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EFFECTS OF INSTRUCTIONS ON A GROUP-ADMINISTERED

TASK OF AUDITORY VIGILANCE

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CHAPTER I

INTRODUCTION

Man is a poor monitor. Operational and laboratory studies have unequivocally established this fact. Nevertheless, the man continues to serve in this role everyday in "man-ascendant" and "machine-ascendant" systems (Crawford, 1961), in which a signal output must be monitored for bits and chunks of information defined as important. In extreme cases, the ultimate survival of the system and the monitor may depend upon the detection of this important information. At the least, the operating efficiency of the system and the monitor will be determined by how well the man functions in this role.

The task of monitoring requires that the man-monitor direct his attention on a signal output and sustain continuously a level of attentional efficiency commensurate with the criticality of the signals to be detected. A large number of studies have shown the attentional efficiency of the man-monitor is degraded when his task is to detect critical signal outputs under the following conditions: (a) the period of monitoring is relatively long and continuous; (b) the critical signal has a relatively low probability of occurrence; (c) the critical signals occur at irregular intervals; (d) the critical signal contrast value is close to a threshold level; and, (e) the working environment is characterized by a reduction in stimulus and response variation (Mackworth, 1950; McGrath, Harabedian, & Buckner, 1959; Bergum & Klein, 1961; Frankmann & Adam, 1962).

The operational consequences of deterioration in attentional efficiency has been illustrated by Bergum and Klein (1961) in a simple example of system reliability. If it is assumed that the hardware components of a given man-machine system is a constant 99% throughout a specified period of operation, and the man-monitor's efficiency is also 99% at the beginning of the watch, then initial system reliability is 98%. If at the end of one-half hour on the job, human monitor efficiency is determined to be 84.3%, total system effectiveness has declined to 83.5%. If at the end of a still longer period of monitoring, man-monitor efficiency drops to 27.6%, total system effectiveness is 26.7%. Thus, it can be seen that human component efficiency can significantly determine overall system efficiency. The reader should bear in mind that system reliability is a function of the products of the individual reliabilities of the components (Ordnance Corps, 1962, p. 149). Dobbins and Skordahl (1962) have prepared an extensive inventory of military and civilian-type jobs in which monitoring is a critical component, requiring high man-monitor reliability.

As a result of interest in the problem of deterioration of attentional efficiency, beginning with Mackworth's (1950) World War Two classic studies of factors affecting the performance of radar operators, a large body of literature has developed. This mass of literature, referred to as <u>vigilance</u> research, has dealt with factors contributing to decline in attentional efficiency and techniques and methods for eliminating or minimizing such deterioration.

Terminology and Concepts

Before proceeding further, the reader should become familiar with some terms and concepts used in vigilance research. From this point on, the vigilance component of attention will be the area of concern.

The investigation of vigilance deals with signal detection under conditions of relatively prolonged and continuous monitoring, when critical signal occurrence interval is irregular, critical signals have a low occurrence probability, critical signal- to-non-critical signal contrast is close to threshold, and the monitoring environment is, in general, characterized by stimulus and response impoverishment.

To detect signals under the conditions enumerated above, the monitor must sustain a high level of alertness or vigilance for the duration of the assigned monitoring or watchkeeping session. The session is sometimes called a watch for short.

The signal output from a display may consist of several types or classes of signals. The particular signal which the monitor is required to detect and report is called the critical signal. During a watch the monitor is required to detect and report a critical signal or signals. The number of critical signals occurring per unit of time on watch is called signal rate. A non-critical signal reported as a critical signal is called either a false positive, false report, or erroneous report. The latter term is used in the investigation to be reported.

Vigilance performance can be evaluated in terms of (a) number of critical signals detected, (b) number of critical signals missed, (c) number of erroneous reports, (d) response latency, (e) changes in threshold sensitivity, and (f) ratio of erroneous reports to critical signals reported. Efficient monitoring is most directly associated with (a) number of critical signals detected and (b) number of erroneous responses. The ideal monitor should detect <u>all</u> critical signals and make <u>no</u> erroneous reports. For a complete discussion of assessment of vigilance performance, the reader is referred to McGrath (1963c).

<u>Vigilance decrement</u> is said to occur if the probability of a signal's being detected decreases as a function of the amount of time the monitor has spent on watch. Vigilance decrement is demonstrated empirically by a decrease in the number of critical signals detected across successive blocks of monitoring trials during a watch. This decrement is expected to be greatest at the end of the first half-hour of a watch (Mackworth, 1950). Sometimes this decrement across time is referred to as the <u>vigilance effect</u> (Bergum, 1963). Assuming signal output strength or contrast to be constant across time, vigilance decrement can be considered to be an attribute of man-monitor behavior.

A <u>simple vigilance</u> task requires the monitor to attend to a single signal output source from a signal display system. A <u>complex vigilance</u> task requires the monitor to attend to several classes of signals from a single display system, multiple displays using a single sense modality, or multiple displays impigning on more than one sense modality.

Monitoring may involve the use of either the <u>visual</u>, <u>auditory</u>, or <u>tactile</u> sensory modalities either singularly or in combination. Vigilance decrement has been found to be characteristic of monitoring regardless of sensory modality used to monitor.

Research Approaches to the Study of Vigilance

The vast bulk of vigilance research has been concerned with identifying the factors underlying defective vigilance performance and vigilance decrement and methods and techniques for improving monitoring performance and eliminating or minimizing decrement. Much of this research is summarized elsewhere (Mackworth, 1950; McGrath, Harabedian, & Buckner, 1959; Bergum & Klein, 1961; Fiske, 1961; Frankmann & Adams, 1962; Baker, 1963; Bucker & McGrath, 1963; Bergum, 1963; Jerison & Pickett, 1963; Broadbent, 1964; Poulton, 1966).

In general, the research has followed two lines of investigation. One approach has been to investigate stimulus, response, and environmental characteristics of the monitor's task as well as management factors associated with the task. The other approach has concentrated on the attributes and state of training of the monitor. It is beyond the scope of this paper to exhaustively review the findings of all these studies. It will suffice to identify the major topics investigated and cite representative studies.

The first approach has involved studies that relate vigilance performance to <u>choice of sense modality and modalities in combination</u> (Buckner & McGrath, 1961, 1963a; R. Baker, Ware, & Sipowicz, 1962; Osbourne, Sheldon & R. Baker, 1963; Gruber, 1964; Loeb & Hawkes, 1961); <u>signal magnitude</u> (C. H. Baker, 1963); <u>rate of signal presentation</u> (C. H. Baker, 1963); <u>probability of critical signal occurrence</u> (Colquhoun, 1961; Broadbent, 1963; Colquhoun & Baddely, 1964); <u>spatial distribution of signals</u> (C. H. Baker, 1963; J. Mackworth, 1963a, b); <u>intersignal interval</u> (C. H. Baker, 1963; McGrath & Harabedian, 1961, 1963); <u>detection response</u>

complexity (Monty, 1962); use of irrelevant stimulation (McGrath, 1960, 1963; Kirk & Hecht, 1963; Ware, Kowal, & R. Baker, 1964); ambient temperature (N. H. Mackworth, 1950); noise level (Jerison & Wing, 1957); rest periods (N. H. Mackworth, 1950; Bergum & Lehr, 1962a, b, 1963c); and, number of monitors employed (Schafer, 1949; Bergum & Lehr, 1962c, 1963c).

In general, it has been found, subject to qualifications found in the above-cited references that: (a) auditory monitoring tends to be more efficient than visual monitoring; (b) dual mode monitoring results in better signal detection performance than single mode monitoring; (c) alternating modalities employed improves vigilance performance; (d) increasing signal rate improves performance; (e) increasing signal magnitude improves performance; (f) signal detection is probably better in areas of high signal density; (g) more signals are probably detected at the average intersignal interval; (h) increasing signal detection response complexity, can improve vigilance performance if the response does not become too comples; (i) bombardment of monitors with irrelevant stimulation in one sense modality can improve vigilance performance in another sense modality; (j) high and low temperatures can adversely affect vigilance performance; (k) noise can adversely impair vigilance performance; (l) rest periods, regardless of length, improve subsequent vigilance performance; and, (m) increasing number of monitors of the same signal output yields more overall signal detections to a point of diminishing returns.

Investigations comprising the second approach in vigilance research, i. e., the attributes of the monitor and his state of training have been concerned with: reliability of performance (Buckner, Harabedian, & McGrath, 1960; Buckner, 1960; C. H. Baker, 1963a); predictability of performance (McGrath, Harabedian, & Buckner, 1960; McGrath, 1961, 1963a); temperament and personality (Bakan, 1959, 1963a, b; Bakan, Belton & Toth, 1963; Colquhoun, 1960); intelligence (N. H. Mackworth, 1950; McGrath, Harabedian, & Buckner, 1960; Ware, 1961; Sipowicz & R. A. Baker, 1961; Ware, R. A. Baker, & Sipowicz, 1962); sex of monitor (Whittenburg, Ross & Andrews, 1956; McCormack, 1960, Hardesty, Trumbo & Bevan, 1963; Neal & Pearson, 1966); age of monitor (York, 1962; Griew & Davies, 1962; Neal & Pearson, 1966); and, state of monitor training (Wiener, 1963; Hardesty, Trumbo & Bevan, 1962).

In general, the results of these investigations have shown: (a) performance of monitors is reliable; (b) selection tests, with the exception of job sample monitoring tasks, have not been dependable predictors of vigilance performance; (c) temperament and personality seem to have some relationship to vigilance performance; (d) intelligence has not been found to be related to vigilance performance; (e) generally, level of vigilance performance has not been conclusively shown to be related to sex of monitor, although a recent evidence suggests women may be poorer auditory monitors; (f) level of vigilance performance has not been conclusively related to age of the monitor, in spite of the expectation that older monitors should be less efficient than younger monitors; and, (g) knowledge of results in training has been found to benefit vigilance performance.

Motivation and the Monitor

Of particular concern to the present dissertation is a large body of the above studies dealing with the factors which act upon the monitor in such a way as to influence his level of motivation. Level of motivation is, in turn, assumed to be reflected in vigilance performance.

Factors that raise the monitor's level of motivation can be conceived of as operating on the energy-mobilizing processes within him. These processes function to increase his energy level. It is assumed one consequence of energy increase is an increased state of alertness which in turn enables him to sustain an increased level of attention. This then leads to an improvement in vigilance performance.

A common finding in many vigilance investigations has been the wide range of individual differences in performance levels observed among subjects. This implies that the efficiency of the suggested energy mobilization processes is ultimately a function of the individual monitor.

Since the monitoring performance of monitors has been found to be reliable (Buckner, Harabedian, & McGrath, 1960; Buckner, 1960; C. H. Baker, 1963a), that is, monitors tend to maintain their relative rank-order, and since attempts to predict vigilance performance has been relatively unsuccessful using conventional selection tests (McGrath, Harabedian, & Buckner, 1960; McGrath, 1961, 1963a), it is suggested that motivational processes play a significant role in determining vigilance performance at least equal to that of ability. Ordinarily, it would be expected that reliable monitor performance would permit the identification of stable predictors of performance, other than job samples, if ability were the primary determinant of performance. Since this has not been the case, some other factor, such as motivation, must play a significant role.

The role of motivation has not been overlooked. Various investigators have asserted that motivation of the monitor is an important factor in vigilance. McGrath, Harabedian, and Buckner (1959) suggested:

> It is highly probable that the observer's motivation is related to his ability to sustain a high detection rate over a prolonged period of time. Secondary results of vigilance experiments have indicated that motivation is a potent factor in determining vigilance performance (p. 9).

Bergum and Klein (1961) noted:

> A broad range of variables known to significantly alter vigilance performance can be conceived of in terms of their motivational effects on the observer. Included among these are the effects of knowledge of results, end spurt, drugs, extraneous stimulation, special instructions, rest periods, and even the frequency of stimulation. In addition, the often noted large individual differences in susceptibility to vigilance decrement suggest that personality (i. e., motivational) variables are of considerable significance in vigilance performance.
>
> The preponderance of variables leading to improved performance are either motivational in character, or inherent to a given operational situation (p. 35).

C. H. Baker (1963) commented:

> . . . motivation level determines the initial level of performance in a vigilance task and expedite or postpone the onset of a decrement in performance. Very early in a task, motivation is a substitute for knowledge of series structure (p. 144).

Frankmann and Adams (1962) stated in their interpretation of Deese's expectancy hypothesis of vigilance performance:

> The level of vigilance for any observer is also subject to modifications due to changes in his motivational states whereas

his extrapolation of future stimulus events might be affected by such changes [in expectancy] (p. 261).

Griew and Davies (1965) have suggested that failure to find age differences in vigilance studies could be due to older monitors operating at a higher motivational level to compensate for psychological deficits associated with advanced age.

Some Empirical Investigations of Monitor Motivation

The results of a number of studies have suggested the operation of the motivation component in the vigilance task. Bergum and Lehr (1963b), for example, found that an end-spurt, characteristic of many vigilance decrement curves reported in the literature, could be eliminated by not telling the subjects how long their watchkeeping session would last and by taking away their timepieces.

The use of knowledge of results (KR) has proved to be a potent improver of vigilance performance, and in some cases has eliminated vigilance decrement (N. H. Mackworth, 1950; Sipowicz, Ware, & R. A. Baker, 1962; Pollack & Knaff, 1958; Wiener, 1963; Hardesty, Trumbo, & Bevan, 1963; Johnson & Payne, 1966). Wiener (1963) investigated the completeness of KR and found that _complete_ KR -- knowledge of correct detections, commissive errors, and ommissive errors -- resulted in superior signal detection when compared to less complete KR and no-KR treatments. It was also shown in the same study that effects of _complete_ KR tended to persist when KR was withdrawn and the signal rate was changed. Johnson and Payne (1966) demonstrated that increasing the frequency of KR improved overall signal detection performance.

Sipowicz, Ware, & R. A. Baker (1962) reported that both KR and rewarded performance resulted in better signal detection performance than no KR and no reward. The highest level of performance was obtained when KR and reward were combined. Bergum and Lehr (1964) found that rewarded signal detection resulted in significantly higher performance levels during early portions of a long watch but deteriorated to the level of unrewarded monitors before the watch terminated. When reward was withdrawn, formerly rewarded monitors detected fewer signals than never-rewarded monitors.

Shifting the locus of KR can lead to an improvement of vigilance performance. C. H. Baker (1961, 1963b) reported that performance on a central monitoring task could be enhanced by giving only KR concerning performance on a concurrent peripheral task.

Even false KR has been found to lead to an improvement in vigilance performance (Loeb & Schmidt, 1960; Weidenfeller, R. A. Baker, & Ware, 1962). Weidenfeller, et al. (1962) demonstrated that false KR administered according to a random schedule can be almost as effective in improving vigilance performance as actual KR.

Pollack and Knaff (1958) reported that punishment for missing signals may be highly effective in improving vigilance performance under certain circumstances. It has been suggested by Glueksberg, Karsh, Lince, and Potts (1962) that punishment may be as effective as KR in improving vigilance performance.

The mode of KR presentation has been found to affect vigilance performance. Hardesty, Trumbo, and Bevan (1963) found that KR delivered by the experimenter <u>in person</u> or via intercom system resulted in a higher level of vigilance performance than presenting KR by an impersonal display of lights. Superiority of the personalized KR treatment persisted on two subsequent test days after KR had been withdrawn. This interpersonal effect has been reported by others. Fraser (1953) reported that vigilance performance was higher when the experimenter was in the room than when he was outside the experimental chamber. Mackworth (1950) found that a telephone message to the subject, telling him to do better, resulted in improved signal detection performance. Bergum and Lehr (1963a) reported that subjects visited by an authority figure during monitoring performed better at a vigilance task than those monitoring under permissive conditions. Ware, Kowal, and R. A. Baker (1964) demonstrated that democratically-treated monitors performed at a higher level on a vigilance task task than autocratically-treated monitors.

In general, multiple and paired monitoring has been found to be a means of improving vigilance performance (Schafer, 1949; Bergum & Lehr, 1961, 1963c). The findings of Bergum and Lehr (1961, 1963c) showed that monitors working together detected more signals than monitors working in isolation. Even when monitors were paired but did not work together, they detected more signals at high signal rates than monitors working in isolation. Performance scores of paired monitors were found to be significantly correlated ($r = .709$, $p < .05$, $N = 10$ pairs). Noting that subjects were not permitted to communicate, the investigators reported they were unable to uncover the factors and underlying the correlated performance.

Drive states, inertia levels, and so forth, associated with personality or temperament characteristics of the monitor may influence how readily the monitor can perceive and respond to motivating stimuli and channel the energy necessary to attain the required level of alertness for a vigilance task. Comparing the performance of introverts and extraverts, Bakan (1959) found that extraverts missed more signals than introverts. Extraverts, on the other hand, tended to benefit more from extra stimulation -- responding to the occurrence of a secondary signal -- than introverts. Initially the performance of extraverts resembled that of introverts. In the long-run, even with secondary signals, the performance of extraverts deteriorated significantly on the primary monitoring task. Bakan's results suggest that extraverts cannot sustain the high level of attention required for vigilance as well as introverts. These findings were confirmed by Bakan, Belton, and Toth (1963). In this experiment, introverts, extraverts, and normal subjects were compared on an auditory vigilance task. The performance of normal subjects more closely resembled that of extraverts than introverts. It was also found that introverts were better monitors in isolation, whereas extraverts were better monitors as members of a group. Bakan and Manley (1963), using self-description retrospective reports, reported that poor monitors tended to describe themselves as being <u>low in efficiency</u> and having <u>negative affect</u>, while good monitors presented a picture of <u>efficiency</u> and <u>positive motivation</u>.

Bakan (1963b) reported that extraverts expressed a preference for monitoring in the afternoon, while introverts preferred mornings. Colquhoun (1960) demonstrated that such preferences may be reflected in vigilance task performance.

Bakan (1963a) analyzed vigilance task description retrospective report items by means of factor analysis and extracted five factors which he named: (a) arousal or interest; (b) frustration; (c) motivation; (d) self-evaluation of performance I; and, (e) self-evaluation of performance II. It is interesting to note that arousal and motivation are the names of two different factors.

Drug effects can be considered under motivation factors since they operate on underlying physiological processes motivation. Amphetamine sulfate (Benzedrine) is a well-established energizer for improving vigilance performance (Mackworth, 1950; Weiner, 1961; Weiner & Ross, 1962). Weiner and Ross (1962) reported that a lactose placebo was almost as effective as d-amphetamine sulfate in increasing observer responses in a vigilance task. In fact, the effects of the placebo were more reliable than that produced by d-amphetamine sulfate, insofar as producing fewer paradoxical reactions. Weiner and Ross went so far as to suggest that a placebo be substituted for d-amphetamine sulfate whenever possible. It is interesting to note that N. H. Mackworth (1950) reported no placebo effect associated with vigilance performance in his drug study.

Effects of Instructions on Vigilance Performance

Among studies of monitor motivation, investigations dealing with the effects of instructions on vigilance performance were conspicuous by their absence. One such experiment was generated to answer methodological questions raised by the Weiner and Ross study mentioned above. O'Hanlon, Schmidt, and C. H. Baker (1964) raised the question that the Weiner and Ross "placebo effect" may have been due to the instructions given the subjects. To evaluate this possibility, an all placebo experiment was designed using as subjects four groups of inmates from a state penal colony in California. These subjects had previously served as paid subjects in vigilance research conducted by the investigators.

In the orientation, prior to beginning their watch, subjects were briefed in groups of four as to the general purpose of the experiment. After the briefing, subjects were given one of four "drug" treatments -- orange pill, yellow pill, white pill, or no pill. Orange pill subjects were informed that the purpose of the experiment was to prove that their pill was supposed to make people more alert. Yellow pill subjects were told that it was important to find out if their pill would really make them less alert resulting in their missing signals. White pill subjects were informed their pill was believed to affect alertness, but how it affected alertness was not known; the purpose of the experiment was to find out in what direction alertness was affected. No pill subjects were told, essentially, that they were a control group designed to see how alert people are when no pills are used, in comparison to people who took different kinds of pills.

