		
WITHIN SUBJECTS	103.50	32			
C (PRE vs POST)	17.02	1	17.02	6.39	<.05
AC	3.52	1	3.52	1.32	
BC	0.14	1	0.14	0.04	
ABC	8.27	1	8.27	3.10	
C x SUBJECTS WITHIN GROUPS	74.56	28	2.66		
TOTAL	235.11	63			

GROUP MEANS

		PRE (C1)		POST (C2)		
		MEAN	S.D.	MEAN	S.D.	N
A1 ATC	AM (B1)	8.75	0.71	7.88	1.80	8
	PM (B2)	8.25	1.49	6.13	2.47	8
A2 AD	AM (B1)	8.38	1.41	7.00	2.88	8
	PM (B2)	8.00	1.77	8.25	1.49	8

TABLE VI

SUBJECTIVE QUESTIONNAIRE ANALYSIS
LEVEL OF RELAXATION

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	72.23	31			
A (ATC vs AD)	5.64	1	5.64	2.71	
B (AM vs PM)	0.14	1	0.14	0.07	
AB	8.27	1	8.27	3.98	
SUBJECTS WITHIN GROUPS	58.19	28	2.08		
WITHIN SUBJECTS	102.50	32			
C (PRE vs POST)	15.02	1	15.02	5.33	<.05
AC	0.14	1	0.14	0.05	
BC	0.14	1	0.14	0.05	
ABC	8.27	1	8.27	2.93	
C x SUBJECTS WITHIN GROUPS	78.94	28	2.82		
TOTAL	174.74	63			

GROUP MEANS

		PRE (C1)		POST (C2)		
		MEAN	S.D.	MEAN	S.D.	N
A1 ATC	AM (B1)	6.38	1.06	6.13	1.36	8
	PM (B2)	6.38	0.92	4.88	1.81	8
A2 AD	AM (B1)	5.88	2.03	4.00	1.51	8
	PM (B2)	5.88	1.64	5.63	1.85	8

TABLE VII

SUBJECTIVE QUESTIONNAIRE ANALYSIS
ATTENTIVENESS

Source of variation	Sum of square	df	Mean square	F	P
BETWEEN SUBJECTS	76.11	31			
A (ATC vs AD)	0.39	1	0.39	0.17	
B (AM vs PM)	2.64	1	2.64	1.14	
AB	8.27	1	8.27	3.56	
SUBJECTS WITHIN GROUPS	64.81	28	2.31		
WITHIN SUBJECTS	159.50	32			
C (PRE vs POST)	97.52	1	97.52	52.95	$<.01$
AC	6.89	1	6.89	3.74	
BC	0.02	1	0.02	0.01	
ABC	3.52	1	3.52	1.91	
C x SUBJECTS	51.56	28	1.84		
TOTAL	235.61	63			

GROUP MEANS

		PRE (C1)		POST (C2)		
		Mean	S.D.	Mean	S.D.	N
A1 ATC	AM (B1)	2.63	1.41	5.25	1.49	8
	PM (B2)	3.25	1.98	6.88	1.36	8
A2 AD	AM (B1)	3.38	1.41	5.63	1.30	8
	PM (B2)	3.50	1.51	4.88	0.83	8

TABLE VIII

PHYSIOLOGICAL MEASURES ANALYSIS:
BODY MOVEMENT

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	912671.150	31			
A (ATC vs AD)	37128.472	1	37128.472	1.35	.50>p>.25
C (AM vs PM)	86178.941	1	86178.941	3.12	.10>p>.05
AC	16754.066	1	16754.066	<1	
SUBJECTS WITHIN GROUPS	772609.671	28	27593.202		
WITHIN SUBJECTS	507085.372	30			
B (1st vs 2nd hour)	118551.097	1	118551.097	8.49	p<.01
AB	433.160	1	433.160	<1	
BC	18889.066	1	18889.066	1.35	.50>p>.25
ABC	6093.753	1	6093.753	<1	
B x SUBJECTS WITHIN GROUPS	363118.296	26	13966.088		
TOTAL	1419756.522	61			

GROUP MEANS

		1st HOUR		2nd HOUR		
		MEAN	S.D.	MEAN	S.D.	N
ATC	AM	97.69	69.54	175.13	118.27	8
	PM	134.14	162.45	230.00	205.97	7
AD	AM	41.88	24.22	68.88	20.64	8
	PM	91.71	129.78	228.50	249.11	7