After receiving their pills, subjects were given a "medical check." Following the "check," subjects performed a ninety minute watch. Analysis of signal detection data revealed no significant differences between treatment groups. Analysis of subjective reports showed that subjects tended to report impairment as a result of capsule ingestion more frequently than enhancement or no effect. Subjects gave the experimenters no reason to believe they suspected they had been given inert material. An incidental finding was that the performance of subjects on the vigilance task had improved since the last time the subjects had participated in a vigilance experiment. The investigators interpreted this as suggesting that knowledge they were participating in a drug study may have had a motivating appeal to the inmates.

The O'Hanlon, et al. study can be criticized basically on the basis of the subject population used, if the reader will excuse a speculative excursion into stereotyping. Since the subjects were inmates of a penal colony, it seems reasonable to suggest that members of such a population may have more sophistication concerning anticipated drug effects than other groups that could have served as a source of subjects. This suggested sophistication could have developed via direct experience with drugs or as a result of cognitive expectancies resulting from social interaction with inmate peers who had had such experience. Given expectancies concerning effects of certain type drugs, it is suggested that subjects did not experience the subjective side-effects they anticipated. Since these expectancies were not met, the instructions concerning drug effects did not have the motivating effects anticipated by the investigators.

Perhaps, had O'Hanlon and company utilized stooges a' la Schachter (see Mandler, 1962) their deception might have led to different results. Weiner and Ross (1962) used college students as subjects in their study. Quite possibly college students, being less sophisticated in drug effects than prisoners, might have been more susceptible to placebo effects.

CHAPTER II

PROBLEM

The experimental psychologist has been aware of the motivational consequences of instructions administered before, during, or after a bit of behavior. Performance levels of subjects, for example, can be changed if subjects are told their task is important or unimportant (Brown, 1961). It is surprising that the influence of instructions on vigilance performance has not been systematically explored. There is no reason to believe instructions should not be motivating. Perhaps there has been over-concern with central nervous system mechanisms and other underlying processes or with the more tangible determinants of vigilance performance.

There is a need for a program of research on the relationship of pretask instructions to vigilance performance designed to answer three basic questions:

(a) Can pretask instructions influence vigilance performance?

(b) How long do pretask instruction effects persist into a watch?

(c) What kinds of instructions are effective determiners of vigilance performance?

A Conceptual Framework: Demand Characteristics

Orne's (1962) formulation of the demand characteristics of the psychological experiment provides a useful conceptual framework within which to investigate the motivational effects of instructions on vigilance performance. According to Orne's position, the subject in a psychological experiment is an active participant in a special form of social interaction called the "psychological experiment." He is not just passively responding to the experimenter-presented stimuli automatically in accord with the experimenter's expectations as defined by the experimental rationale. The behavior of a subject in an experiment is conceived to be problem solving behavior in which the subject sees his task to be one of ascertaining the true purpose of the experiment and responding in a manner which will support the hypothesis being tested. To accomplish this ". . . the totality of clues which convey the experimental hypothesis to the subject (Italics mine) become the significant determinants of the subject's behavior" (Orne, 1962, p. 779). These clues, Orne called "demand characteristics of the experimental situation" (p. 779). Such clues can be rumors about the experiment, information imparted during subject recruitment, the person of the experimenter, explicit and implicit communication during the experiment, apparatus, time-of-day, ambient environment of the laboratory, apparent subject characteristics, and many others. In light of this formulation, it can be said that a subject's score in any psychological experiment is a function of (a) the experimenter's independent variables; (b) the subject's interpretations of the independent variable, purpose of the experiment, and associated stimuli; and (c) other factors that fall outside the realm of this investigation.

The extent to which demand characteristics can influence experimental results has been demonstrated by Orne (1962, 1965) and Orne and Scheib (1964). In the latter study, it was demonstrated that some of the findings of sensory deprivation studies could have been due to demand characteristics arising from procedures and situational stimuli associated with the sensory deprivation experiment. Especially crucial in that study were the consistency and mutual support of cues. It was suggested earlier that O'Hanlon, Schmidt, and C. H. Baker (1964) failed to obtain a placebo effect due to an inconsistency of cues resulting from a possible subject experience factor.

Orne (1962) has suggested that subjects in a psychological experiment, especially college students, identify with the goals of science in general and feel they have a personal stake in the success of the experiment in which they are participating. To have this feeling of personal stake, the subject must assume (a) the experimenter is competent and (b) that he himself is a "good subject."

According to this formulation, a "a good subject" is one who perceives his task as validating the experimenter's experimental hypothesis. Consequently, in line with the demand characteristics position, the subject will make an effort to seek-out cues which will enable him to identify the experimenter's hypothesis so that he can direct his behavior toward validating the hypothesis and thus fulfill the role of "good subject." This is especially the case when the experimenter is concealing his true experimental hypothesis from the subject, or when the subject <u>believes</u> the hypothesis is being concealed. If the cue elements in the experimental situation yield a <u>consistent</u> picture supporting the perceived hypothesis, the subject is expected to perform qualitatively and quantitatively in a manner intended to support the perceived hypothesis. Obtained performance level should reflect the perceived hypothesis. If, on the other hand, the subject is unable to ferret-out a set of cues that yield a consistent picture of the perceived hypothesis, the subject may cease and desist in attempting to "validate" the experimenter's hypothesis. Such a situation could be reflected in an overall low level of task performance and a wide range of individual differences in performance. Thus, in planning an experiment involving deception of subjects, it is critical that deception cues be consistent and mutually supporting.

According to Orne (1962):

> One of the basic characteristics of the human being is that he will ascribe purpose and meaning even in the absence of purpose and meaning (p. 780).

since

> . . . subjects have a real stake in viewing their performance as meaningful (p. 780).

It can thus be assumed that subjects will seize upon all available cues to attribute meaning to an otherwise "purposeless" situation to justify one's participation in such a situation. Such a "purposeless" situation, from a subject's point of view, can be the psychological experiment in which he is participating.

Orne has suggested the following hypothesis for empirical test:

> *We should predict that there would be measurable differences in motivation between subjects who perceive a particular experiment as "significant" and those who perceive the experiment as "unimportant."* (italics mine) (p. 778).

This hypothesis is critically relevant to the investigation of the relationship between pretask instructions and vigilance performance.

The Vigilance Task

A typical vigilance task is inherently a monotonous task. The monitor must repetitively evaluate a sequence of stimuli presented to him at a given rate over a relatively prolonged period of time. His task is to detect and report the occurrence of certain stimuli which have been defined to him as critical. Such stimuli typically have a low stimulus contrast value with respect to noncritical stimuli. This means each stimulus must be evaluated. The task is so contrived that (a) few critical signals occur during a watch, (b) critical signals occur at irregular intervals, (c) the monitor has no foreknowledge of critical signal rate or frequency of occurrence, and (d) the monitor must concentrate on all stimuli presented in order to detect all critical stimuli programmed to occur. To perform successfully at this task, the monitor must sustain a high level of attention continuously during the entire period of the watch. Failure to do so can result in a critical signal not being detected.

Such a task can have the aura of a "purposeless task" to the assigned monitor, especially if he is given no feedback concerning how successful he has been in performing a task such as this. It is conceivable, in such a situation, that a monitor may become discouraged and choose either to not pay attention or allow his level of attention to fluctuate. As a result, signal detection performance may deteriorate. As pointed-out earlier, deterioration in signal detection performance has been shown to be characteristic of vigilance performance. It is suggested here, that to some degree, such deterioration in vigilance performance is a function of the monitor's choosing to pay attention or not pay attention. Bakan's (1963) analysis of retrospective reports of subjects who performed an auditory vigilance task suggested that, in fact, some subjects may have become discouraged and chose not to monitor.

Subjective Fatigue

A curious side-effect found associated with performing a vigilance task has been a soporific effect (McGrath, 1960; Bakan, 1963). McGrath (1960) interviewed subjects following a vigilance task. His subjects reported their main problems during the watch were (a) detecting signals and (b) staying awake. After analysis of the subjective reports, McGrath concluded:

> The main problem solving task as far as most subjects were concerned eventually boiled down to trying to stay awake rather than trying to detect signals (p. 5).

He further reported that his subjects employed techniques such as walking around the monitoring booth and making-up games, to name a few, to stay awake. McGrath was not able to report any relationship between subjective reports and vigilance performance. Bakan utilized a questionnaire and obtained similar reports from his subjects. They too found the task soporific yet made an effort to stay awake by stretching, moving about, and shaking themselves.

During the pilot studies that preceded this dissertation, a colleague who was using the same group of subjects complained they had been "ruined" for his study, because the subjects came to him "looking beat" and "acting beat" and tended to be rather hostile toward his experiment. This raised the question whether the nature of the "effect" was psychological due to disagreeable nature of the vigilance task or physiological or sensory in nature, induced by task stimuli.

The above-mentioned problem has not as yet been investigated. It is suspected the effect is psychological rather than stimulus-induced by the nature of the vigilance task. If it is psychological in nature, it is suspected the effect would be sensitive to instruction effects. A vigilance task perceived to be worthwhile and interesting should have less associated soporific effect than a vigilance task perceived as not worthwhile and uninteresting.

Concept of the Investigation

The problem areas identified in the preceding sections suggested the need for an investigation to evaluate the effects of pre-task instructions on vigilance performance. More specifically: (a) a need to compare the vigilance performance of subjects who have received "special" pre-task instructions with subjects who received "standard" or "non-special" pre-task instructions; and (b) a need to compare the effects of pre-task instructions with the effects of a task structuring technique which has demonstrated performance-enhancing capabilities, with respect to a vigilance task. Since it was planned to use the Bakan auditory vigilance task, one suitable technique for enhancing vigilance performance was the secondary signal used by Bakan (1959). The secondary signal has the effect of increasing effective signal density, thereby increasing the arousal characteristics of the task.

Since Orne (1962) has suggested that subjects who perceive an experiment as "significant" will be measurably more motivated than subjects who perceive an experiment to be "not significant," this suggested to believe he should do well. The motivation associated with the task was intended to be intrinsic to the task itself. It should be noted that "attention to perceptual detail" was selected because it was a fictitious variable yet was judged to sound "psychologically important" to subjects and yet avoided the ethical problems that could arise from the use of potentially ego-damaging attributes of subjects (Kelman, 1965).

Certain preparations were required for the subjects assigned to this treatment before they arrived at the experiment room. Since subject rosters were available prior to an experimental session, 3 x 5 slips of paper were prepared. Each slip contained the name of the subject as it appeared in the University of Oklahoma student directory and a "test score" greater than 90 and less than 100. These slips of paper were attached to the form booklets to be used during the experimental session. Prior to the session an attempt was made to telephone each SI subject and remind him or her to come to the experiment. If a subject could not be reached by telephone the experimenter made a point of apologizing to the subjects for their not being called.

At the experimental session, experiment form booklets were passed-out to subjects, as the experimenter called-off the name of each subject. After booklets were distributed, subjects were given the following pre-task instructions, also shown in Appendix J:

> Let me begin by saying, participation in this experiment will satisfy the Psychology 1 requirement to participate in an experiment. Let me assure you that you will not be shocked or subjected to physical pain.
>
> Did everyone get a reminder phone call this afternoon? If you didn't, I apologize. You were supposed to be called.

We've gone to a lot of trouble to get some information on you before you came here tonight. We have developed a special scoring key that is used to predict how proficient a person should be in the ability to attend to perceptual detail. To do this, the scoring key is applied to the freshman orientation test you took, and we obtained a special "attention to perceptual detail" score.

Tonight we want to check out this score. All of you should have high "attention to perceptual detail" scores, and we are particularly interested in those persons with high scores. A high score is one of 90 or higher. Your score is the red number on the slip of paper attached to your form booklet. Make sure you write your score on each form you fill out tonight.

Before we go any further, write your student ID number on the slip of paper that contains your score. Turn the slip in as you leave the experiment tonight. Your ID number permits us to double check your score.

Tonight, you will perform a task that requires "high attention to perceptual detail" ability. Since you all received high scores, 90 or better, I don't anticipate you will have any difficulty with the task. You should all do extremely well.

Let's get started, and I'll tell you what you are going to do.

Note, the instruction emphasis was on the ability of the individual subject in the instructions, the high scores and their relationship to performance, and the esoteric nature of the task as far as "scientific significance" was concerned. While subjects performed the MLT, the experimenter perused a statistics text as he had during RC treatments.

Subject Important-High Task Load. Subject Important-High Task Load or SI+ treatment was included for the same reason as IT+. Subjects assigned to SI+ were treated identically as SI subjects except they performed the MLT under high task load.

Combined Treatments

Combined Treatments-Normal Task Load. The purpose of the CT treatment was to determine if combining IT and SI pretask instruction treatments lead to an improvement in vigilance performance over IT or SI alone, and to determine if CT was necessary to achieve vigilance performance anticipated to be associated with high task load monitoring.

Subjects assigned to CT were treated the same way as IT and SI subjects in all respects, including instructions, except CT subjects were informed during the final phase of instructions,

> We are particularly interested in how persons who score high in "attention to perceptual detail" react to the training procedure. Those with high scores and training should have no trouble with the listening task. It will help you perform your task, if you imagine that you are an astronaut and your survival will depend on how well you perform the task.

Complete model CT instructions are contained in Appendix K.

Combined Treatments-High Task Load. The purpose of CT+ was to determine the effects of high task load monitoring on combined IT and SI. CT+ subjects were treated the same way as CT subjects except CT+ subjects performed the MLT under high task load.

Feeling-tone Checklist

To investigate changes in psychological fatigue or "feeling-tone" reported to be associated with performing a vigilance task, the "Feeling-tone Checklist," or FTC, (Pearson, 1957; Pearson & Byars, 1956) was selected because of the care with which this device was constructed and validated and its apparent suitability to assess the soporific effect associated with vigilance tasks. Utilization of the FTC in this investigation was considered exploratory in nature. The FTC was administered to determine if (a) it was sensitive to changes in feeling-tone during a vigilance task, and (b) if it was sensitive to instruction effects. If the latter resulted in an affirmative answer this would be evidence that the soporific effect has a psychological component and further evidence the FTC is a measure psychological fatigue.

The FTC was developed by Pearson (1957; also see Pearson & Byars, 1956) as an adjunct to psychomotor skills research at the USAF School Aviation Medicine. The FTC is available in two equivalent forms, A and B, which have a reported equivalent forms reliability of .92 and .95 (Pearson & Byars, 1956). Examples of Forms A and B are shown in Appendices L and M, respectively. Both forms contain 13 items and were both developed by the "scale discrimination method." According to Pearson (1957),

> The items, individually and collectively were valid, with checklist reliabilities being in the order of .90. Both sets of items, further, constituted a unidimensional scale according to the criteria of Guttman scale analysis (p. 191).

In the previously cited references, it was demonstrated that both forms of the FTC reliably assessed changes in feeling-tone across time and differentially as a function of task. The developer has suggested that the FTC may have utility as an assessor of industrial morale.

The FTC was self-administered. Subjects were instructed to read the directions on the questionnaire form and to fill it out according to the directions. Examples of the directions are shown in Appendices L and M. Each form of the FTC contains 13 statements, and the subject must indicate whether he feels (a)

Better than, (b) Same as, or (c) Worse than each statement, which describes a state of fatigue. All statements must be answered.

For scoring puposes, the response categories are assigned the following weights: (a) Better than -- "2"; (b) Same as -- "1"; and, (c) Worse than -- "0". The subject's score is the sum of the category weights associated with his item responses. FTC scores can range from "0", indicating the subject is extremely psychologically fatigued, to "26", indicating the subject is minimally fatigued psychologically.

In this investigation, Form A of the FTC was administered immediately after pre-task instructions, since it was felt that feeling-tone should be at its highest at that point. FTC, Form B was next administered immediately following AT16 to assess feeling-tone as a function of pre-MLT practice. Finally, Form A was administered immediately following the MLT to assess the effects of changes in psychological fatigue as a function of having performed the MLT. Form B was used in the second administration to prevent subjects from developing response sets in filling-out the FTC.

OU Subject Pool Survey

The "OU Subject Pool Survey" was administered to all subjects at the end of the MLT in guise of a survey required by the Department of Psychology. Subject were simply handed the survey and told:

> I have been asked to have you complete this questionnaire, I'm passing out. The instructions on the questionnaire will tell you what it is all about. It's self-explanatory
>
> After you complete it, you may leave. Leave the questionnaire face down on the desk as you leave. I am not supposed to see how you filled it out. Thank you!

The purpose of this procedure was an attempt to elicit a relatively objective evaluation of the experiment from the subjects. Subject behavior in a pilot study had suggested that a task such as the MLT had a potential capability of arousing hostility. It was felt that a questionnaire, such as the "Survey," seemingly divorced from the experiment, might tap this hostility, if subjects were given an opportunity to complain about the experiment to "higher authority." Furthermore, it was felt the amount of "complaint" would be a function of the perceived significance of the experiment.

The "Survey", itself, was designed to assess the motivational aspects of the study from the point of view of the subject. The "Survey" was essentially an application of Bakan's (1963) retrospective report technique and intended to ascertain (a) how interesting the subject perceived the experiment to be and (b) whether the subject felt the time spent participating was well-spent. If it can be stipulated that interest and perceived worthwhileness can be equated to motivation, the "Survey" should provide an estimate of the subject's motivation with respect to the experiment. Therefore, this instrument provided a technique for estimating (a) whether interest in the experiment was associated with pre-task instructions and (b) whether interest in the task was related to vigilance performance. In the latter instance, a direct association would suggest that motivation influences vigilance performance.

A sample of the "OU Subject Pool Survey" is shown in Appendix N. For data analysis purposes, the "Survey" was divided into three parts: (a) items 1 through 9 whose summed score provided an index of "interest" or "arousal" associated with the experiment; (b) three individual items, each designed to assess an aspect of "interest in" and "perceived worthwhileness of" the experiment independently; and, (c) an open-ended question asking the subject to state the purpose of the experiment. The three parts of the "Survey" are discussed below.

"Arousal-Interest" Items. Items 1 through 9 were intended to assess the "arousing" nature " or "interest value" of the experimental treatments associated with the MLT. These items were chosen, because they defined a factor Bakan (1963) named "arousal" or "interest" as a result of a factor analysis of retrospective report items obtained subsequent to a vigilance task similar to the MLT. Examination of the factor analysis data showed these items had content relevant to the investigation being reported here.

Bakan (1963) described this factor as follows:

> Items strongly weighed for Factor I seem to suggest an active involvement in doing the vigilance task when the relationship is positive and a tendency to be out of touch with the task when the relationship is negative. Enjoyment, interest, and challenge characterize the positively related items, whereas not listening, daydreaming, feeling sleepy, and just sitting there characterize the negatively related items (Pp. 96-98).

Factor loadings associated with each of the nine items are shown in Appendix O.

To obtain a score from the nine items, a weight of 1 or 0 was assigned to each item. The basis for each weight assignment was the direction of the factor loading. It was intended that a high score reflect high "arousal" or "interest" and a low score reflect low "arousal" or "interest." Therefore, items with positive factor loadings were scored 1 if answered "Yes" and 0 if answered "No." This scoring criterion was applied to items 1, 2, and 3. Items with negative factor loadings were scored <u>0</u> if answered "Yes" and <u>1</u> if answered "No." This criterion was applied to items 4, 5, 6, 7, 8, and 9.

<u>Item 10</u>, "<u>I would like to participate in this kind of experiment again!</u>" This item could be answered "Yes" or "No." It was hypothesized that subjects who had felt they participated in a worthwhile experiment would answer this item "Yes." while those who did not perceive the experiment as worthwhile or significant would answer the item, "No." It was of interest to determine whether answer patterns would be related to experimental treatments.

<u>Item 11</u>. "<u>I was made to feel this was an important experiment.</u>" This item also could be answere "Yes" or "No." This item was intended to assess the effects of pre-task instructions, and answer the question, "Did subjects perceive the experimental treatments as intended by the experimenter?" Ideally, subjects assigned to IT, SI and CT treatments should have answered this question "Yes"; those assigned to RC should answer it "No." The problem was to determine whether subject response patterns reflected the ideal.

<u>Item 12</u>. "<u>I feel that I made a useful contribution to scientific psychology by serving as a subject in this experiment</u>. This item could be answered "Yes" or "No." This item was also intended to ascertain whether subjects perceived the experiment as worthwhile and whether they felt they had been wasting their time by participating. It was of interest to determine whether item response patterns were related to experimental treatments.

<u>Open-ended Question</u>, "<u>What do you think was the purpose of the experiment?</u>" This question was intended to find out if subjects detected

any deception, which there was, in the conduct of the experiment. It was felt that if they detected deception they would state something to the effect that the reason given them for the experiment was not necessarily true. The question to be answered was, "Is detection of deception reflected in task (MLT) performance?"

Subject's Form Booklet

A booklet of forms was prepared for each subject prior to experiment sessions. The booklet contained each form the subject would use during the session in the order in which they would be used. The forms were stapled together in a manner so that each form could be removed and handed-in immediately after it was completed. The forms were arranged in the following order: (a) Feeling-tone Checklist, Form A; (b) Form Q, Vigilance Practice, Visual; (c) Form P, Vigilance Practice Sheet, Auditory; (d) Feeling-tone Checklist, Form B; (e) Form A (or Form B), Standard Vigilance Answer Sheet; and, (f) Feeling-tone Checklist Form A. Booklets prepared for subjects in SI, SI+, CT, and CT+ assigned treatments had an 3 x 5 slip of paper affixed which contained their name and "attention to perceptual detail" score.

Experimental Room and Apparatus

The experiment was conducted in a standard classroom. The room was approximately 20 feet wide and 40 feet long with a seating capacity of 35 to 40 students. A table in the front of the room was used as platform for the tape recorded and th hold forms and pencils. The room was on the second floor of the building, and since the study was conducted in the evening hours there was little if any interference from noises outside the room. During the experiment subjects were seated in standard classroom chairs which were equipped with writing arms. Illumination in the classroom was provided by overhead fluorescent light fixtures. The room contained a clock over the doorway, however, subjects were asked not to look at it during the experiment.

The vigilance task was played through the speaker system of a Wollensack Model T-1980 tape recorder. The sound levels used were discussed earlier. The recorder was positioned on the table so that the tape reels faced away from the subjects, and the subjects could not use the amount of tape on the reels as a technique for estimating time-to-go on the MLT, thus minimizing the possibility of "end spurt."

Experimental Procedure

Recruiting Subjects. It was felt that an evaluation of pre-task instruction effects would be most effective if subjects were nonvolunteers when they entered the experiment. It was felt that such subjects would not be highly motivated to participate in the experiment. This requirement was approximated by recruiting subjects from Psychology 1 sections whose instructors required that students participate in at least one experiment in order to receive extra course points.

Two instructors who had such requirements were asked to recruit subjects personally for this experiment. This was done to put pressure on potential subjects to volunteer for an experiment in which the instructor had some "personal" interest. These instructors did not inform their students that the experiment was being conducted by a graduate student as a dissertation project. Students were told, essentially, that an experiment was going to be conducted in the evenings, four nights a week, at a certain classroom. They were further informed sessions would last approximately an hour and a half, and those who were interested could sign-up for either the 7 PM or 9 PM session. It was explained that ten men and ten women were needed for each session. The instructor did not mention the nature of these experiments. After imparting this information, the instructor circulated a roster for subjects to sign and select a time and day for participation. The subjects thus went on record, for the instructor to see, of signing-up to participate in the experiment. Those who signed the roster were told to report to a "Mr. Neal" when they arrived at the designated classroom, and they would be told more about the experiment at that time.

An attempt was made to recruit subjects at least one day before each session so that the experimenter could make preparations for each session. This timing was important when SI, SI+, CT, and CT+ treatments were scheduled.

Conduct of Experimental Sessions. Subjects were tested in groups ranging from six to 27 in size. It had been planned to test subjects in groups of 20 -- ten men and ten women -- at a time in order to expedite conduct of the experiment. Due to the nature of the recruiting procedure and circumstances over which the experimenter had no control (i. e., prior commitments of potential subjects) the number persons tested fluctuated from session to session. As a result, make-up sessions were held to complete treatment cells. Since the MLT was to be group administered, it was decided that minimum group size for an experimental or make-up session should be six, and both males and females should be represented. This policy resulted in treatment cells being unevely filled with subjects.

Two treatment sessions were held each evening of the experiment, one beginning at 7 PM and a second session at 9 PM. Since the late sessions had small attendance these sessions were generally used for make-up sessions. Treatment sessions were conducted in the following order: RC, RC+, IT, IT+, SI, SI+, CT, and CT+. Randomized or counter-balanced order would have been preferable from the standpoint of design, but ordered treatments were used to counter the "campus grapevine" effects.

When subjects reported to the classroom where the experiment was being conducted, they were seated so that there was an empty seat between subjects to prevent copying. When small groups were tested, subjects were seated close together, still with an empty seat between subjects, to simulate density of group factors associated with larger group administrations. This was an attempt to control possible arousal factors which might be associated with administration group size.

After all subjects were seated, the experimenter distributed the form booklets and asked subjects to keep them face down until told to turn them over. When an SI, SI+, CT or CT+ session was scheduled form booklets were distributed to subjects by name. After all subjects received booklets, the experimenter delivered either RC, RC+, IT, IT+, SI, SI+, CT, or CT+ pre-task instructions depending on the scheduled treatment.

After pre-task instructions, subjects were asked to turn their form booklets over and complete <u>FTC, Form A</u>. After the FTC was completed, subjects were requested to remove them from the booklet and hand-in the completed form. Next, subjects received the <u>Visual Training Task</u>, followed by the Five Minute Auditory Training Task, and finally the Sixteen Minute Auditory Training Task. All answer forms were turned-in to the experimenter. After AT-16 was finished, subjects were asked to complete FTC, Form B and then turn it in. Subjects then were given a stretch break in place. After the stretch break, subjects were asked to put away their personal watches and the Main Listening Task was administered. When the MLT was completed, FTC, Form A was administered for the final time. Prior to leaving the experiment, and prior to handing in the final FTC, subjects were told:

> Since it is getting late, I will not be able to discuss the experiment with you. If you are interested in finding out more about the experiment, write down on the back of the last form you filled-out whether you want to do this during a regular class session or special meeting. I'll do my best to arrange something. I'll let you know what has been worked-out through your instructor.

After subjects turned-in Form A, they were handed the OU Subject Pool Survey and asked to complete it. After subjects completed the Survey they were told:

> Please do not discuss this experiment with your friends, classmates, or roommates. This could ruin the experiment. We find we get the best results if people come to the experiment "cold" and do not know what to expect. Thank you for participating and being so cooperative.

Final remarks to the subjects are reprinted in Appendix P. Subjects then handed-in the OU Subject Pool Survey face-down and left the room. The scheduled sequence of events during the experimental session are summarized in Table 1.

TABLE 1

SEQUENCE OF EVENTS, ALL EXPERIMENTAL SESSION

Order	Event
1	Pre-task Instructions (RC RC+, IT, IT+, SI, SI+, CT, or CT+).
2	Feeling-tone Checklist, Form A
3	Visual Training Task (for MLT)
4	Five Minute Auditory Training Task (for MLT)
5	Sixteen Minute Auditory Training Task (for MLT)
6	Feeling-tone Checklist, Form B
7	Stretch Break
8	Main Listening Task
9	Feeling-tone Checklist, Form A
10	OU Subject Pool Survey
11	Ss excused

Recapitulation of Experimental Design and Final Design Data

The primary purpose of the investigation was to investigate the effects of pre-task instructions on vigilance performance. Data analysis was based on 203 undergraduates -- 104 males and 99 females -- who served as subjects. Subjects were recruited by Psychology 1 instructors who told them nothing about the experiment, except the place and time where it was being conducted.

When subjects reported to the place of the experiment they were assigned to one of four treatment groups -- Required Chore (RC), Important Task (IT), Subject Important (SI), or Combined Treatments (CT) -- which determined the type pre-task instruction treatment the subject and his group would receive during the experimental session. Treatment groups were further subdivided into Normal Task Load and High Task Load groups. This division determined whether a given group of subjects performed the 48 minute criterion auditory vigilance task -- the Main Listening Task (MLT) -- under Normal Task Load (0) or High Task Load (+) conditions, thus permitting an evaluation of pre-task instructions vs. task load effects. Only one pre-task instruction-task load treatment combination was conducted per experiment session.

The structure of the experiment is illustrated in Figure 1. Note, there were four Pre-task instruction Treatments, each administered under either High Task Load (+) or Normal Task Load (0). The treatment combinations were administered to both Male and Female subjects who served in only one treatment combination cell and no other cell. Note further that the MLT was divided within itself into three Successive

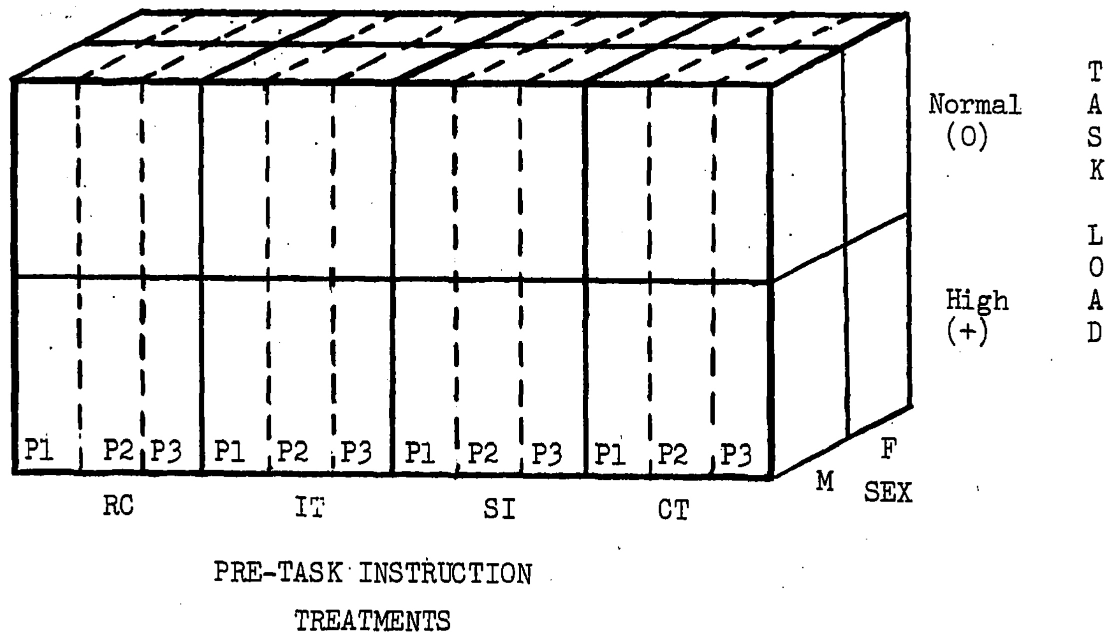


Fig. 1 -- Structure of Experimental Design to Evaluate the Effects of Pre-Task Instructions on Vigilance Performance

Subperiods (repeated measurements) to permit evaluation of vigilance performance across time. Table 2 shows the actual number of subjects, by sex, allocated treatment combination cells.

Prior to performing the Main Listening Task all subjects received training appropriate to the task load at which the MLT would be performed. Such training consisted of (a) the _Visual Training Task_, (b) the _Five Minute Auditory Training Task_, and (c) _the Sixteen Minute Auditory Training Task_.

To investigate possible psychological fatigue effects associated with vigilance performance and pre-task instructions the _Feeling-tone Checklist_ (FTC) was administered on three occasions during the experiment -- (a) immediately following pre-task instructions, (b) following the last auditory training task, and (c) immediately following the end of the MLT. The design structure for the FTC was analogous to Figure 1.

To evaluate subjects' motivation levels associated with experimental treatments, the _OU Subject Pool Survey_ was administered following the last FTC administration.

TABLE 2

NUMBERS OF SUBJECTS ALLOCATED TO TREATMENT COMBINATION CELLS

Task Load	Sex of Subject	Pre-task Instructions RC	IT	SI	CT	Total
0	M	11	13	10	13	47
	F	10	14	12	11	47
+	M	14	14	11	18	57
	F	19	11	10	12	52
	Total	54	52	43	54	203

CHAPTER IV

RESULTS

The primary purpose of this study was to investigate the effects of pre-task instructions on vigilance performance. Performance scores from the two auditory training tasks and the *Main Listening Task* were utilized in the analysis of the data. The purpose of including the practice tasks in the data analysis was to explore possible temporal factors which might be associated with the onset of instruction effects.

Analysis of variance was the primary technique of data analysis employed. Basic data analysis plans were derived by the Dahlke (1964, 1965a, b) integrated approach to analysis of variance. Since treatment cells contained unequal numbers of subjects (see Table 2), data analysis plans were modified to permit use of the unweighted means solution to multifactor analysis of variance designs for unequal cell *n*'s (Winer, 1962, Pp. 241-244, 374,478).

Five Minute Auditory Training Task

The analysis of variance of the number of critical signals detected during the *Five Minute Auditory Training Task* (AT5) is summarized in Table 3. The table shows that only the *Task Load* main effect was significant ($F = 7.28$, $p < .01$). Examination of main effect means revealed that fewer critical signals were detected when subjects were initially learning to monitor under High Task Load conditions ($M_{+} = 4.28$) than under Normal Task Load ($M_{0} = 4.79$). This difference is shown graphically in Figure 2.

TABLE 3

ANALYSIS OF VARIANCE OF NUMBER OF CRITICAL SIGNALS DETECTED DURING FIVE MINUTE AUDITORY TRAINING TASK

Source	SS	df	MS	F[a]	p
Instructions (I)	0.3700	3	0.1233	0.07	
Task Load (L)	12.7424	1	12.7424	7.28	<.01
Sex (X)	0.5402	1	0.5402	0.31	
I x L	0.6872	3	0.2291	0.13	
I x X	3.5770	3	1.1923	-0.68	
L x X	0.0012	1	0.0012	0.01	
I x L x X	2.7342	3	0.9114	0.52	
Error	327.2845	187	1.7502		

[a]Critical values of F are listed in Appendix Q.

Sixteen Minute Auditory Training Task

Table 4 summarizes the analysis of variance of number of critical signals detected during the Sixteen Minute Auditory Training Task (AT16). Examination of Table 4 shows that the following components were significant: (a) Task Load main effect ($F = 19.06$, $p < .01$); (b) Instructions x Task Load interaction ($F = 3.44$, $p < .05$); and, (c) Instructions x Task Load x Sex interaction ($F = 2.90$, $p < .05$).

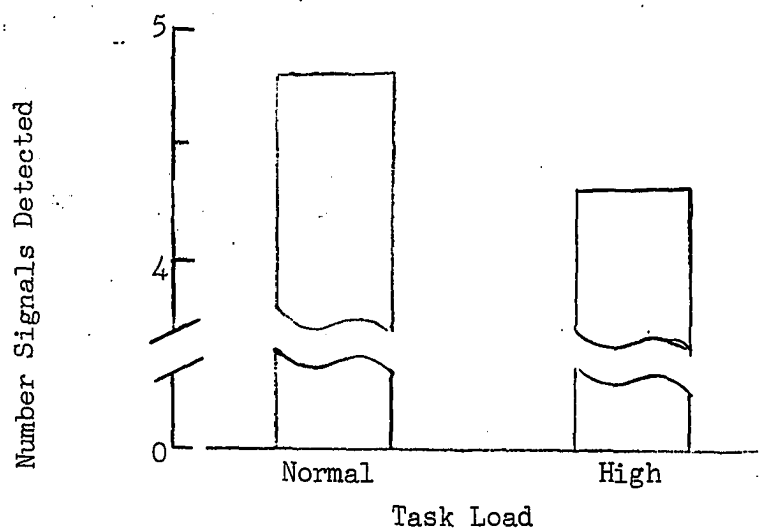


Fig.2. Comparison of Normal and High Task Load Means, Five Minute Auditory Training Task.

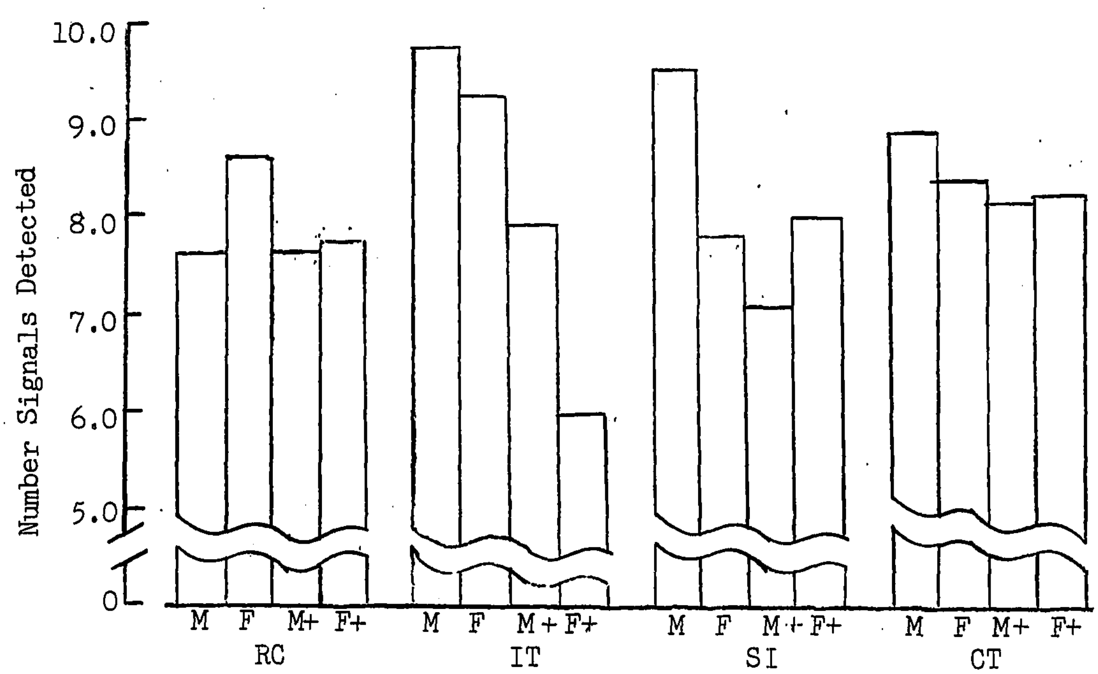


Fig. 3. Mean Number of Signals Detected for Treatment Cell During 16 Minute Auditory Training Task.

Examination of Task Load main effects means revealed that, as was the case in AT5, subjects learning to perform the monitoring task under High Task Load detected fewer critical signals ($M_+ = 7.54$) than subjects learning to monitor under Normal Task Load ($M_0 = 8.70$).