TABLE IX

PHYSIOLOGICAL MEASURES ANALYSIS:
CONDUCTANCE

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	759.1261	31			
A (ATC vs AD)	19.0423	1	19.0423	<1	
C (AM vs PM)	51.2477	1	51.2477	2.083	$.25>p>.10$
AC	.0457	1	.0457	<1	
SUBJECTS WITHIN GROUPS	688.7904	28	24.5997		
WITHIN SUBJECTS	54.7166	32			
B (1st vs 2nd hour)	42.7226	1	42.7226	105.0211	$p<.01$
AB	.1991	1	.1991	<1	
BC	.0260	1	.0260	<1	
ABC	.3798	1	.3798	<1	
B x SUBJECTS WITHIN GROUPS	11.3891	28	.4068		
TOTAL	813.8427	63			

GROUP MEANS

		1st HOUR		2nd HOUR		
		MEAN	S.D.	MEAN	S.D.	N
ATC	AM	7.44	3.51	5.80	3.53	8
	PM	9.06	3.91	7.65	1.85	8
AD	AM	8.43	3.44	6.88	3.29	8
	PM	10.47	5.24	8.53	4.36	8

TABLE X

PHYSIOLOGICAL MEASURES ANALYSIS:
HEART RATE

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	6054.705	31			
A (ATC vs AD)	188.409	1	188.409	<1	
C (AM vs PM)	13.496	1	13.496	<1	
AC	17.108	8	17.108	<1	
SUBJECTS WITHIN GROUPS	5835.692	28	208.417		
WITHIN SUBJECTS	383.271	32			
B (1st vs 2nd hour)	270.808	1	270.808	70.51	p<.01
AB	.135	1	.135	<1	
BC	.224	1	.224	<1	
ABC	4.563	1	4.563	1.19	.50>p>.25
B x SUBJECTS WITHIN GROUPS	107.541	28	3.840		
TOTAL	6437.976	63			

GROUP MEANS

		1st HOUR		2nd HOUR		
		MEAN	S.D.	MEAN	S.D.	N
ATC	AM	74.83	13.72	69.97	13.30	8
	PM	76.13	8.10	72.57	8.68	8
AD	AM	71.80	8.64	68.20	7.44	8
	PM	72.10	11.13	67.67	9.43	8

TABLE XI

PHYSIOLOGICAL MEASURES ANALYSIS:
HEART RATE VARIABILITY

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	178.951	30			
A (ATC vs AD)	.474	1	.474	<1	
C (AM vs PM)	.725	1	.725	<1	
AC	14.417	1	14.417	2.383	.25>p>.10
SUBJECTS WITHIN GROUPS	163.335	27	6.049		
WITHIN SUBJECTS	34.760	31			
B (1st vs 2nd hour)	17.173	1	17.173	28.457	p<.01
AB	.048	1	.048	<1	
BC	1.120	1	1.120	1.860	.25>p>.10
ABC	.125	1	.125	<1	
B x SUBJECTS WITHIN GROUPS	16.294	27	.603		
TOTAL	213.711	61			

GROUP MEANS

		1st HOUR		2nd HOUR		
		MEAN	S.D.	MEAN	S.D.	N
ATC	AM	6.76	1.62	8.12	1.73	8
	PM	7.87	2.37	8.51	1.94	8
AD	AM	7.56	1.47	8.88	1.77	7
	PM	6.58	1.69	7.52	1.80	7

TABLE XII

PHYSIOLOGICAL MEASURES ANALYSIS:
SYSTOLIC BLOOD PRESSURE

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	6200.3594	31			
A (ATC vs AD)	385.1406	1	385.1406	2.13	.25>p>.10
C (AM vs PM)	511.8906	1	511.8906	2.84	.25>p>.10
AC	252.0157	1	252.0157	1.40	.25>p>.10
SUBJECTS WITH GROUPS	5051.3125	28	180.4040		
WITHIN SUBJECTS	1046.5000	32			
B (1st vs 2nd hour)	511.8906	1	511.8906	27.36	p<.01
AB	3.5157	1	3.5157	<1	
BC	.3907	1	.3907	<1	
ABC	6.8905	1	6.8905	<1	
B x SUBJECTS WITHIN GROUPS	523.8125	28	18.7075		
TOTAL	7246.8594	63			

GROUP MEANS

		1st HOUR		2nd HOUR		
		MEAN	S.D.	MEAN	S.D.	N
ATC	AM	116.50	14.96	110.88	10.30	8
	PM	126.63	10.60	120.00	10.35	8
AD	AM	115.75	9.98	109.75	9.08	8
	PM	116.63	6.35	112.25	4.98	8

TABLE XIII

PHYSIOLOGICAL MEASURES ANALYSIS:
DIASTOLIC BLOOD PRESSURE

Source of variation	Sum of squares	df	Mean square	F	P
BETWEEN SUBJECTS	5246.6094	31			
A (ATC vs AD)	511.6094	1	511.8906	3.01	.10>p>.05
C (AM vs PM)	.0156	1	.0156	<1	
AC	147.0157	1	147.0157	<1	
SUBJECTS WITHIN GROUPS	4587.6975	28	169.9144		
WITHIN SUBJECTS	1274.5000	32			
B (1st vs 2nd hour)	1.2656	1	1.2656	<1	
AB	19.1407	1	19.1407	<1	
BC	107.6407	1	107.6407	2.61	.25>p>.10
ABC	34.5155	1	34.5155	<1	
B x SUBJECTS WITHIN GROUPS	1111.9375	28	41.1829		
TOTAL	6521.1094	63			

GROUP MEANS

		1st HOUR		2nd HOUR		
		MEAN	S.D.	MEAN	S.D.	N
ATC	AM	74.25	6.52	76.75	11.60	8
	PM	78.38	7.61	78.63	12.83	8
AD	AM	71.25	11.87	74.50	8.43	8
	PM	72.25	12.24	67.38	7.63	8

CHAPTER IV

SUMMARY AND CONCLUSIONS

This experiment was designed to examine the conflicting theories concerning the psychophysiological correlations of boredom. Some of the theorists have concluded that boredom is a state of declining arousal while others have presented a case for boredom to actually be a condition of increasing arousal. For this experiment, several psychological and physiological factors, generally considered as indicators of level of arousal, were selected for study. Standardized tests established boredom susceptibility and subjective questionnaires given pre- and posttasks established levels of attentiveness, irritation, relaxation, energy, and boredom. The physiological measures included blood pressure, skin conductance, body movement, heart rate, and heart rate variability.

There were two experimental tasks. The first task, a simplified air traffic control (ATC) task, which required the subject to respond to infrequent changes on a simulated radar scope, was expected to produce feelings of monotony and boredom. In anticipation of maintaining a state of interest, another task was used for comparison. The second task consisted of a series of magazine advertisements, each followed by a related questionnaire, to which the subject responded. Sixteen subjects performed each task, with eight each performing in morning or afternoon sessions.

No significant physiological differences were found between groups; however, there were significant declines, from the first to second hour, in conductance, heart rate, and systolic blood pressure, conversely, significant increases were found for heart rate variability and body movement. The decreasing variables showed changes which Barmack (1937) and others have found to accompany monotonous or boring task performance. The variables which increased reflect changes which Thackray et al. (1974) have found to occur during monotonous performance.

Analysis of the subjective questionnaire responses showed significant increases in reported boredom for all groups on both tasks. It is interesting to note that the interest task was perceived as significantly less boring and monotonous in the morning than in the afternoon, while the opposite was true for the boring task. These differences were the only ones which were significant between the two tasks. This suggests that a time-of-day effect was operating; unfortunately, outside of the studies by Dermer and Berschied (1972) and Froberg (1974), the literature contains very scanty information concerning subjective time-of-day effects. These studies found peak daily arousal levels in both early and later afternoon. None of these findings seems to apply to the results of the present study. While the significant interaction between tasks and changes during the sessions suggest that the boring task (ATC) subjects perceived their task to be more tiring than did the interesting task (AD) subjects, overall both tasks resulted in changes such as declining attention and increased irritation which are consistent with Barmack's (1937) findings.

Since both tasks yielded patterns which are identified with boredom, no clear and unambiguous results were obtained to differentiate

between conditions of interest and boredom. It is somewhat puzzling that no greater difference was found between the two tasks, especially when considering that the interesting task was more intellectually demanding than the passive vigilance task.

For the most part, the prior work in the area of boredom research has seized upon a few specific response characteristics and a conclusion of boredom as an increasing or decreasing arousal state has then been inferred. This particular experiment has results compatible with both sides of the question. For instance, the decreases in attentiveness, level of energy, heart rate, and skin conductance would seem to suggest declining arousal, while increases in body movement and irritation suggest increasing arousal. If, however, the construct of boredom is viewed as a complex response pattern consisting of a variety of changes, then little is to be gained by drawing conclusions from studying the various parts out of context with the whole. Davis (1957), for example, has shown that subjective states such as anger, fear, and sex emotion are each characterized by different patterns of physiological activity, with some variables increasing and other decreasing in level of activity. The conclusion, then, is that boredom may be viewed as a complex response pattern and the component parts thereof serve only to define its parameters. Further research is needed to determine how this pattern differs from that associated with interest.

A SELECTED BIBLIOGRAPHY

Baker, C. H. Man and radar displays. New York: The Macmillan Company, 1962.

Barmack, J. E. Boredom and other factors in the physiology of mental effort: An exploratory study. Archives of Psychology, 1937, 218, 1-83.