TABLE 4

ANALYSIS OF VARIANCE OF NUMBER OF CRITICAL SIGNALS DETECTED DURING SIXTEEN MINUTE AUDITORY TRAINING TASK

Source	SS	df	MS	F[a]	p
Instructions (I)	7.3255	3	2.4418	0.71	
Task Load (L)	65.6502	1	65.6502	19.06	< .01
Sex (X)	5.5811	1	5.5811	1.62	
I x L	35.5115	3	11.8372	3.44	< .05
I x X	17.6192	3	5.8731	1.70	
L x X	0.5929	1	0.5929	0.17	
I x L x X	29.9880	3	9.9960	2.90	< .05
Error	644.0395	187	3.4441		

[a]Critical values of F are listed in Appendix Q.

Since Task Load was a component in the significant I x L and I x L x X interactions, the effects of Load must be interpreted in light of these interactions. The Newman-Keuls procedure was used to compare all I x L cell means. The results of these comparisons are shown in Table 5. Examination of the table shows that the main sources of the interaction were the differences between IT vs. IT+, between IT+ vs. CT and SI, and SI+ and RC+ vs. IT.

TABLE 5

COMPARISONS OF ALL INSTRUCTIONS X TASK LOAD (IxL) CELL MEANS, SIXTEEN MINUTE AUDITORY TRAINING TASK, BY NEWMAN-KEULS PROCEDURE[a,b]

IxL:	IT+	SI+	RC+	RC	CT+	CT	SI	IT
Mn.	(6.89)	(7.53)	(7.60)	(8.07)	(8.14)	(8.61)	(8.66)	(9.45)
						*	*	**
								**

[a]Underlined means are not significantly different from one another.

[b] *Differences significant at $p < .05$.
**Differences significant at $p < .01$.

Analysis of the I x L x X interaction by the Newman-Keuls procedure, summarized in Table 6, showed that poor signal detection performance by female subjects who received IT treatment and were learning to monitor under High Task Load (ITF+ treatment) was the primary source of the significant three-way interaction. The performance of ITF+ significantly differed from CTF+, CTF, RCF, CTM, ITF, SIM, and

TABLE 6

COMPARISONS OF ALL INSTRUCTIONS X TASK LOAD X SEX (IxLxX) CELL MEANS, SIXTEEN MINUTE AUDITORY TRAINING TASK, BY NEWMAN-KEULS PROCEDURE[a,b]

I x L x X Cell:	ITF+	STM+	RCM+	RCF+	RCM	SIF	ITM+	SIF+	CTM+	CTF+	CTF	RCF	CTM	ITF	SIM	ITM
Mean:	(5.91)	(7.06)	(7.57)	(7.63)	(7.64)	(7.83)	(7.88)	(8.00)	(8.11)	(8.17)	(8.36)	(8.50)	(8.86)	(9.21)	(9.50)	(9.69)
	___	___	___	___	___	___	___	___	___	*	*	*	**	**	**	**
		___	___	___	___	___	___	___	___	___	___	___	___	___	___	*
			___	___	___	___	___	___	___	___	___	___	___	___	___	___

[a]Underlined means are not significantly different from one another.

[b] *Differences significant at $p < .05$.
**Differences significant at $p < .01$.

ITM. The only other difference between cells was between SIM+ and ITM. Examination of the means of treatment cells in Tables 5 and 6 show that, in general, the performance of subjects learning high task load monitoring still tended to be lower than those learning normal task load monitoring. This situation is shown in Figure 3, which is a graph of the three-way interaction cell means.

Main Listening Task

The Main Listening Task (MLT) was the criterion performance task in this investigation. The two auditory training tasks were utilized to prepare subjects for the MLT.

The number of critical signals detected during the course of the MLT were analyzed using the unweighted means solution for multifactor analysis of variance with repeated measurements (Dahlke, 1964, 1965a, b; Winer, 1962, pp. 374-378), because treatment cell n's were unequal and successive 16 minute subperiods were taken into consideration. This design was illustrated in Figure 1.

Table 7 summarizes the analysis of variance of critical signals detected during the course of the MLT. Examination of Table 7 reveals the following components of the analysis were significant: (a) Instructions main effects ($F = 3.70$, $p < .05$); (b) Periods main effects ($F = 16.89$, $p < .01$): and, Instructions x Task Load interaction ($F = 2.67$, $p < .05$).

All Subperiod means were compared using the Newman-Keuls procedure and are summarized in Table 8. These comparisons revealed that, on the average, more signals were detected during the first 16 minute subperiod ($M_{p1} = 5.19$) than during the second subperiod ($M_{p2} = 4.74$)

TABLE 7

ANALYSIS OF VARIANCE OF NUMBER OF CRITICAL SIGNALS DETECTED DURING MAIN LISTENING TASK

Source	SS	df	MS	F[a]	p
Instructions (I)	32.0252	3	10.6751	3.70	<.05
Task Load (L)	0.7460	1	0.7460	0.94	
Sex (X)	4.8290	1	4.8290	1.67	
I x L	23.0864	3	7.6955	2.67	<.05
I x X	8.9204	3	2.9735	1.03	
L x X	2.0739	1	2.0739	0.72	
I x L x X	12.7976	3	4.2659	1.48	
Error a	539.1724	187	2.8833		
Periods (P)	26.9218	2	13.4609	16.89	<.01
I x P	6.6603	6	1.1105	1.39	
L x P	2.1376	2	1.0688	1.34	
X x P	0.1176	2	0.0588	0.07	
I x L x P	8.7416	6	1.4569	1.83	
I x X x P	4.2863	6	0.7144	0.90	
L x X x P	2.4843	2	1.2422	1.56	
I x L x X x P	5.4145	6	0.9024	1.13	
Error b	298.0077	374	0.7968		

[a]Critical values of F are listed in Appendix Q.

or third subperiod ($M_{p3} = 4.73$). This was the decline in mean signal detection expected in a vigilance task of this type. Figure 4 shows the vigilance performance curves for all treatment groups. Note that the

TABLE 8

COMPARISONS OF ALL SUBPERIODS MEANS, MAIN LISTENING TASK, BY NEWMAN-KEULS PROCEDURE[a,b]

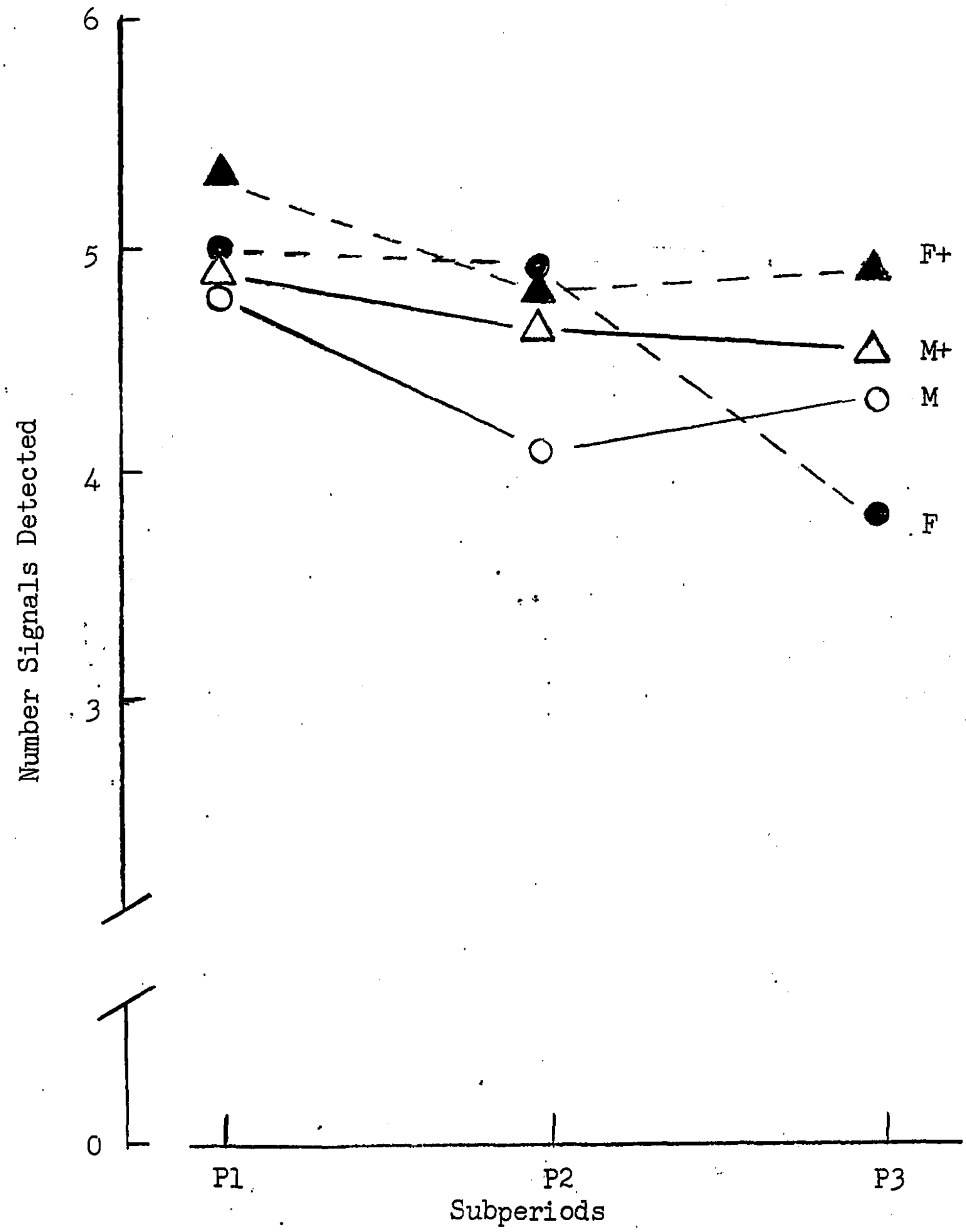
Subperiods	P1	P2	P1
Means	(4.73)	(4.74)	(5.19)
	________	________	**

[a]Underlined means do not differ from one another significantly.

[b]** Means differ at $p < .01$.

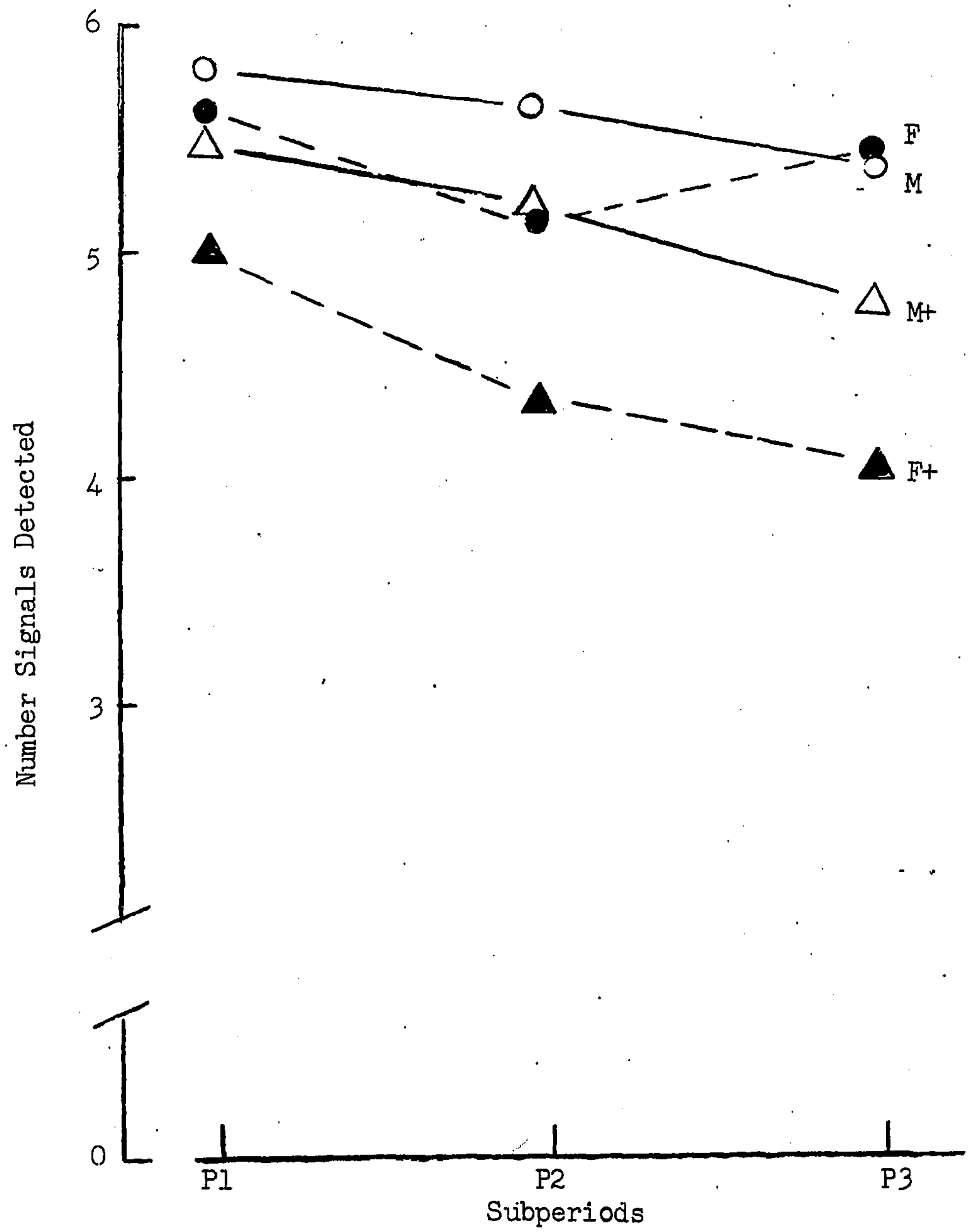
first subperiod was characterized by the highest detection means in 15 out of 16 groups. Detection means typically declined during the second subperiod. During the third subperiod detection means tended to be variable with respect to second subperiod detection means, accounting for the apparent leveling-off during the third subperiod.

The Instructions main effects means were compared by the Newman-Keuls procedure, and these comparisons are summarized in Table 9. These comparisons showed that subjects who received IT and CT pre-task instructions, on the average, detected more critical signals overall than subjects who received RC and SI pre-task instructions, and these differences



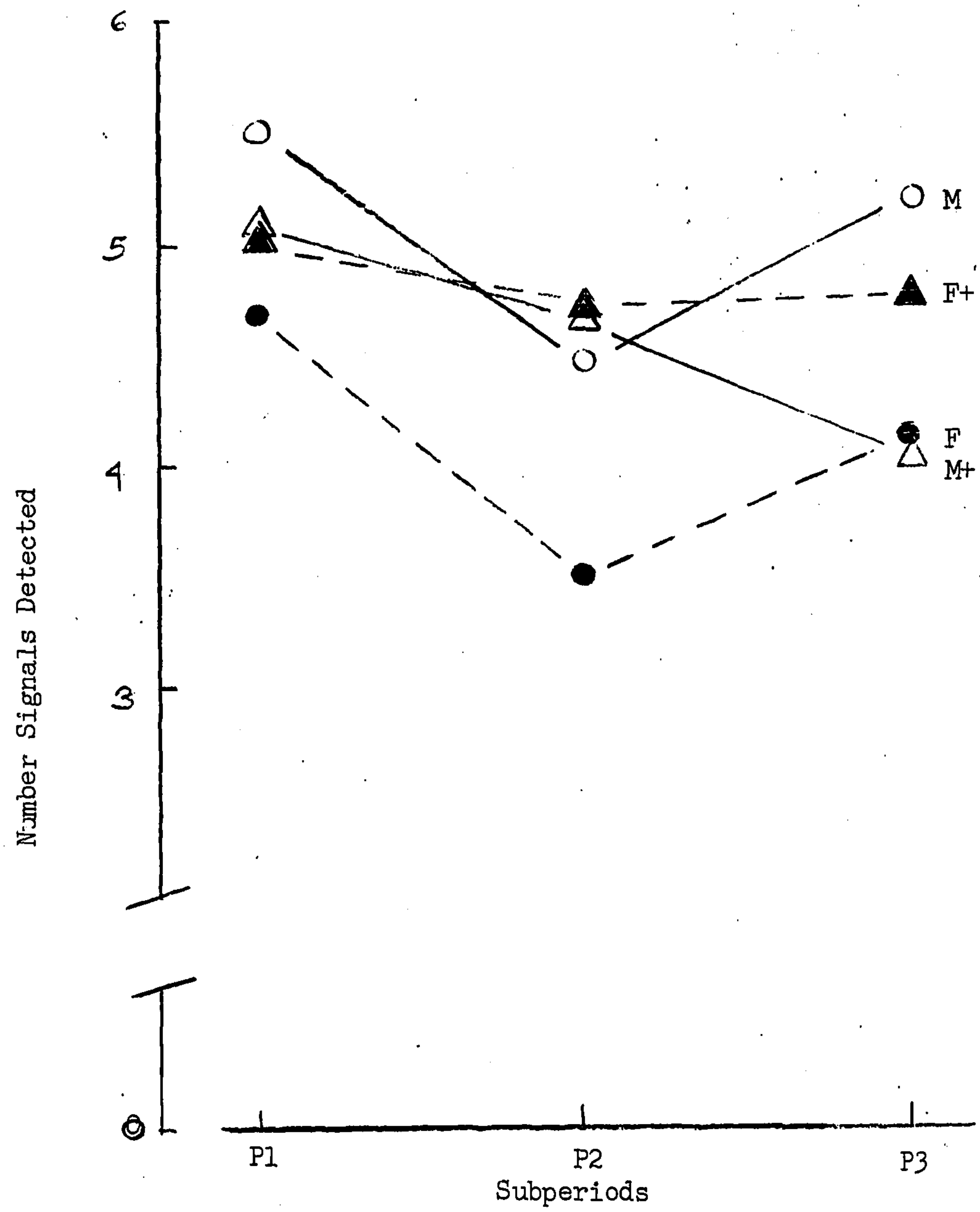
a. Required Chore

Fig. 4. Number of Critical Signals Detected per Subperiod per Treatment Group During Main Listening Task.