Berlyne, D. E. Conflict, arousal, and curiosity. New York: McGraw-Hill, 1960.

Berlyne, D. H. Arousal and reinforcement. In D. Levine (Ed.), Nebraska symposium on motivation (Vol. 15). Lincoln: University of Nebraska Press, 1967.

Blake, M. J. F. Circadian variations in mental efficiency. In W. P. Calhoun (Ed.), Biological rhythms and human performance. New York: Academic Press, 1971, 39-108.

Davis, R. C. Response patterns. In R. A. Sternbach (Ed.), Principles of psychophysiology. New York: Academic Press, 1966, 219-227.

Dermer, Marshall, & Berscheid, E. Self-report of arousal as an indicant of activation level. Behavioral Science, 1972, 17, 420-429.

Eysenck, H. J., & Eysenck, S. B. G. Eysenck personality inventory manual. San Diego: Educational and Industrial Testing Service, 1968.

Fiske, D. W., & Maddi, S. R. (Eds.). Functions of varied experience. Homewood, Ill.: Dorsey, 1961.

Froberg, J. E. Circadian rhythms in catecholamine exertion, performance and selfrating. Report No. 36, The Laboratory for Clinical Stress Research, Stockholm, April, 1974.

Geiwitz, P. V. Structure of boredom. Journal of Personality and Social Psychology, 1966, 3, 592-600.

Hebb, D. O. Drives and the C.N.S. (conceptual nervous system). Psychological Review, 1955, 62, 243-254.

Hebb, D. O. A textbook of psychology. Philadelphia: W. B. Saunders Company, 1958.

Johnston, W. A., Howell, W. C., & Goldstein, I. L. Human vigilance as a function of signal frequency and stimulus density. Journal of Experimental Psychology, 1966, 72-5, 736-743.

London, M., Schubert, D. S. P., & Washburn, D. Increases of automatic arousal by boredom. Journal of Abnormal Psychology, 1972, 80-1, 29-36.

Mackworth, J. F. Vigilance and attention. Baltimore: Penguin Books, 1970.

Reinberg, Alain. The hours of changing responsiveness or susceptibility. Perspectives in Biology and Medicine, 1967, 11-1, 111-128.

Thackray, R. I. Monotony and boredom as factors in the design of man-machine systems: A consideration of the evidence relating monotony and boredom to stress. Unpublished paper, Civil Aeromedical Institute, Oklahoma City, 1974.

Thackray, R. I., Jones, K. N., & Touchstone, R. M. Personality and physiological correlates of performance decrement on a monotonous task requiring sustained attention. British Journal of Psychology, in press, 1974.

Zuckerman, Marvin. Manual and research report for the sensation seeking scale (SSS). Unpublished paper, University of Delaware, Newark, 1972.

APPENDIX A

AIR TRAFFIC CONTROL TASK INSTRUCTIONS

"The basic instructions for this experiment have been tape recorded so as to insure accuracy and uniformity of information to each subject. At times, however, you will be asked if you have questions. When this situation occurs, we will stop the tape and ask for your response."

"During the experiment, we will be recording certain physiological responses for later evaluation. Therefore, before explaining the specific tasks that you will be performing, we will now attach the necessary sensing devices. Should you be unfamiliar with such equipment, let us assure you that there are no hazards involved and you will not receive shocks or any other unpleasant stimuli from the devices. We will explain the sensors to you. We will enter shortly and make the attachments."

(Pause: Attach electrodes, give subjective rating scale, form A.)

"The purpose of this experiment is to provide basic information related to the design and use of equipment intrinsic to aviation, air traffic control, and safety; therefore, we request your complete cooperation and attention as a subject in the experiment."

"By now, you probably have visually examined the console at which you are seated. You will notice that the left side of the console is dominated by a circular, simulated radar screen. Upon this screen will be projected targets, or 'blips,' representing aircraft flying along

specific routes, and at various speeds. The scale diameter, of the screen, represents one hundred miles. Because we are using a projector rather than an actual computer-generated radar system, the screen will show a series of static frames rather than a constantly changing radar sweep image. Each target will be designated with certain letters and numbers which will be explained a little later. Also note a small, up-lit, red light at the upper left of the console."

"On the right portion of the console, you will see four vertical columns of color coded buttons. For this experiment, you will only be using three buttons, on the bottom row, that is, the bottom red, yellow, and blue buttons indicated as: altitude check, code, and aircraft check. When the buttons are pressed, they will light up to indicate that your response has been recorded. In a moment, we will give you a signal to press each of the three buttons, in turn, for purpose of demstration. When responding, press the button until it lights up, then release it immediately. Start from left to right and press each button once, starting . . . now."

(Pause.)

"Do you have any questions about the buttons?"

(Pause.)