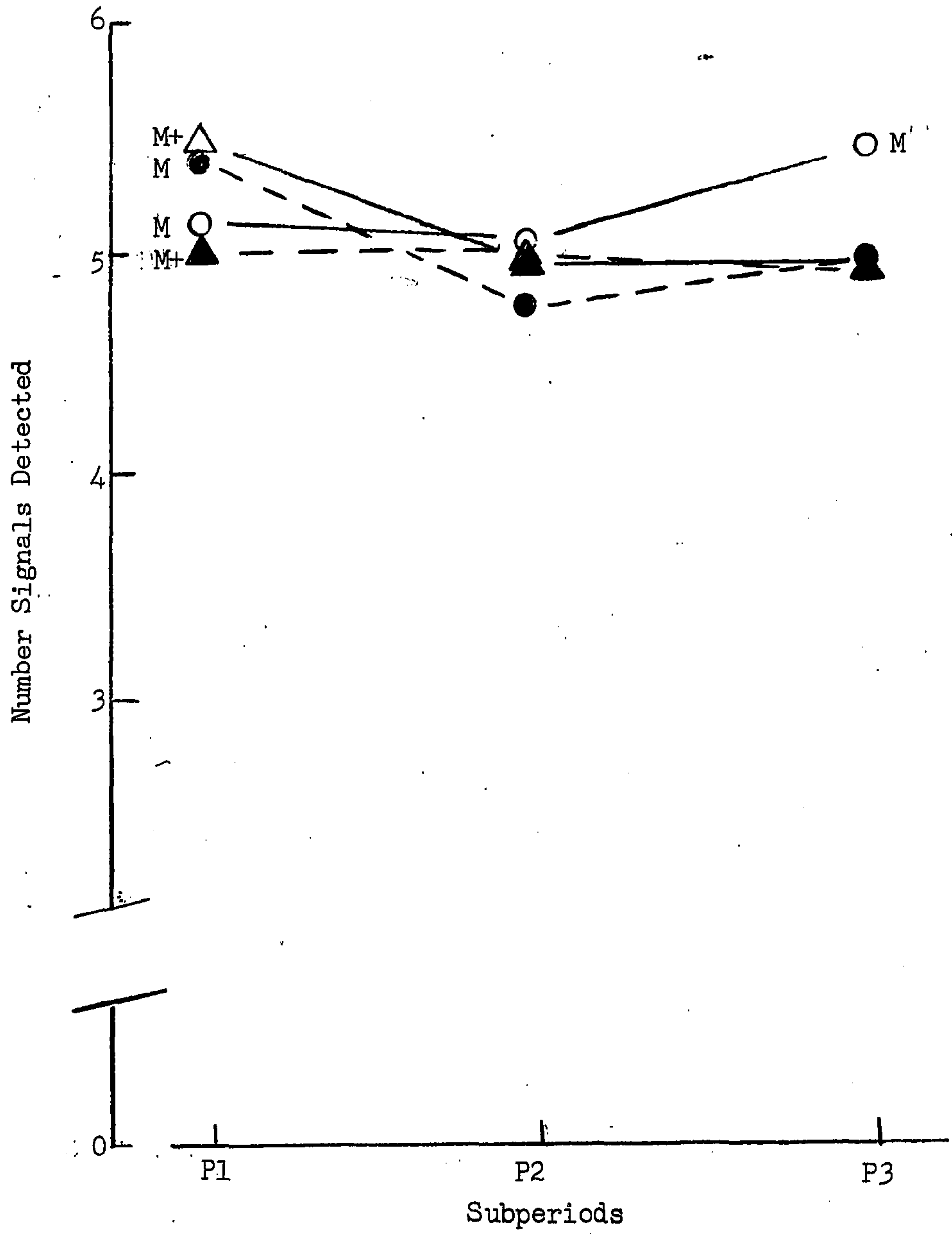
b. Important Task

Fig. 4. Number Critical Signals Detected per Subperiod per Treatment Group During Main Listening Task.



c. Subject Important

Fig. 4. Number of Critical Signals Detected per Subperiods per Treatment Group During Main Listening Task.



d. Combined Treatments

Fig. 4. Number Critical Signals Detected per Subperiod per Treatment Group During Main Listening Task.

were statistically significant. On the other hand, CT and IT did not differ significantly, and RC and SI did not differ significantly. The latter finding was surprising since SI had been designed to be a motivating treatment.

TABLE 9

COMPARISONS OF ALL INSTRUCTIONS EFFECTS MEANS, MAIN LISTENING TASK, BY NEWMAN-KUELS PROCEDURE[a,b]

Effects	RC	SI	CT	IT
Means	(13.95)	(13.97)	(15.26)	(15.45)
			**	**

[a]Underlined means do not differ from one another significantly.

[b]** Means differ at $p < .01$ level.

Since Instructions interacted with Task Load, the I x L cell means were compared using the Newman-Keuls procedure. These comparisons are summarized in Table 10. Examination of Table 10 suggested that IT and CT treatments demonstrated their superiority to RC and SI treatments when monitoring was performed at Normal Task Load, since SI+, IT+, RC+ and CT+ means did not differ significantly. Since High Task Load means interposed themselves between the significantly different Normal Task Load means, it is suggested that high task load monitoring may have had some kind of leveling effect on over-all vigilance performance.

It is interesting to note that IT and IT+ means differed significantly. Examination of Figure 4b suggests this difference was probably due to the relative poor signal detection performance of female subjects assigned to IT+. It is also interesting to note IT treatment

TABLE 10

COMPARISONS OF ALL INSTRUCTIONS X TASK LOAD (IxL)
CELL MEANS, MAIN LISTENING TASK, BY
NEWMAN-KEULS PROCEDURE[a,b]

IxL:	RC	SI	SI+	IT+	RC+	CT+	CT	IT
Mean:[c]	(13.4)	(13.8)	(14.2)	(14.4)	(14.5)	(15.1)	(15.4)	(16.5)
	———	———	———	———	———	*	**	**
		———	———	———	———	*	*	**
			———	———	———	———	———	**
						———	———	*

[a]Underlined means to the left of column IT do not differ significantly.

[b] *Differences between means significant at $p < .05$.
**Differences between means significant at $p < .01$.

[c]Means rounded to one decimal place.

was clearly superior to all other treatments, in terms of resulting signal detection performance. Further examination of Table 10 suggests that CT and CT+ treatments were equally effective in improving signal detection performance.

No interaction effects were obtained involving Instructions and Subperiods. This suggested that Instruction effects obtained were associated with overall vigilance performance rather than the temporal aspects of vigilance.

Erroneous Reports During Main Listening Task

Erroneous reports (ER), defined in Chapter III, reflect the accuracy and dependability of the monitor's report of signal occurrence. ER rate associated with the Main Listening Task was generally low and positively skewed. 51.7% of the subjects reported no ERs, 25.6% reported only one ER, and 22.7% reported more than one ER. Considering these factors, it was decided to analyze ER rate by chi-square analysis (Maxwell, 1961). Table 11 shows the ER frequencies associated with each treatment combination ER category. Table 12 summarizes the chi-square comparisons made during this analysis. Each row in the table summarizes one comparison. ER rate was always categorized--No ERs (0), One ER (1), or More than One ER (<1).

Row a of Table 12 shows that ER rate was independent of type instructions received by the subjects ($X^2 = 5.725$, df = 6, $p < .50$). Row b shows that ER rate was not associated with the task load at which the MLT was performed ($X^2 = 4.588$, df = 3, $p < .80$), and Row c shows that ER rate was not associated with instruction and task load combinations when all IxL frequencies were compared ($X^2 = 10.678$, df = 14, $p < .80$).

ER rate was related (see Row d) to sex of subject in combination with instructions received ($X^2 = 27.120$, df = 14, $p < .025$), but not related (see Row e) to sex of subject in combination with task load

TABLE 11

ERRONEOUS REPORT (ER) RATES (FREQUENCIES)
ASSOCIATED WITH EXPERIMENT
TREATMENT GROUPS

Treatment Code			ER Rate Categories			Row Sum
Instr.	Load	Sex	0	1	1	
RC	0	M	4	4	3	11
		F	6	2	2	10
	±	M	5	5	4	14
		F	9	4	6	19
IT	0	M	12	1	0	13
		F	5	6	3	14
	±	M	8	4	2	14
		F	4	3	4	11
SI	0	M	7	0	3	10
		F	3	4	5	12
	±	M	7	1	3	11
		F	5	3	2	10
CT	0	M	7	6	0	13
		F	6	1	4	11
	±	M	14	3	1	18
		F	3	5	4	12
	Column Sum		105	52	46	203

TABLE 12

SUMMARY OF CHI-SQUARE COMPARISONS MADE
WITH ER RATE CATEGORIZED
AS: NONE, 1, >1

Comparison	Result
a. Between Instructions (RC vs. IT vs. SI vs. CT.)	$X^2 = 5.725$, df = 6, not sig.
b. Between Task Loads (+ vs. 0)	$X^2 = 4.588$, df = 3, not sig.
c. IxL Cells vs. IxL Cells	$X^2 = 10.678$, df = 14, not sig.
d. IxX Cells vs. IxX Cells	$X^2 = 27.120$, df = 14, $p < .025$
e. LxX Cells vs. LxX Cells	$X^2 = 7.653$, df = 6, not sig.
f. Between Sexes (M vs. F)	$X^2 = 13.500$, df = 2, $p < .01$
g. M vs. F in RC only	$X^2 = 1.912$, df = 2, not sig.
h. M vs. F minus RC	$X^2 = 16.673$, df = 2, $p < .001$
i. RC (pooled) vs. all males (minus RC)	$X^2 = 9.310$, df = 2, $p < .01$
j. RC (pooled) vs. all females (minus RC)	$X^2 = 0.657$, df = 2, not sig.

($\underline{X}^2$ = 7.653, $\underline{df}$ = 6, $\underline{p}$ <.30). When ER rates of males and females were compared (see row $\underline{f}$) it was found that women tended to report more than one (>1) ER more frequently than men, and men were more likely to report no ER's than women ($\underline{X}^2$ = 13.5, $\underline{df}$ = 2, $\underline{p}$ <.01). The contingency table for this analysis is shown in Table 13.

TABLE 13

ER RATES ASSOCIATED WITH
SEX OF SUBJECT

Sex	ER Rate			Sum
	0	1	>1	
M	64	24	16	104
F	41	28	30	99
Sum	105	52	46	203

$\underline{X}^2$ = 13.5, $\underline{df}$ = 2, $\underline{p}$ <.01

To determine whether ER rate was associated with intended motivational aspects of pre-task instructions, the components of the over-all significant I x X chi-square were explored in the manner described below. The ER rates of only males and females receiving RC pre-task instructions were compared (see Table 14), and the obtained chi-square was not significant ($\underline{X}^2$ = 1.912, $\underline{df}$ = 2, $\underline{p}$ <.50). Next, ER rates of all other male and female subjects were evaluated (see Table 15), and it was found that males were more likely to report no ER's and fewer

TABLE 14

ER RATES ASSOCIATED WITH
MALES AND FEMALES IN RC

Sex	ER Rate			Sum
	0	1	>1	
M	9	9	7	25
F	15	6	8	29
Sum	24	15	15	54

$X^2 = 1.912$, df = 2, n. s.

TABLE 15

ER RATES ASSOCIATED WITH
MALES(-RC) AND FEMALES(-RC)

Sex	ER Rate			Sum
	0	1	>1	
M(-RC)	55	15	9	79
F(-RC)	26	22	22	70
Sum	81	37	31	149

$X^2 = 16.673$, df = 2, $p < .001$

ER's than female subjects, who, in turn, were likely to report more than one ER ($\underline{X}^2$ = 16.673, df = 2, p $<$.001). ER rates of all males less RC males were compared with the ER rates of all RC receiving subjects, pooled (see Table 16). It will be seen that non-RC males tended to

TABLE 16

ER RATES ASSOCIATED WITH
RC (POOLED) AND MALES (-RC)

Variable	ER Rate			Sum
	0	1	>1	
RC(Pooled)	25	15	15	54
Males(-RC)	55	15	9	79
Sum	79	30	24	133

$\underline{X}^2$ = 9.31, df = 2, p = $<$.01

report significantly fewer ER's than RC-assigned subjects ($\underline{X}^2$ = 9.310, df = 2, p $<$.01). The analogous comparison between non-RC females and all RC-assigned subjects (see Table 17) showed the ER rates of these two

TABLE 17

ER RATES ASSOCIATED WITH RC(POOLED)
AND FEMALES (-RC)

Variable	ER Rates			Sum
	0	1	>1	
RC(Pooled)	24	15	15	54
Females(-RC)	26	22	22	70
Sum	50	37	37	124

$\underline{X}^2$ - 0.657, df = 2, n.s.

groups did not differ significantly ($\underline{X}^2$ = 0.657, <u>df</u> = 2, <u>not significant</u>). The above analysis suggests the possibility that sex differences were possibly due to motivational differences.

<u>Feeling-tone Checklist and</u>

<u>Psychological Fatigue</u>

<u>Feeling-tone Checklist</u> (FTC) scores were analyzed using the same analysis of variance plan as used to analyze MLT performance. The repeated measurements elements in the analysis of FTC scores were the first (Form A), second (Form B), and third (Form A) administrations of the check-list.

Table 18 summarizes the analysis of variance of FTC scores. Examination of the table shows the following components of the analysis were significant: (a) <u>Administrations</u> main effect ($\underline{F}$ = 161.44, $\underline{p}$ <.01); (b) <u>Task Load x Administrations</u> interaction ($\underline{F}$ = 8.75, $\underline{p}$ <.01); (c) <u>Sex x Administrations</u> interaction ($\underline{F}$ = 6.20, $\underline{p}$ <.01); (d) <u>Instructions x Sex x Administrations</u> interaction ($\underline{F}$ = 2.21, $\underline{p}$ <.05); and, <u>Load x Sex x Administrations</u> interaction ($\underline{F}$ = 3.05, $\underline{p}$ = <.01). Note that all significant elements of the analysis were associated with temporal factors.

A Newman-Keuls procedure comparison of the means in the <u>Instructions</u> main effect, summarized in Table 19, showed that FTC scores reliably declined ($\underline{p}$ <.01) from the first administration ($\underline{M}_1$ = 12.37) to the second administration ($\underline{M}_2$ = 10.07) to the third administration ($\underline{M}_3$ = 7.87).

A comparison of all cell means in the <u>Task Load x Administrations</u> interaction, again using the Newman-Keuls procedure and summarized in Table 20, again showed that FTC scores declined reliably from administration to administration regardless of assigned task load. The <u>terminal</u>

TABLE 18

ANALYSIS OF VARIANCE OF FEELING-TONE CHECKLIST SCORES

Source	SS	df	MS	F[a]	p
Instructions (I)	129.6344	3	43.2115	1.87	
Load (L)	3.8428	1	3.8428	0.17	
Sex (X)	16.0083	1	16.0083	0.69	
I x L	120.5241	3	40.1747	1.74	
I x X	106.0140	3	35.3380	1.53	
L x X	57.4219	1	57.4219	2.48	
I x L x X	83.1971	3	27.7324	1.20	
Error a	4323.9144	187	23.1225		
Administrations(A)	1985.4163	2	992.7082	161.44	<.01
I x A	51.1952	6	8.5325	1.39	
L x A	107.5832	2	53.7916	8.75	<.01
X x A	76.1974	2	38.0987	6.20	<.01
I x L x A	30.9998	6	5.1666	0.84	
I x X x A	81.4894	6	13.5816	2.21	<.05
L x X x A	37.5414	2	18.7707	3.05	<.01
I x L x X x A	17.8776	6	2.9796	0.48	
Error b	2299.8223	374	6.1492		

[a]Critical values of F listed in Appendix Q.

TABLE 19

COMPARISONS OF ALL ADMINISTRATIONS MEANS
FEELING-TONE CHECKLIST, BY
NEWMAN-KEULS PROCEDURE[a]

Administrations:	3rd	2nd	1st
Means:[b]	(7.87)	(10.07)	(12.37)
	———	**	**
		———	**

[a] * Difference significant at $p < .05$.
** Difference significant at $p < .01$.

[b]Note, all means differ from one another at $p < .01$.

TABLE 20

COMPARISONS OF ALL TASK LOAD X ADMINISTRATIONS
(LxA) CELL MEANS, FELLING-TONE CHECKLIST
BY NEWMAN-KEULS PROCEDURE[a]

L x A:	3+	3	2	2+	1	1+
Means:	(7.22)	(8.52)	(10.04)	(10.10)	(11.99)	(12.75)
	———	**	**	**	**	**
		———	**	**	**	**
			———	———[b]	**	**
					———	———[b]

[a] * Differences significant at $p < .05$.
** Differences significant at $p < .01$.

[b]If more than two means share common underline, difference between means not statistically significant.

FTC mean score of high task load-assigned subjects ($\underline{M}_+ = 7.22$) was significantly lower ($\underline{p} < .01$) than that of subjects assigned to normal task load ($\underline{M}_0 = 8.52$) monitoring. The mean FTC scores of subjects did not differ significantly from one another at the first two administrations. This interaction has been plotted in Figure 5.

Comparing all cell means in the Sex x Administrations interaction by Newman-Keuls procedure, summarized in Table 21, still showed that FTC mean scores declined from administration to administration regardless of sex of subject. At the last administration of the FTC, female

TABLE 21

COMPARISONS OF ALL SEX X ADMINISTRATIONS (XxA)
CELL MEANS, FEELING-TONE CHECKLIST,
BY NEWMAN-KEULS PROCEDURE[a]

X x A:	3F	3M	2M	2F	1M	1F
Means:	(7.20)	(8.55)	(10.01)	(10.13)	(12.25)	(12.49)
	———	**	**	**	**	**
		———	**	**	**	**
			———	——— b	**	**
					———	——— b

[a] * Differences significant at $\underline{p} < .05$.
** Differences significant at $\underline{p} < .01$.

[b] If more than two means share common underline, differences between the means not statistically significant.

subjects had a significantly lower ($\underline{p} < .01$) mean FTC score ($\underline{M}_F = 7.20$) than male subjects ($\underline{M}_M = 8.55$). FTC means did not differ significantly

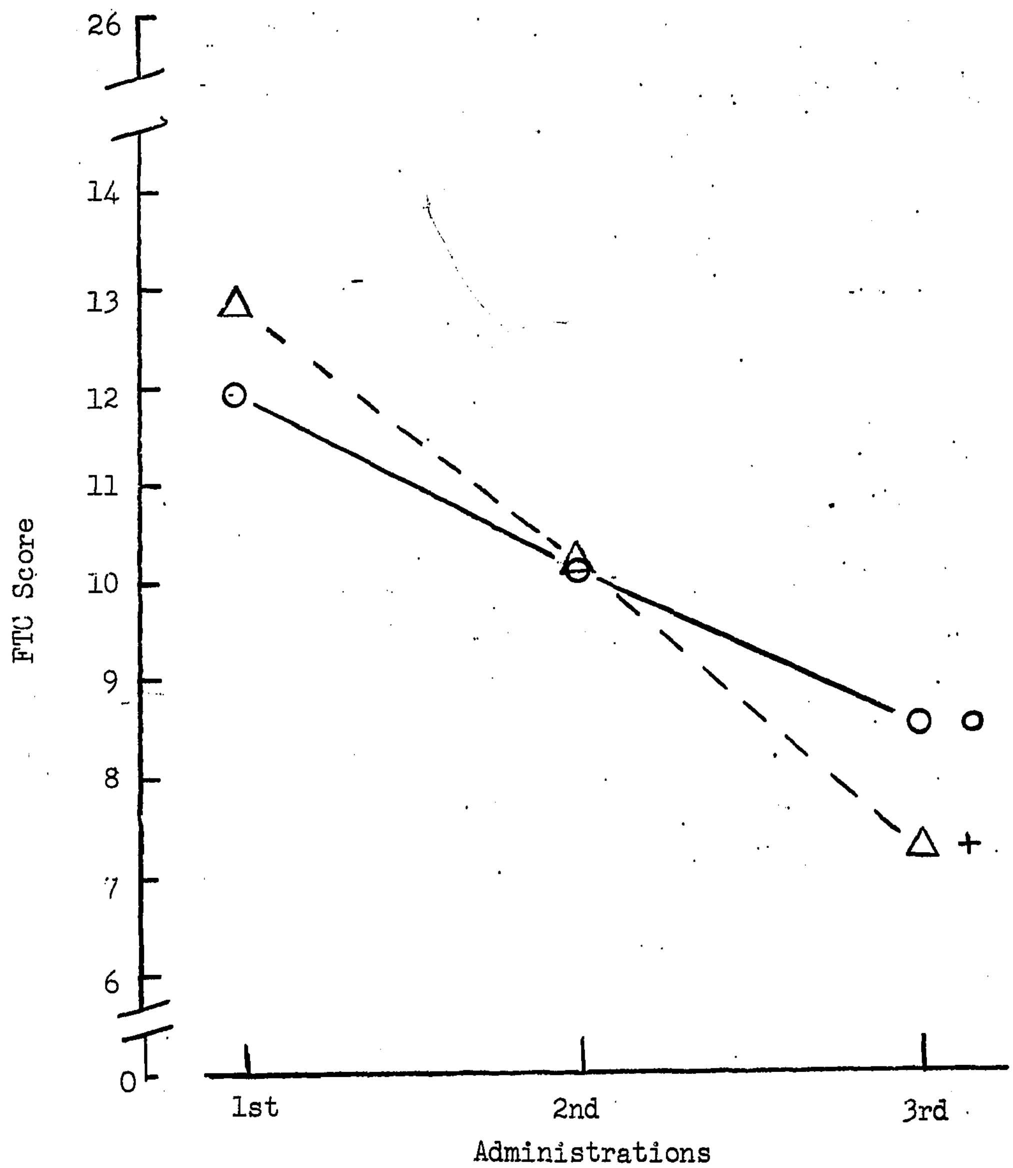


Fig. 5. Mean FTC Score Across Administration: Normal Task Load (0) vs. High Task Load (+)

at administrations one or two. Figure 6 presents a plot of this interaction.