"O.K., your task will be to monitor the targets on the screen and observe changes in the alphanumeric designation of the targets. The first two letters and the three numbers are identification, for example, SA 521 might represent Standard Airlines, flight five-two-one. The last letter, which will be a letter 'C,' indicates the altitude status of the target aircraft and means the aircraft is maintaining a constant altitude. If the letter 'C' changes to a letter 'N,' it signifies that an

altitude change is occurring. When this happens, immediately push the bottom, red, altitude check button. Respond only during the frame with the 'N' target, do not respond while the frames are changing or during a subsequent frame, such responses will be counted as errors."

"The other two buttons will be used in conjunction, with the red light at the upper left of the console. The red light indicates an alert, broadcast to all aircraft and air traffic controllers, that no altitude changes are to be made during this period. Each time the light comes on, you will acknowledge by pressing the yellow, code button once, disregarding the number of frames it may overlap. Should an aircraft show a change of altitude while the red light is on, also press the blue button, designated aircraft check, and write down the aircraft identification number. Do this even if the light comes on during a frame in which an aircraft is already in a change of altitude state."

"In summary, then, your task will be to monitor the radar and indicate any changes in aircraft altitude by pressing the red button, acknowledge alerts indicated by the console light by pressing the yellow button, and respond to an aircraft changing altitude during an alert by pressing the blue button and writing down the aircraft identification number."

"Do you have any questions about the task?"

(Pause.)

"Very well, we will now make our final equipment adjustments and take three blood pressure readings, after which the experiment will begin. Rest quietly and watch the screen."

APPENDIX B

ADVERTISEMENT TASK INSTRUCTIONS

"The basic instructions for this experiment have been tape recorded so as to insure accuracy and uniformity of information to each subject. At times, however, you will be asked if you have questions. When this situation occurs, we will stop the tape and ask for your response."

"During the experiment, we will be recording certain physiological responses for later evaluation. Therefore, before explaining the specific tasks that you will be performing, we will now attach the necessary sensing devices. Should you be unfamiliar with such equipment, let us assure you that there are no hazards involved and you will not receive shocks or any other unpleasant stimuli from the devices. We will enter shortly and make the attachments."

(Pause: Attach electrodes and give subjective rating scale, form A.)

"The purpose of this experiment is to study the physiological and psychological processes involved in short-term memory and cognitive evaluation. This information is essential to the transformation of theoretical knowledge to practical application; therefore, we request your complete cooperation and attention as a subject in this experiment."

"By now, you probably have visually examined the console at which you are seated. You will notice that the left side of the console is

dominated by a circular screen, which is the only part of the console to be used in this experiment."

"The task which you will be performing consists of two parts. You will first see a reproduction of a magazine advertisement projected upon the screen which you are to read carefully, with the objective of retaining as much information about the format and structure of the advertisement as possible. The advertisement will then be replaced on the screen by a questionnaire consisting of six multiple choice questions, some of which may have more than one possible answer. You will have only a limited amount of time for reading and responding before a new advertisement appears. This series will continue until we tell you that the experiment is over."

"In a few moments we will introduce you to the questions, give you an answer sheet, and discuss them with you."

(Pause: Enter, turn projector on, discuss questions.)

"Very well, we will now make our final equipment adjustments and take three blood pressure readings, after which the experiment will begin. Do you have any final questions before we begin?"

(Pause.)

"Rest quietly now and watch your screen."

APPENDIX C

SUBJECTIVE RATING SCALES: FORMS A AND B

SUBJECTIVE RATING SCALE A

Think of how you feel right now and rate your feelings, attitudes, and emotions by circling the number which best describes them.

1	2	3	4	5	6	7	8	9
Very attentive		Quite attentive		Attentive		Inattentive		Very inattentive

1	2	3	4	5	6	7	8	9
Very wide awake & energetic		Mo More pep than usual		About my usual level of energy		More tired than usual		Very tired and sleepy

1	2	3	4	5	6	7	8	9
Very strained		Moderately bored		Indifferent		Relaxed		Completely relaxed

1	2	3	4	5	6	7	8	9
Extremely bored		Moderately bored		Indifferent		Moderately interested		Extremely interested

1	2	3	4	5	6	7	8	9
Extremely irritated		Quite irritated		Moderately annoyed		Mildly annoyed		Indifferent

SUBJECTIVE RATING SCALE B

Think of how you felt near the end of the task period you just completed. Rate your feelings, attitudes, and emotions by circling the number which best describes them. It is important that you try to rate how you felt while performing the task, and not how you may feel right now.

1	2	3	4	5	6	7	8	9
Very attentive		Quite attentive		Attentive		Inattentive		Very inattentive

1	2	3	4	5	6	7	8	9
Very wide awake & energetic		More pep than usual		About my usual level of energy		More tired than usual		Very tired and sleepy

1	2	3	4	5	6	7	8	9
Extremely bored		Moderately bored		Indifferent		Moderately interested		Extremely interested

1	2	3	4	5	6	7	8	9
Extremely irritated		Quite irritated		Moderately annoyed		Mildly annoyed		Indifferent

Think of how you felt about the task at the end of the period just completed. Circle the number which best describes your feelings.

1	2	3	4	5	6	7	8	9
Extremely monotonous		Moderately monotonous		Not monotonous		Moderately interesting		Extremely interesting

APPENDIX D

ADVERTISEMENT TASK QUESTIONNAIRE

1. For whom do you feel the advertisement was primarily designed?

   A. men
   B. women
   C. men and women equally
   D. not specific to men or women
   E. unsure

2. Did the advertisement include consumer awareness appeal such as:

   A. safety/comfort
   B. ecology
   C. information
   D. economy
   E. none of the above

3. By whom is the product or service most likely to be used?

   A. men
   B. women
   C. men and women equally
   D. not specific to men or women
   C. unsure

4. Did the advertisement stress:

   A. uniqueness/exclusiveness
   B. majority appeal
   C. quality
   D. practicality
   E. none of the above

5. What was the emotion appeal?

   A. sex
   B. love
   C. pride/self-esteem
   D. excitement
   E. other

6. How were claims of product integrity substantiated?

   A. famous person or average person endorsement
   B. guarantee
   C. trademark or major manufacturer
   D. impartial endorsement (i.e., testing company)
   E. none of the above

APPENDIX E

AIR TRAFFIC CONTROL TASK STIMULI PRESENTATION BY: TARGET ORDER, DESIGNATION, AND SPEED PER FRAME

Target identification	Target speed	Target identification	Target speed
1. XW 310	1.0 cm/frame	36. TG 170	0.5 cm/fr
2. EL 190	1.0 " "	37. UX 330	0.5 " "
3. EL 130	1.0 " "	38. TG 110	0.5 " "
4. MH 150	0.5 " "	39. DJ 330	1.0 " "
5. XW 230	0.5 " "	40. XW 90	0.5 " "
6. YO 210	0.5 " "	41. YO 370	1.0 " "
7. MH 190	0.5 " "	42. LB 230	0.5 " "
8. HL 290	0.5 " "	43. YO 190	1.0 " "
9. EX 170	1.0 " "	44. DL 350	1.0 " "
10. YB 250	1.0 " "	45. DL 110	1.0 " "
11. YN 330	0.5 " "	46. UZ 350	0.5 " "
12. UZ 110	0.5 " "	47. QQ 150	0.5 " "
13. UZ 310	0.5 " "	48. DL 310	1.0 " "
14. YB 230	1.0 " "	49. DJ 290	0.5 " "
15. QQ 310	1.0 " "	50. YO 170	0.5 " "
16. XW 110	1.0 " "	51. EX 330	1.0 " "
17. DJ 170	0.5 " "	52. UZ 210	1.0 " "
18. EX 90	1.0 " "	53. EX 190	1.0 " "
19. BJ 230	0.5 " "	54. UZ 290	1.0 " "
20. YN 370	1.0 " "	55. UZ 170	1.0 " "
21. DL 150	1.0 " "	56. DJ 270	1.0 " "
22. DL 230	0.5 " "	57. YN 250	1.0 " "
23. LB 270	0.5 " "	58. HA 170	1.0 " "
24. XW 130	0.5 " "	59. QQ 250	0.5 " "
25. TG 190	1.0 " "	60. QQ 350	0.5 " "
26. TG 350	0.5 " "	61. DL 210	1.0 " "
27. EL 90	1.0 " "	62. BJ 270	1.0 " "
28. MH 270	1.0 " "	63. QQ 290	0.5 " "
29. MH 310	1.0 " "	64. UZ 150	1.0 " "
30. YB 370	1.0 " "	65. YO 90	0.5 " "
31. UZ 230	0.5 " "	66. BJ 250	0.5 " "
32. XW 210	1.0 " "	67. QQ 190	0.5 " "
33. YO 310	0.5 " "	68. EL 170	0.5 " "
34. TG 270	1.0 " "	69. LB 110	1.0 " "
35. YB 330	1.0 " "	70. EX 230	0.5 " "

APPENDIX E

(continued)