The cell means in the Task Load x Sex x Administrations interaction were compared by Newman-Keuls procedure, and this comparison is summarized in Table 22. With the exception of males monitoring under normal task load, FTC mean score again declined reliably from administration to administration. Males monitoring under normal task load showed significant decline ($p < .01$) in mean FTC score from the first administration ($M_{MO1} = 12.49$) to the second administration ($M_{MO2} = 9.98$), but decline to the third administration was minimal ($M_{MO3} = 9.53$) and not significant. This interaction is plotted in Figure 7. This finding suggests that the significant two-way interactions, L x A and X x A, were due to a large extent to the high terminal mean FTC score of this group of male subjects. It is interesting to note that differences between groups were significant at the first FTC administration. These significances can be discerned from Table 22 and Figure 7.

Finally, the cell means in the Instructions x Sex x Administrations interaction were compared using the Newman-Keuls procedure. The comparisons are summarized in Table 23, and the interaction is plotted in Figure 8. Again, FTC scores declined across administrations, and the decline was statistically significant, except for the males who received CT treatment. The FTC mean score of this group actually increased from the second administration ($M_{CTM} = 10.7$) to the third administration ($M_{CTM} = 11.0$) following a decline from the first administration ($M_{CTM} = 13.0$) to the second. The terminal FTC mean of the CT males was significantly higher than the terminal FTC means of all other groups. Examination of

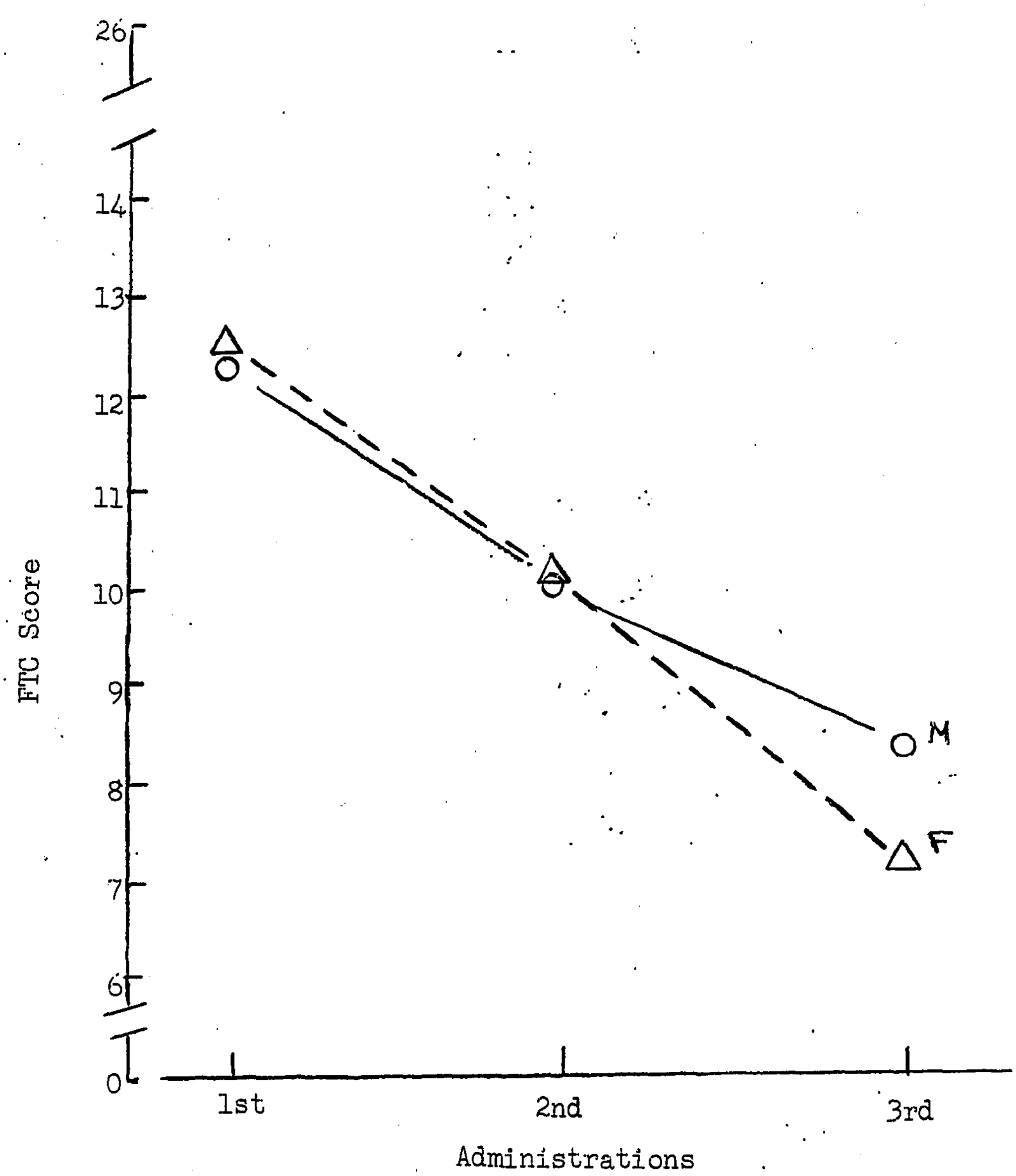


Fig. 6. Mean FTC Score Across Administrations: Males (M) vs. Females (F)

TABLE 22

COMPARISONS OF ALL TASK LOAD X SEX X ADMINISTRATIONS
(LxXxA) CELL MEANS, FEELING-TONE CHECKLIST
BY NEWMAN-KEULS PROCEDURE[a]

L x X x A:	3F+	3F	3M+	3M	2M	2M+	2F	2F+	1F	1M+	1M	1F+
Means:[b]	(6.88)	(7.52)	(7.56)	(9.53)	(9.98)	(10.04)	(10.11)	(10.16)	(11.50)	(12.02)	(12.49)	(13.48)
	———	———	———	**	**	**	**	**	**	**	**	**
				———	———	———	———	———	**	**	**	**
									———	———	*	**
										———	———	**
												*

[a] * Differences significant at $p < .05$.
** Differences significant at $p < .01$.

[b] If more than two means share common underline, differences between the means not statistically significant.

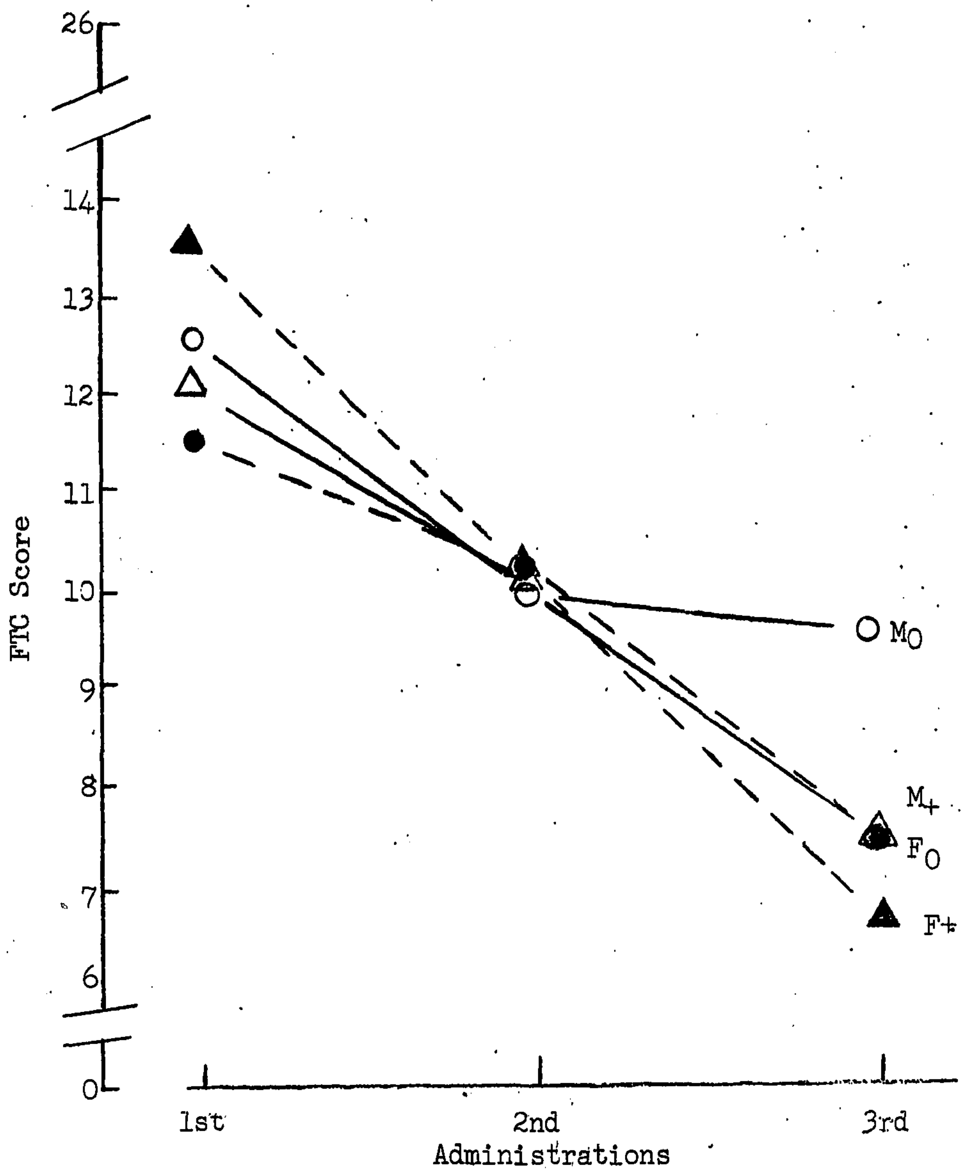


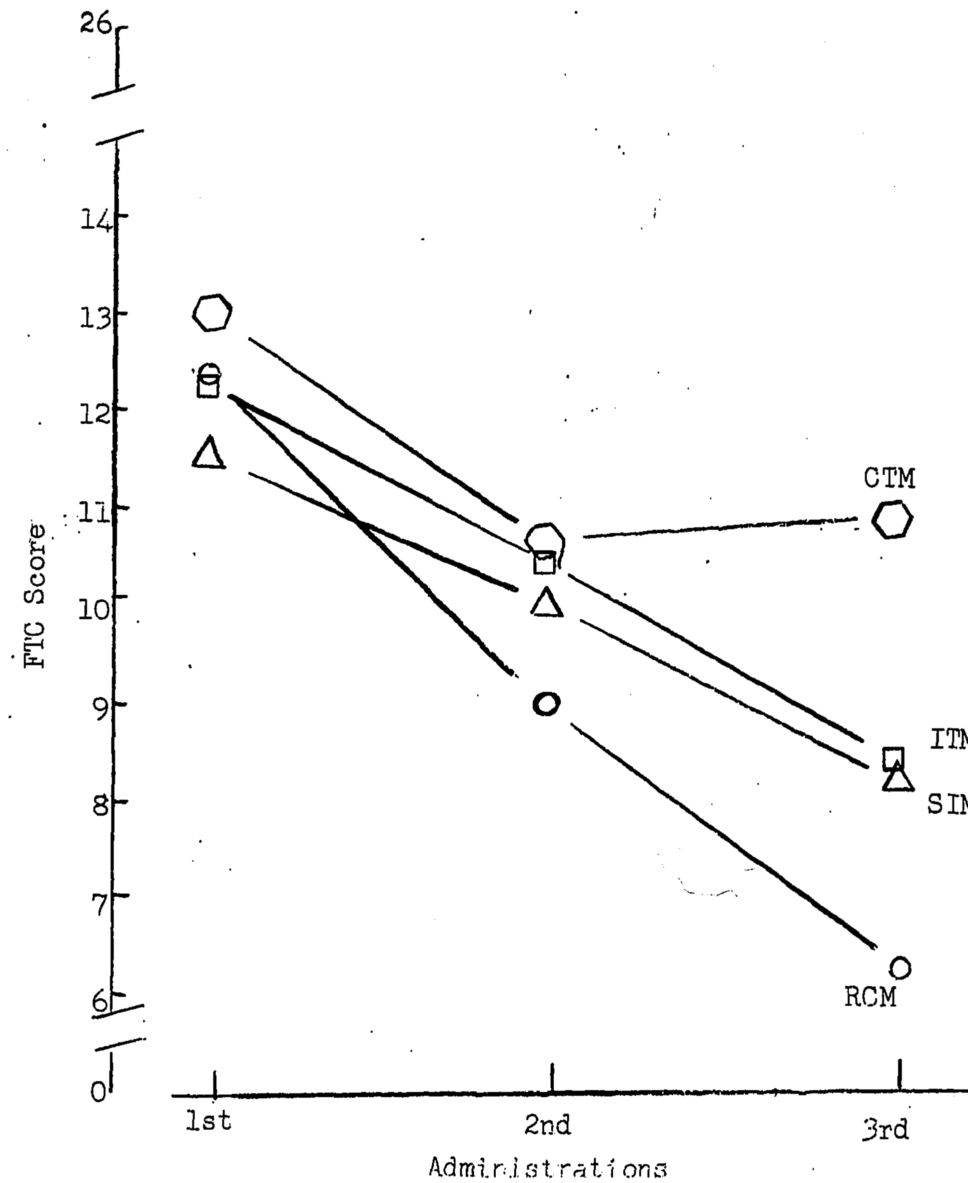
Fig. 7. Mean FTC Score across Administration: Sex of Subject by Task Load.

TABLE 23

COMPARISONS OF ALL INSTRUCTIONS X SEX X ADMINISTRATIONS
(IxXxA) CELL MEANS, FEELING-TONE CHECKLIST
BY NEWMAN-KEULS PROCEDURE[a]

IxXxA	3RCM	3SIF	3CTF	3RCF	3IIF	3ITM	3SIM	2RCM	2RCF	2SIF	2ITM	2SIM	2ITF	2CTF	2CTM	3CTM	1ITM	1SIM	1SIF	1RCF	1RCM	1CTF	1ITF	1CTM
Means	6.3	6.8	7.0	7.1	7.9	8.3	8.6	9.0	9.8	9.8	10.0	10.3	10.4	10.5	10.7	11.0	11.5	12.1	12.3	12.3	12.4	12.6	12.8	13.0

[a]Underlined means are not significantly different. Open areas to the right of the lines represent significances at <.05 and <.01.



a. Males

Fig. 8a. Mean FTC Score across Administration: Pre-task Instructions by Sex of Subject.

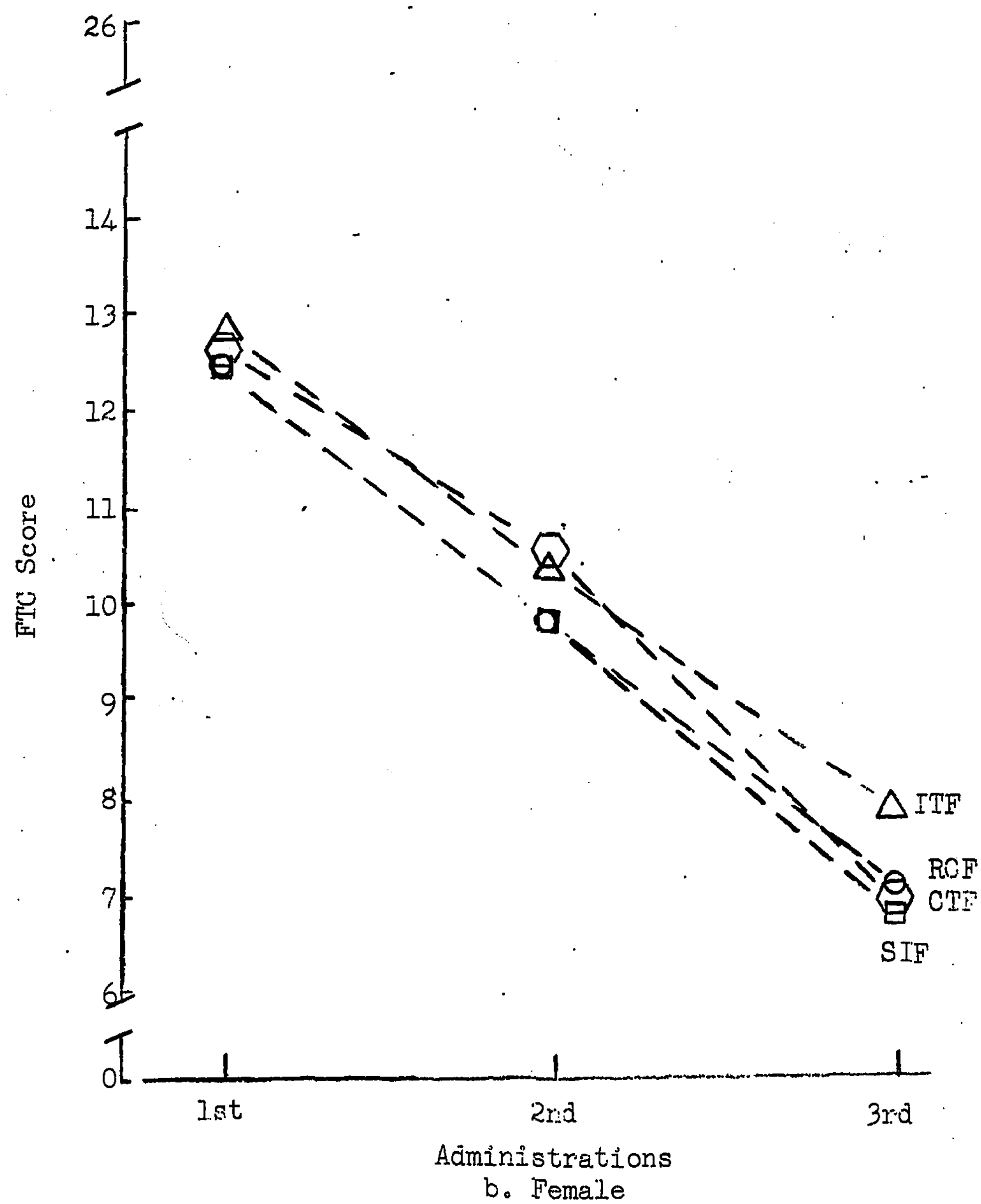


Fig. 8b. Mean FTC Score across Administrations: Pre-task Instructions Treatment by Sex of Subject.

the plot of terminal means shown in Figure 8a clearly shows that CTM subjects were, on the average, different in terms of FTC means. In fact, the significant L x A, X x A, and L x X x A interactions were probably due to the terminal FTC score of males assigned to Combined Treatments. With the exception of an additional terminal administration significant difference between SI males and RC males, cell means at administrations one and two did not differ significantly.

The general picture throughout the analysis of FTC scores has been that differences between treatment cells were not manifested until the end. Note that means for male and female subjects have been plotted separately in Figure 8. The plot of the means suggest that males may be more apt to be affected differentially by the factors contributing to FTC scores than are females. This was evidenced by the apparent greater dispersion of male means associated with FTC administrations. The order of means in the terminal administration -- RCM (M_{CM} = 6.3), ITM (M_{IT} = 8.3), SIM (M_{SI} = 8.6), and CTM (M_{CT} = 11.0)-- suggest the factors contributing the apparent dispersion might have been Pre-task Instructions.