Target identification	Target speed	Target identification	Target speed
71. EL 210	1.0 cm/frame	85. LB 190	0.5 cm/fr
72. DJ 230	1.0 " "	86. YO 230	1.0 " "
73. MH 90	1.0 " "	87. XW 350	1.0 " "
74. YO 250	1.0 " "	88. DL 290	1.0 " "
75. EL 310	0.5 " "	89. LB 310	0.5 " "
76. MH 110	1.0 " "	90. UZ 370	0.5 " "
77. UZ 130	1.0 " "	91. EL 270	1.0 " "
78. EL 150	0.5 " "	92. EX 370	1.0 " "
79. DL 170	1.0 " "	93. UZ 90	1.0 " "
80. YO 150	1.0 " "		
81. UZ 190	1.0 " "		
82. BJ 310	0.5 " "		
83. YN 150	0.5 " "		
84. HA 270	1.0 " "		

APPENDIX F

AIR TRAFFIC CONTROL TASK: PROGRAM OF EVENTS

Frame number	Target identification	Event	Frame number	Target identification	Event
4	EL 190	N	123	XW 130	turn
5	MH 150	turn	128	MH 310	enter
7	XW 310	N	128	DL 230	turn
10	EL 290	turn	129	YB 370	enter
13	EL 130	N	129	LB 270	turn
17	EX 170	enter	132	YB 370	N
22	YB 250	enter	137	BJ 230	turn
23	XW 310	N	139	TG 350	turn
28	YN 330	enter	142	UZ 230	enter
30	UZ 110	enter	144	DL 230	N
31	UZ 310	enter	150	LB 270	N
35	YB 230	enter	151	XW 210	enter
37	YB 250	N	151	YO 310	enter
40	YN 330	N	153	TG 270	enter
41	YB 230	turn	155	TG 350	N
41	QQ 310	enter	157	YB 330	enter
45	YN 330	N	158	YB 370	N
45	XW 110	enter	163	TG 170	enter
55	DJ 170	enter	167	UZ 330	enter
56	UZ 310	N	169	YE 330	turn
57	YN 331	turn	173	TG 170	turn
59	EX 90	enter	178	XW 210	turn
64	UZ 310	turn	181	UZ 330	turn
72	BJ 230	enter	187	UZ 330	N
73	YN 370	enter	190	TG 110	enter
75	EX 90	N	190	DJ 330	enter
77	DL 150	enter	190	YB 330	turn
83	DL 230	enter	191	XW 90	enter
85	EX 90	N	196	XW 210	N
87	YN 370	turn	200	YO 370	enter
88	LB 270	turn	201	YO 190	enter
89	XW 130	enter	201	LB 230	enter
102	TG 190	enter	202	XW 90	N
110	TG 350	enter	202	TG 110	turn
113	EL 90	enter	203	DL 350	enter
116	MH 270	enter	205	LB 230	N
117	TG 190	turn	208	DL 110	enter

APPENDIX F

(continued)

Frame number	Target identification	Event	Frame number	Target identification	Event
209	DL 350	turn	335	LB 110	enter
213	YO 190	turn	344	BJ 250	turn
222	UZ 350	enter	345	EX 230	enter
223	DJ 330	turn	346	YO 90	N
224	XW 90	turn	352	QQ 190	N
227	QQ 150	enter	352	QQ 290	turn
230	DL 310	enter	325	YO 90	turn
232	DJ 290	enter	353	EL 210	enter
233	DL 110	N	356	EL 170	turn
233	YO 170	enter	358	LB 110	turn
236	EX 330	enter	359	LB 110	
237	UZ 210	enter	360	DJ 230	enter
243	QQ 150	turn	365	QQ 190	turn
244	DJ 290	turn	366	DJ 230	turn
259	EX 330	turn	369	MH 90	enter
263	QQ 150	N	376	MH 90	N
266	EX 190	enter	378	EL 210	N
267	UZ 290	enter	378	MH 90	turn
268	UZ 170	enter	382	YO 250	enter
273	EX 190	turn	382	EL 310	enter
274	DJ 270	enter	383	MH 110	enter
275	YN 250	enter	385	UZ 130	enter
282	YO 170	N	386	EX 230	N
285	HA 170	enter	393	QQ 290	turn
291	HA 170	turn	394	MH 110	N
293	DJ 290	N	395	EL 150	enter
297	QQ 250	enter	396	MH 110	turn
298	QQ 350	enter	398	EL 310	turn
303	QQ 350	N	401	DL 170	enter
306	DL 210	enter	403	EL 150	N
307	BJ 270	enter	404	YO 150	enter
307	QQ 290	enter	407	UZ 190	enter
309	UZ 150	enter	407	EL 150	turn
310	DL 210	N	410	BJ 310	enter
311	YO 90	enter	412	MH 110	turn
311	QQ 350	turn	414	YN 150	enter
312	YO 90	N	420	MH 110	N
315	BJ 250	enter	420	BJ 310	turn
320	BJ 290	N	427	HA 270	enter
321	QQ 250	turn	429	LB 190	enter
323	DL 210	turn	434	YO 230	enter
326	UZ 150	turn	438	YN 150	turn
332	QQ 190	enter	438	UZ 190	turn
332	EL 170	enter	439	XW 350	enter