"Arousal-Interest" Questionnaire

The "Arousal-Interest" questionnaire comprised the first nine items of the "OU Subject Pool Survey." The questionnaire was designed to estimate whether subjects (a) found the experiment, particularly the MLT, "arousing" or "interesting" and (b) whether such perceptions of the experiment were related to experimental treatments, specifically pre-task instructions.

Since this was the first time, to the best of the experimenter's knowledge, these items had been combined into a single questionnaire,

questionnaire reliabilities were computed by treatment groups. The technique used for computing the reliabilities involved analysis of variance of item responses (Winer, 1962, pp. 131-132). The obtained coefficients are shown in Table 24. These coefficients indicate the extent to which item response patterns of subjects within treatment groups were in agreement.

TABLE 24

RELIABILITIES OF "AROUSAL" OR "INTEREST QUESTIONNAIRE BY SUBJECT GROUPS

Load	Sex	Instructions			
		RC	IT	SI	CT
O	M	.339	.458	.581	.744
O	F	.568	.545	.840	.620
±	M	.794	.486	.567	.302
±	F	.639	.427	.516	.756

The average reliability was .574. In general, the reliabilities were low (see Table 24). This was not surprising considering item factor loadings tended to be low (see Bakan, 1963a). This suggested that items were heterogeneous rather than homogeneous in content. It is highly probable that each item made a unique contribution to the "arousal-interest" score.

Table 25 summarizes the analysis of variance of questionnaire scores. Examination of the table reveals the following components of the analysis were significant: (a) Instructions main effect ($F = 3.23$, $p < .05$) and (b) the Sex main effect ($F = 6.13$, $p < .05$).

TABLE 25

ANALYSIS OF VARIANCE OF "AROUSAL" SCORES FROM "OU SUBJECT POOL SURVEY"

Source	SS	df	MS	F[a]	p
Instructions (I)	43.3491	3	14.4497	3.23	<.05
Task Load (L)	11.5260	1	11.5260	2.58	
Sex (X)	27.3788	1	27.3788	6.13	<.05
I x L	0.0037	3	0.0012	0.00	
I x X	10.7298	3	3.5766	0.80	
L x X	6.5280	1	6.5280	1.46	
I x L x X	2.7550	3	0.9183	0.21	
Error	835.3951	187	4.4673		

[a]Critical values of F listed in Appendix Q.

Examination of main effect means of the Sex factor revealed that females had a lower score ($M_F = 5.13$), on the average, than males ($M_M = 5.88$), suggesting that women probably did not find the experiment as interesting as did men.

The four means in the Instructions main effect were compared by the Newman-Keuls procedure, and these comparisons are summarized in Table 26. The table shows that questionnaire means of subjects assigned to IT and CT were both significantly higher than those assigned to RC and SI. These differences in means suggest that subjects who received Important Task and Combined Treatments pre-task instructions tended to find experiment more "arousing" or "interesting" than subjects who received Required Chore and Subject Important pre-task instructions. The relationships between means are shown graphically in Figure 9.

TABLE 26

COMPARISONS OF ALL INSTRUCTIONS EFFECTS "AROUSAL" SCORE MEANS, "OU SUBJECT POOL SURVEY," BY NEWMAN-KEULS PROCEDURE[a,b]

Effects	RC	SI	IT	CT
Means	(4.89)	(5.22)	(5.92)	(6.01)
	————	————	**	**
		——	*	*
			————	————

[a]Underlined means are not significantly different from one another.

[b] * Differences significant at $p < .05$.
** Differences significant at $p < .01$.

Individual Items

Items 10, 11, and 12 of the "OU Subject Pool Survey" were designed to independently assess the attitudes of subjects toward the experiment as a function of pre-task instructions. All items were answered Yes or No by subjects. Items were analyzed in terms of frequency of use of these two response categories using chi-square analysis. The results of these analyses are presented below.

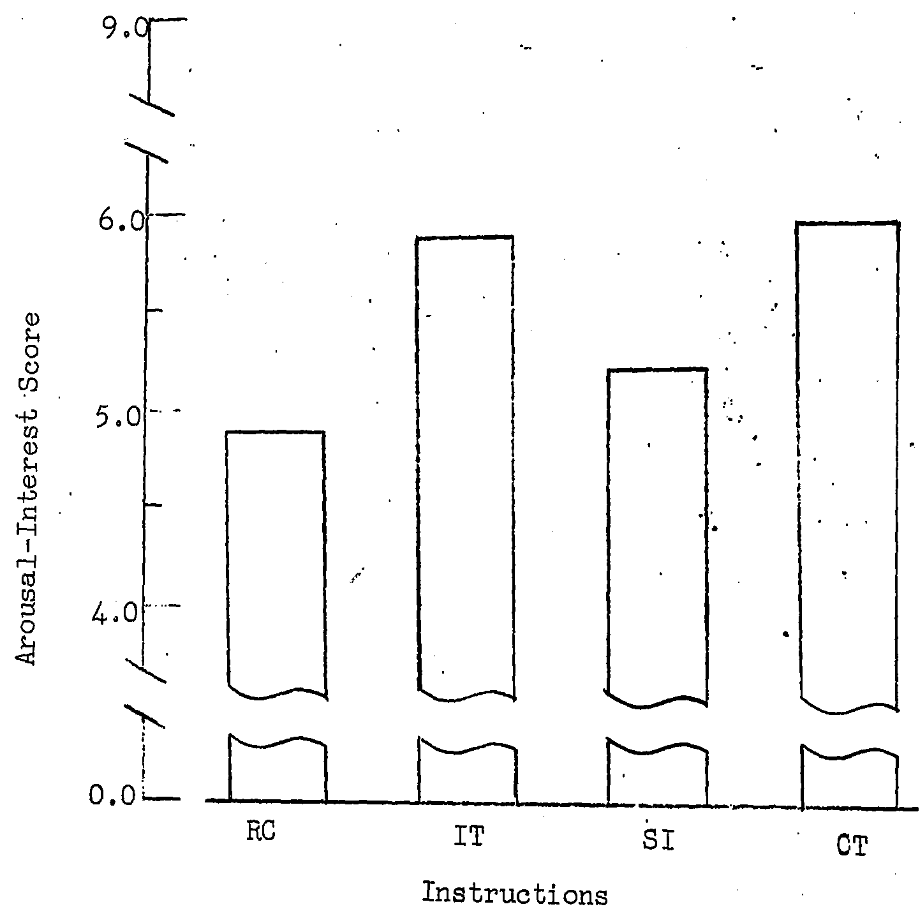


Fig. 9. Mean Arousal-Interest Scores for All Pre-task Instruction Groups.

Item 10: "I would like to participate in this kind of experiment again." Response frequencies associated with each experimental treatment cell are shown in Table 27, and all chi-square comparisons made are summarized in Table 28.

TABLE 27

ITEM 10 RESPONSE FREQUENCIES
BY TREATMENT CELLS

Load	Sex	R	Instructions RC	IT	SI	CT	
0	M	Yes	7	11	4	11	33
		No	4	2	6	2	14
0	F	Yes	5	9	6	6	26
		No	5	5	6	5	21
+	M	Yes	6	11	4	15	36
		No	8	3	7	3	21
+	F	Yes	11	6	6	7	30
		No	8	5	4	5	22
		Sum	54	52	43	54	203

It was expected that subjects who believed the experiment to be "significant" or "worthwhile" would express a willingness to be subjects again. The question to be answered was, "Would the tendency to answer 'yes' be associated with pre-task instruction treatments?"

Item response pattern was significantly associated with the type pre-task instructions subjects received ($\underline{X}^2 = 10.15$, $\underline{df} = 3$, $\underline{p} < .02$). Subjects receiving IT and CT tended to answer the question "yes"; those

TABLE 28

SUMMARY OF CHI-SQUARE COMPARISONS MADE ON ITEM 10

Comparison	Result
a. Pre-task Instructions	$\underline{X}^2 = 10.15$, $\underline{df} = 3$, $\underline{p} < .02$
b. CT vs. IT only	$\underline{X}^2 = 0.01$, $\underline{df} = 1$, $\underline{n}$. $\underline{s}$.
c. RC vs. SI only	$\underline{X}^2 = 0.21$, $\underline{df} = 1$, $\underline{n}$. $\underline{s}$.
d. RC+SI vs. CT+IT	$\underline{X}^2 = 8.73$, $\underline{df} = 1$, $\underline{p} < .01$
e. Task Load (0 vs. +)	$\underline{X}^2 = 2.72$, $\underline{df} = 1$, $\underline{n}$. $\underline{s}$.
f. I x L Cells	$X^2 = 13.95$, $\underline{df} = 9$, $\underline{n}$. $\underline{s}$.
g. I x X Cells	$\underline{X}^2 = 18.47$, $\underline{df} = 9$, $\underline{p} < .05$
h. Instructions (females only)	$\underline{X}^2 = 0.41$, $\underline{df} = 3$, $\underline{n}$. $\underline{s}$.
i. CT vs. IT (males only)	$\underline{X}^2 = 0.00$, $\underline{df} = 1$, $\underline{n}$. $\underline{s}$.
j. RC vs. SI (males only)	$\underline{X}^2 = 0.41$, $\underline{df} = 1$, $\underline{n}$. $\underline{s}$.
k. CT+IT vs. RC+SI (males only)	$\underline{X}^2 = 14.20$, $\underline{df} = 1$, $\underline{p} < .001$

receiving SI and RC tended to split their responses evenly between "yes" and "no." When only the item response patterns of CT and IT groups were compared, it was found these two groups did not differ significantly ($\underline{X}^2 = 0.01$, $\underline{df} = 1$, $\underline{n}$. $\underline{s}$.). Likewise, RC and SI groups did not differ significantly in terms of response pattern ($\underline{X}^2 = 0.21$, $\underline{df} = 1$, $\underline{n}$. $\underline{s}$.). When the response patterns of combined CT and IT groups were compared with response patterns of combined RC and SI groups, significance of response pattern association significantly improved ($\underline{X}^2 = 8.73$, $\underline{df} = 1$, $\underline{p} < .01$) with CT and IT groups favoring the "yes" response.

Item response was found to be independent of task load at which subjects performed the MLT ($\underline{X}^2 = 2.72$, $\underline{df} = 1$, $\underline{n}.\ \underline{s}.$) and independent of Task Load in combination with pre-task instructions ($\underline{X}^2 = 13.95$, $\underline{df} = 9$, $\underline{n}.\ \underline{s}.$).

When Instructions were considered in conjunction with sex of subject a significant association was obtained with respect to response pattern ($\underline{X}^2 = 18.47$, $\underline{df} = 9$, $\underline{p} < .05$). Comparing response frequencies of females alone, it was found that response pattern was independent of pre-task instructions received ($\underline{X}^2 = 0.41$, $\underline{df} = 3$, $\underline{n}.\ \underline{s}.$). This suggested the source of the significant chi-square was associated with the male subjects. RC males were compared with SI males; response frequencies did not differ significantly ($\underline{X}^2 = 0.04$, $\underline{df} = 1$, $\underline{n}.\ \underline{s}.$). The comparison of response frequencies of CT males with IT males was not significant ($\underline{X}^2 = 0.00$, $\underline{df} = 1$, $\underline{n}.\ \underline{s}.$). Combined IT and CT males were compared with combined RC and SI males, and the response pattern was significant ($\underline{X}^2 = 14.20$, $\underline{df} = 1$, $\underline{p} < .001$). These data suggest that males who received either IT or CT pre-task instructions were more likely to answer Item 10, "yes," than RC and SI males and female subjects.

<u>Item 11</u>: "<u>I was made to feel this was an important experiment</u>." Response frequencies to this item are tabled in Table 29 and all chi-square comparisons are summarixed in Table 30. The purpose of this item was to evaluate the effectiveness of pre-task instructions by finding out whether subjects perceived the instructions as intended.

TABLE 29

ITEM 11 RESPONSE FREQUENCIES
BY TREATMENT CELLS

Load	Sex	R	Instructions				Sum
			RC	IT	SI	CT	
0	M	Yes	6	10	7	10	33
		No	5	3	3	3	14
0	F	Yes	3	7	5	8	23
		No	7	7	7	3	24
+	M	Yes	4	13	3	11	31
		No	10	1	8	7	26
+	F	Yes	7	7	6	10	30
		No	12	4	4	2	22
		Sum	54	52	43	54	203

Analysis of "yes" - "no" response frequencies showed that response frequency was significantly related to type pre-task instructions received ($\underline{X}^2 = 19.39$, df = 3, $\underline{p} < .001$). Comparing RC and SI groups, it was found that response category usage was independent of type instructions ($\underline{X}^2 = 0.92$, df = 1, n. s.); likewise, a comparison of IT with CT was not significant ($\underline{X}^2 = 0.01$, df = 1, n. s.). Thus, the response patterns of RC and SI groups were similar to one another; and, IT and CT response patterns resembled one another. Examination of frequencies suggested it would be meaningful to compare RC and SI individually with combined IT and CT. When the responses of RC subjects were

TABLE 30

SUMMARY OF CHI-SQUARE COMPARISONS MADE ON ITEM 11

Comparison	Result
a. Pre-task instructions	$\underline{X}^2 = 19.39$, $\underline{df} = 3$, $\underline{p} < .001$
b. RC vs. SI only	$\underline{X}^2 = 0.92$, $\underline{df} = 1$, $\underline{n}.\ \underline{s}.$
c. CT vs. IT only	$\underline{X}^2 = 0.01$, $\underline{df} = 1$, $\underline{n}.\ \underline{s}.$
d. RC vs. CT+IT	$\underline{X}^2 = 17.95$, $\underline{df} = 2$, $\underline{p} < .001$
e. SI vs. CT+IT	$\underline{X}^2 = 7.09$, $\underline{df} = 2$, $\underline{p} < .05$
f. I x X cells	$\underline{X}^2 = 24.30$, $\underline{df} = 9$, $p. < .01$
g. RC vs. SI in IxX	$\underline{X}^2 = 16.87$, $\underline{df} = 3$, $\underline{p} < .001$
h. IT vs. CT in IxX	$\underline{X}^2 = 5.38$, $\underline{df} = 3$, $\underline{n}.\ \underline{s}.$
i. RC vs. CT+IT in IxX	$X^2 = 22.32$, $\underline{df} = 6$, $\underline{p} < .01$
j. SI vs. CT+IT in IxX	$\underline{X}^2 = 13.06$, $\underline{df} = 6$, $\underline{p} < .05$
k. I x L cells	$\underline{X}^2 = 24.30$, $\underline{df} = 9$, $\underline{p} < .01$
l. RC vs. SI in IxL	$\underline{X}^2 = 2.50$, $\underline{df} = 3$, $\underline{n}.\ \underline{s}.$
m. IT vs. CT in IxL	$\underline{X}^2 = 2.16$, $\underline{df} = 3$, $\underline{n}.\ \underline{s}.$
n. RC vs. IT+CT in IxL	$\underline{X}^2 = 21.86$, $\underline{df} = 6$, $\underline{p} < .01$
o. SI vs. IT+CT in IxL	$X^2 = 12.01$, $\underline{df} = 6$, $\underline{p} < .10$

compared with combined IT and CT, the obtained chi-square was significant ($\underline{X}^2 = 17.95$, $\underline{df} = 2$, $\underline{p} < .001$). IT and CT subjects tended to answer the item, "yes"; RC subjects tended toward, "no." SI subjects preferred to distribute their responses equally between "yes" and "no" in comparison with combined CT and IT ($\underline{X}^2 = 7.09$, $\underline{df} = 2$, $\underline{p} < .05$).

Further chi-square analyses taking sex of subject and instructions into consideration and task load and instructions into consideration were conducted. These are summarized in Table 30. These analyses did not alter the conclusions drawn from analyses of responses associated with instructions, alone. That is, subjects who received IT and CT pre-task instructions tended to answer the item, "Yes." Those receiving RC pre-task instructions tended to answer it, "No." Those receiving SI distributed their responses between "yes" and "no."

Item 12: "I feel that I have made a useful contribution to scientific psychology by serving as a subject in this experiment." The purpose of this item was to ascertain if subjects felt they made a contribution to psychology by participation, that is, identified with the goals of science. Response frequencies associated with treatment cells are tabled in Table 31, and chi-square analyses are summarized in Table 32.

Response to this item was independent of pre-task instructions received ($\underline{X}^2 = 5.91$, $\underline{df} = 3$, $\underline{n}.\ \underline{s}.$), independent of instructions by sex of subject classification ($X^2 = 10.10$, $\underline{df} = 9$, $\underline{n}.\ \underline{s}.$), but associated with instructions classified by task load ($\underline{X}^2 = 17.72$, $\underline{df} = 9$, $\underline{p} < .05$). Response patterns were independent of task load alone ($\underline{X}^2 = 0.37$, $\underline{df} = 1$, $\underline{n}.\ \underline{s}.$). Next, within task load classification, CT and IT combined was compared with RC and SI combined; again the chi-square was not significant ($\underline{X}^2 = 3.69$, $\underline{df} = 3$, $\underline{n}.\ \underline{s}.$). It was decided to examine item response frequencies at normal task load and high task load alone when each was partitioned into pre-task instruction categories. Response pattern was found independent of instructions at normal task load monitoring ($\underline{X}^2 = 2.08$, $\underline{df} = 3$, $\underline{n}.\ \underline{s}.$). Finally, item response patterns associated with pre-task

TABLE 31

ITEM 12 RESPONSE FREQUENCIES BY TREATMENT CELLS

Load	Sex	R	Instructions				Sum
			RC	IT	SI	CT	
0	M	Yes	3	10	6	12	36
		No	3	3	4	1	11
0	F	Yes	6	11	8	7	32
		No	4	3	4	4	15
+	M	Yes	7	14	9	11	41
		No	7	0	2	7	16
+	F	Yes	14	11	9	9	43
		No	5	0	1	3	9
		Sum	54	52	43	54	203

instructions at high task load were compared, and the obtained chi-square was statistically significant ($X^2 = 13.49$, $df = 3$, $p < .01$). Examination of response frequencies across this dimension indicated that the majority of subjects answered the item, "Yes," but 36% of the RC subjects and 33% of the CT subjects answered the item, "No," whereas <u>none</u> of the IT and 11% of the SI subjects answered the item, "No." Apparently the tendency to answer this item "yes" or "no" was a function of the amount of work, task load, and pre-task instructions received.

Free Response Item

The purpose of the free response item in the "Survey" was to determine if subjects detected deception and would say so. Only <u>one</u> subject, a female, reported that she suspected deception. Participating in

TABLE 32

SUMMARY OF CHI-SQUARE COMPARISONS MADE ON ITEM 12

Comparison	Result
a. Pre-task Instructions	χ^2 = 5.91, df = 3, n. s.
b. I x X cells	χ^2 = 10.19, df = 9, n. s.
c. I x L cells	χ^2 = 17.72, df = 9, $p < .05$
d. Load (+ vs. 0)	χ^2 = 0.37, df = 1, n. s.
e. IT+CT vs. RC+SI in IxL	χ^2 = 3.69, df = 3, n. s.
f. Instructions at Normal Task Load	χ^2 = 2.08, df = 3, n. s.
g. Instructions at High Task Load	χ^2 = 13.49, df = 3, $p < .01$.

a CT session, she reported that she suspected something was wrong, because her companion had never taken orientation tests, yet received an "attention to perceptual detail" score. The majority of the subjects answered the item by repeating what the experimenter had told them. It was decided the item had been phrased too indirectly for its intended purpose. Item responses were not analyzed.

Results Summary

1. Analysis of the Five Minute Auditory Training Task revealed that during initial stages of learning the skills required for the Main Listening Task, subjects learning high task load monitoring detected fewer signals than subjects learning normal task load monitoring.