APPENDIX F

(continued)

Frame number	Target identification	Event	Frame number	Target identification	Event
444	DL 290	enter	464	XW 350	N
444	HA 270	turn	464	UZ 370	turn
446	XW 350	turn	466	YO 230	turn
448	LB 310	enter	467	YN 150	N
451	YN 150	N	469	EL 270	turn
452	UZ 370	enter	477	YO 230	N
454	XW 350	turn	479	EX 370	enter
458	LB 190	turn	479	UZ 90	enter
462	EL 270	enter			

APPENDIX G

ADVERTISEMENT TASK: PRODUCT ADVERTISERS IN ORDER OF PRESENTATION

1. Taylor Bedding Mfg. Co. - Mattresses
2. PPG Industries - Insulating glass
3. Western International Hotels
4. De Beers Consolidated Mines, Ltd. - Diamonds
5. Schick Safety Razor Co. - Razor blades
6. General Electric - Washing machines
7. Proctor & Gamble Co. - Fabric softener
8. Comerco, Inc., - Olympic Stain Div. - House paint
9. American Forest Institute - Product information
10. General Foods - Dog food
11. Firestone - Tires
12. Sears - Women's clothing
13. Pioneer Electronics Corp. - Stereo/hi-fi equipment
14. Datsun - Automobiles
15. Wish-Bone - Salad dressing
16. Canon USA, Inc. - Still cameras
17. S. C. Johnson & Son, Inc. - Rug cleaner
18. AIC Photo, Inc. - Motion picture cameras
19. American Motors Corp. - Automobiles
20. AIC Photo, Inc. - Camera lenses
21. Rubbermaid Inc. - Bath accessories
22. Kodak - Slide projector
23. Seagram Distillers Co. - Whiskey
24. Mercedes-Benz - Automobiles
25. Mattel, Inc. - Toys
26. Heineken - Beer
27. Clairol, Inc. - Hair coloring
28. Honeywell - Thermostats
29. Bradley Automotive - Kit automobiles
30. CPC International (Mazola) - Cooking oil
31. Henry McKenna Distillery - Whiskey
32. Bulova Watch Co. - Watches
33. P&B Inc. - Camera lenses
34. William Carter Co. - Children's clothing
35. ADT - Security systems
36. Questor - Disposable baby bottles
37. Starcraft - Travel trailers
38. Rotorway Inc. - Kit helicopters
39. Gerber Products Co. - Baby care products
40. General Motors, Chevrolet Div. - Automobiles
41. General Motors, Chevrolet Div. - Pickup trucks

APPENDIX G

(continued)

42. Johnson & Johnson - Baby oil
43. Gallo Vineyards - Wine
44. Ely & Walker - Children's clothing
45. Parker - Writing pens
46. Clairol - Hair spray
47. U.S. Industries - Clothing
48. Phelps Dodge - Cable and wire products
49. Norge - Washing machines
50. Bausch & Lomb - Sunglasses
51. Personal Products Co. - Sanitary napkin
52. STP - Automotive air filters
53. Sarah Coventry - Jewelry
54. Honda Motor Co. - Motorbikes
55. Bank of New York - Banking and finance services
56. Mirro Aluminum Co. - Portable electric broilers
57. Kraft - Cheese products
58. Ralston Purina Co. - Dog food
59. General Motors, Delco Div. - Shock absorbers
60. Betty Crocker - Convenience foods

VITA

Joe Powell Bailey

Candidate for the Degree of

Master of Science

Thesis: LEVELS OF AROUSAL: A COMPARISON OF CONDITIONS OF INTEREST AND BOREDOM

Major Field: Educational Psychology

Biographical:

Personal Data: Born in Oklahoma City, Oklahoma, August 10, 1942, the son of Mr. and Mrs. J. Tooley Bailey. Married to Janet Lee McDermett Bailey, with two children, Bobbi Lavon Bailey and Floyd Eric Bailey.

Education: Graduated from John Marshall High School, Oklahoma City, Oklahoma, in May 1960; attended Oklahoma State University in 1960 and 1961; attended Oklahoma State University Technical Institute (Oklahoma City) in 1965; received the Bachelor of Science degree from Oklahoma State University in 1970, with a major in Psychology; completed requirements for the Master of Science degree at Oklahoma State University in July, 1975.

Professional Experience: Psychology Technician, Federal Aviation Administration, Civil Aeromedical Institute, 1972 to present.