2. Analysis of the Sixteen Minute Auditory Training Task showed that, in general, subjects learning high task load monitoring tended to

detect fewer signals than those learning normal task load monitoring. The significance of these differences were primarily attributal to the poor signal detection performance of female subjects assigned to high task load monitoring following Important Task pre-task instructions, and the superior signal detection performance of males learning normal load monitoring following Important Task pre-task instructions.

3. Analysis of signal detections during the Main Listening Task revealed: (a) signal detection performance deteriorated following the first subperiod of the watch; (b) subjects who received both Important Task or Combined Treatments pre-task instructions detected more critical signals during the over-all course of the watch than subjects who received Required Chore or Subject Important pre-task instructions; (c) the signal detection performances of Important Task and Combined Treatments subjects were comparable; (d) the signal detection performance of Required Chore subjects was comparable to that of Subject Important subjects; (e) the effects of pre-task instructions were most markedly associated with performing the Main Listening Task under normal task load monitoring rather than high task load monitoring; (f) IT-assigned subjects detected more signals than IT+-assigned subjects, however performance graphs suggested the difference was due to the poor signal detection performance of females assigned to IT+; (g) there was no statistically significant evidence that high load monitoring improved vigilance performance; (h) differences in vigilance performance were associated with over-all detections of signals rather than signal detections across time.

4. Analysis of erroneous reports of signals during the Main Listening Task suggested that female subjects were more likely to report

more erroneous signals than male subjects. The erroneous report frequencies of female subjects resembled that of subjects who received Required Chore pre-task instructions, suggesting the possibility that motivational differences between male and female subjects may have accounted for the different ER rates.

5. Analysis of Feeling-tone Checklist scores showed that FTC scores reliably declined from administration to administration, except for one group of male CT subjects whose FTC score did not change from the second to third administration. Evaluation of interactions suggested that the deviant responses of the CTM group contributed highly to other significant interactions. Data plots suggested that treatment effects were most likely to be associated with the terminal administration of the FTC; that is, factors affecting FTC scores are temporal in nature. Data plots also suggested that males may have been more affected by differential factors contributing to FTC level than were females. Data plots also suggested the possibility of pre-task instruction effects in the FTC scores of male subjects, but the significant interaction involving CT males confused that conclusion.

6. Analysis of the "arousal-interest" questionnaire scores suggested that (a) males tended to find the experiment more interesting than females; (b) subjects who received IT or CT pre-task instructions tended to find the experiment more "interesting" than subjects who received either RC or SI pre-task instructions; and, (c) questionnaire reliabilities suggest the item content to be heterogeneous.

7. Analysis of the individual items suggested: (a) With respect to Item 10, CT and IT-assigned subjects tended to indicate a

willingness to "participate in this kind of experiment again." RC and SI-subjects tended to answer the item "yes" as frequently as "no." The tendency to answer "yes" tended to be more associated with male CT and IT-assigned subjects than either male SI and IT subjects or female subjects. (b) The extent to which subjects answered "yes" to Item 11, was associated with the type pre-task instructions received. The item responses of IT and CT subjects indicated they were made <u>to feel the experiment was important</u>, while RC-assigned subjects tended to answer, "no," and SI subjects were just as likely to answer the item "yes" as "no." (c) The results of the analysis of Item 12 was not clear-cut. As a rule, most subjects answered this item, "yes," indicating they believed they had "made a useful contribution to scientific psychology." There was, however, a slight tendency for response frequencies to differ among these subjects who experienced high load monitoring to decrease the already low "no" response.

CHAPTER V

DISCUSSION

Practice Tasks

Before discussing the main findings of the investigation, the practice tasks carried out before the Main Listening Task will be discussed because they may have a bearing on the findings. The rather lengthy practice session prior to the Main Listening Task resulted from pilot-study experience with the Bakan-type vigilance task and an attempt to eliminate apparent task learning during the first subperiod. The value of such training was brought out in the analysis of practice task performance.

Practice tasks were analyzed to determine if pre-task instructions effected monitoring performance during task learning. Instead of finding instruction effects, it was found that practice task performance levels were determined mostly by the stimulus-response characteristics of the task. Subjects assigned to high task load monitoring apparently had a more difficult time learning their type monitoring than subjects learning normal task load monitoring. This conclusion was suggested by the fact that normal task load subjects detected more signals during practice than high task load subjects during both AT5 and AT16. When subjects received AT16 there was some evidence that pre-task instructions were beginning to have some effect on performance. This was suggested by the relatively higher signal detection performance of subjects who received _Important Task_ pre-task instructions (See Tables 5 and 6). Still, AT16 performance was characterized by the high task load subject groups having lower detection means than normal task load subjects. By the time subjects received the MLT, task load effects had apparently moderated.

The analysis of practice data has implications for vigilance research methodology. The findings from this analysis strongly imply that even in vigilance research, especially with a task such as the one used in this investigation, inadequate task training could mask experimental treatments being investigated. It is highly probable that had a shorter training procedure been used, a significant difference would have been found between normal and high task load monitoring during the MLT.

Main Listening Task

The results of the analysis of signal detections showed rather conclusively that level of vigilance performance can be influenced by type pre-task instructions subjects receive concerning the relative significance of the vigilance task. Basically, it was found that subjects who received _Important Task_ or _Combined Treatments_ pre-task instructions detected more critical signals than subjects who received _Required Chore_ or _Subject Important_ pre-task instructions. These results were associated with over-all vigilance performance rather than vigilance performance across time. Analysis of the _Instructions_ x _Load_ interaction (See Table 10) suggested that instruction effects were more directly associated with normal load monitoring than with high load monitoring. This latter finding was surprising since Bakan's (1959) original study led us to expect that an increase in effective signal density would improve vigilance performance, due to increased arousal. It was also surprising to find that vigilance performance following <u>Subject Important</u> pre-task instructions resembled that of <u>Required Chore</u> subjects rather than <u>Important Task</u> or <u>Combined Treatments</u> as had been anticipated. The <u>Subjected Important</u> treatment was <u>designed</u> to be a significant experiment from the point of view of subjects. Apparently this effect was not achieved. We shall return to this issue later.

It was found further in the analysis of the "Arousal-Interest" scores from the "OU Subject Pool Survey," that higher "Arousal-Interest" mean scores were associated with subject groups who monitored following <u>Important Task</u> or <u>Combined Treatments</u> pretask instructions, and lower mean "Arousal-Interest" scores were associated with those groups who received <u>Required Chore</u> or <u>Subject Important</u> pre-task instructions. In terms of item response pattern, an IT or CT subject was likely to describe the task of monitoring as follows:

> <u>He (she) enjoyed doing the task and found it an interesting and challenging task. The time spent on the task was not wasted. He (she) would not stop paying attention and was not lost in his own daydreaming. A strong temptation to fall asleep was not experienced. Neither did he (she) feel like getting up and walking out nor just sitting there until it was over.</u>

On the other hand, an RC or SI subject was apt to typify the monitoring task as follows:

> <u>He (she) did not enjoy the task and did not find it interesting or challenging. He (she) felt the time spent on the task was wasted. If the task had lasted longer he (she) certainly would have stopped paying attention, and at times he (she) was completely lost in his (her) own daydreaming. At times he (she) felt like getting up and walking out or like giving up and just sitting there until the experiment was over.</u>

The mean score patterns found in the analysis of "Arousal-Interest" scores strongly suggested that perceived interest value of a monotonous task, such as a vigilance task, influences task performance level. Since, analysis of the "Feeling-tone Checklist" scores suggested that psychological fatigue increased during the course of a vigilance task, it is possible that persons perceiving the task to be interesting or significant will make a conscious effort to overcome psychological fatigue. Perhaps the nature of pre-task instructions themselves have the effect of raising tension levels in the subject. Additional research is needed to answer the question of how pre-task instructions have this effect and what processes are involved. The fact remains, apparent "arousal" or "interest" value of the experimental treatment was associated with vigilance performance.

Analysis of the individual items from the "OU Subject Pool Survey" showed that the expressed interest in participating in "this kind of experiment again" was associated with experimental treatments. Subjects who received IT and CT instructions were more positively inclined toward participating again than those who received RC and SI instructions. It was further found, the pattern was associated with male subjects rather than female subjects.

The extent to which subjects reported they were made to feel the experiment was important (Item 11) was again related to pre-task instructions. Subjects who responded in the affirmative tended to be assigned to IT and CT treatments, whereas those assigned to RC and SI tended to answer in the negative or be undecided, as in the case of SI subjects.

Vigilance task performance, then, tended to support the hypothesis stated earlier:

> Pre-task instructions to monitors can lead to enhanced vigilance performance.

Vigilance task performance, in conjunction with the data from the analysis of "Arousal-Interest" items and the individual items tended to support the other hypothesis to the effect:

> <u>There will be measurable differences in motivation between monitors in a vigilance task who perceive the task to be "significant" and those who perceive the task to be "not significant", and such differences will be reflected in performance on a vigilance task</u>.

<u>Some Qualifications</u>

It should be pointed out that several factors may limit the generality of the findings from this study -- (a) the nature of the vigilance task, (b) type subjects used, and (c) administration of the vigilance task.

<u>Nature of the Vigilance Task</u>. The Bakan vigilance task can be classified as a cognitive stimulus-type vigilance task. The other types of auditory vigilance tasks found in the literature tend to be more "psychophysical" in nature, using critical signals which are changes in tonal intensity, frequency, or duration and which have 90% or better detection thresholds. The Bakan task is more of an abstraction of the kinds of stimuli subjects monitor in everyday life, such as lectures, conversations, radio broadcasts, therapy sessions, and so forth, and thus in itself, in spite of its noxious, monotonous quality, may have some intrinsic motivational quality due to its stimulus familiarity quality as opposed to the other type vigilance tasks which probably do not have the quality of familiarity. It is conceivable that pre-task instructions may be more effective when used in conjunction with the more intrinsically familiar cognitive type task. Research is needed in this area. It should be pointed out that Neal and Pearson (1966) found that the two type tasks

were comparable as vigilance tasks, but whether they are comparable in terms of sensitivity to motivational factors, such as used in this investigation, remains to be determined.

Type Subjects Used. The subjects used in this study were undergraduates from the University of Oklahoma. It is not known whether susceptibility to pre-task instructions, such as used in this investigation, would characterize other types of subjects that might have been used, such as members of the armed forces, industrial workers, hired subjects, and similar groups which have been used in vigilance studies reported in the literature. It is interesting to note that Orne's (1962) demand characteristics formulation assumed college students as subjects identifying with the goals of science. Since efficient performance of a vigilance task has been considered to require a significant motivational input from the subject, in terms of choosing to monitor or not to monitor, the basic motivational structure of the subject population is a crucial consideration in the generalization of results from an investigation such as this. There is need of cross-population research on this problem.

Administration of the Vigilance Task. The Bakan task as used in this investigation was group administered. Since Bergum and Lehr (1962a, c, 1963c) have shown that paired or group monitoring improves vigilance performance, this raises the question whether the instruction effects would have been obtained, had subjects monitored as individuals in isolation, as is the common approach in vigilance research. Bakan and Manley (1963) have demonstrated the suitability of this task as a group administered task, but the question is, "Would pre-task instruction effects have been obtained if subjects had monitored in isolation?" Research is needed on this question.

Problem of High Task Load

Bakan's (1959) original study, using this task, would lead us to expect that we should obtain better vigilance performance when subjects are responding to a secondary signal, our high task load. Re-examination of his study revealed that the two studies are not directly comparable. For one thing, he categorized his subjects as either introverts or extraverts on the basis of a personality inventory. He found that extraverts tended to benefit from secondary signals during the first two subperiods of the watch which lasted 80 minutes; introverts benefited from the secondary signal during the latter stages -- last three subperiods -- of the watch. A later study (Bakan, Belton, and Toth, 1963) showed that "normal" subjects monitored like extraverts rather than introverts. In spite of this added bit of knowledge, examination of performance curves across time (See Figure 4) revealed no monitoring performance analogous to that obtained by Bakan. It is conceivable, recalling the earlier discussion of the practice tasks, that subjects had not adequately learned to perform high task load monitoring prior to starting the Main Listening Task. Examination of Figure 4 which plots vigilance tasks across time does not support this contention since high task load subjects did not consistently do worse than normal task load monitoring subjects. It can be said that high task load subjects did not do better than normal task load subjects.

Figure 4a suggests an interesting trend for the Required Chore subjects. Toward the end of the watch, signal detections by normal task load monitors tended to decline, whereas that of high task load monitors appeared to stay at a higher signal detection level. Note in Figures 4b and 4d that instruction effects tended to keep vigilance at a relatively high level within the 48 minute watch. It would have been interesting to have increased watch length to 120 minutes to see if instruction effects persisted over the longer period of time and to determine the possible existence of a changeover point where instructions cease to be effective and task load becomes the primary arouser.

Sex Differences

An interesting finding was that suggesting women were less efficient monitors than men in an auditory vigilance task. It was shown in the analysis of erroneous reports that women tended to commit more ER's than men. This suggested that women were either careless listeners or careless reporters, or both. One is almost tempted to conclude that women in our culture just are not good listeners.

Referring again to Figure 4, note that in Figures 4a, 4b, and 4c, that poor signal detection performance, where it occurred was inevitably associated with female subject groups. This trend resembled a similar trend for females to be poorer monitors reported by Neal and Pearson (1966).

Further analysis of ER's suggested that females were less motivated than male subjects. Analysis of "Arousal-Interest" scores reliably showed that females found the experiment less interesting than did males. It is suggested that instructions used with the intention of motivating all subjects were intrinsically such, as to have more appeal to male subjects than to female subjects. For example, the "astronaut"-type instructions used to motivate subjects in IT and CT instructions, probably represented a task with which male subjects could more readily identify than could females, since astronauts, in fact, have all been males. RC and SI instructions, apparently, had no intrinsic motivating appeal to either sex.

Feeling-tone

Analysis of "Feeling-tone Checklist" scores showed that, in general, psychological fatigue increased during the course of a vigilance task, as evidenced by reliable decline in mean FTC scores. This demonstrated that the soporific effect reported to be associated with performing a vigilance task can be assessed quantitatively. The evaluation of the FTC erred in that a control group not monitoring was not included to permit a comparison with subjects who were monitoring. Such a group was not included because the primary purpose for employing the FTC was to determine if it was sensitive to instruction differences. Since clear-cut instructions differences were not found, it is recommended that future vigilance investigations employing the FTC utilize the non-monitoring group as a control group.

Certain inferences can be drawn from examination of Figures 8a & b: (a) Experimental effects influencing level of feeling tone may not be detected early during a prolonged task in which feeling-tone is being assessed periodically, but may be detected during the latter stages of the task. Note in Figure 8 how the treatment group means tended to diverge with successive administrations. (b) Men may have been more sensitive to experimental factors influencing feeling-tone level. Note that the scores of male subjects tended to be spread-out more than for female subjects at all three administrations of the FTC. Possibly, this may reflect the apparent over-all low task motivation of the female subjects. (c) The plot of scores for the male subjects, does suggest the possibility that FTC scores may have been influenced by instruction effects since terminal FTC means generally ranked themselves roughly in the general order of instruction effects -- RC, IT, SI, and CT -- found in the analysis of vigilance data. Possibly, had a longer watch been utilized these differences would have been significant in the same order as other variable means reported. The utility of the FTC as an adjunct to vigilance research, needs further evaluation.

Why Treatment Differences?

Vroom's Cognitive Model of Motivation. Although the data has supported a demand characteristics hypothesis concerning some relationships between perceived task significance and task performance, these results do not explain why demand characteristics operate, and why a pretask instruction treatment, such as Subject Important, designed to convey significance of task to subjects, did not have this effect whereas other treatments seemed to lead to intended effects. Vroom's (1964) quasi-mathematical cognitive model of motivation suggests some explanations for these findings.

According to the model, the outcome of a contemplated act of behavior has valence ranges from negative (-1) through positive (+1) in value. Valence value of an outcome is determined by the individual's preference for the outcome. Preference is synonymous with motive, in the sense used by Vroom. If, it is assumed that utilization of data from an experiment is an outcome, then it is reasonable to suggest that subjects serving in the experiment can have a preference associated with the outcome of an experiment. Thus, perceived outcome of an experiment can have an associated valence value, ranging from positive, through neutral, to negative, depending on anticipated satisfaction or dissatisfaction with the outcome. Outcome valence may be modified as acts are performed to accomplish the outcome.

Operating in conjunction with outcome valence is expectancy. Expectancy refers to the subjective expectancy that an outcome will or will not follow the performance act. Expectancy can be conceived as having a subjective probability value which may assume any value ranging from "0" (minimal certainty) through "1" (maximal certainty). The former indicating the act will not be followed by an outcome; the latter indicating the act will be followed by the outcome. Expectancy value can fluctuate from moment to moment.

Valence and expectancies combine to determine the force on the individual to perform the acts leading to an outcome. According to Vroom (1964):

> The force on a person to perform an act is a monotonically increasing function of the algebraic sum of the products of the valences of all outcomes and the strength of his expectancies that the act will be followed by the attainment of these outcomes (p. 18).

It is suggested that performance on the criterion vigilance task -- the MLT -- may well have been determined by the interaction of valence and expectancy. Logical analyses of the experimental treatments suggest certain hypotheses concerning the nature of the tasks from the subject's point of view.

Required Chore. The RC treatment can be characterized as having near neutral outcome valence and medium to high positive expectancy of data utilization. The resultant would be low positive force strength. Thus, subjects assigned to this treatment would not be expected to put forth maximal effort (force strength) into the performance act directed at accomplishing the outcome. It is surmised subjects viewed the experiment as participation in a legitimate experiment, since they had been recruited by their instructor. When they were not told the purpose of the experiment, they may have thought to themselves that the experiment served a useful purpose, but it was useful to someone else. As a result, outcome valence probably approached the neutral point. Subjects probably assumed the task to be worthwhile, but developed a "I-could-care-less!" attitude toward the experiment.

Subject Important. It is suggested that SI treatment was characterized by low-to-medium outcome valence with an associated low-to-medium outcome expectancy. The cross-products of these two components yield low force strength directed toward achieving the outcome.

Logical analysis of treatment elements, in retrospect, suggests that a score for ability in "attention to perceptual detail" may have been too esoteric for the subject population. This was an "ability" subjects did not know they had, with which they could not identify, and probably could have "cared less" whether they had it. Either having or not having the ability was not sufficiently anxiety proboking to ego-involve the subject in the experiment. It was learned during the course of the experiment that some subjects were not aware they had ever taken orientation test and did not understand how the "attention to perceptual detail" score was obtained. It is suggested that cues in the experimental situation were in conflict and not interpreted by the subjects as supporting the experimenter's stated <u>objectives</u> of the experiment. It is suspected subjects felt they were being deceived in some manner, and they may have felt "attention to perceptual detail" sounded "phony." As a consequence, outcome expectancy probability was lowered since the perceived utilization of experimental data was beclouded.

<u>Important Task and Combined Treatments</u>. Both IT and CT can be characterized as having had both high positive outcome valence and high expectancy probability. The high outcome valences were derived from a task with which subjects, especially males, could identify and felt was important -- the United States space program.

High outcome expectancies were derived from the demand characteristic of the experiment in the form of mutually supporting cues. Subjects were told they were going to be trained, and the purpose of the experiment was to evaluate a training procedure which was designed to improve monitoring performance. All situational and contextual cues pointed in that direction. There <u>was</u> training, and the experimenter read NASA reports during the course of the experiment. As a consequence, subjects had little other choice than to believe the data was being collected in support of the space program. Therefore, outcome expectancy probability should have been high. Consequently, high positive outcome valence and high expectancy probability yielded a resultant force of sufficient strength to <u>enhance</u> vigilance performance.

Vroom's (1964) motivation model may have utility in handling the more spectral motivational components in vigilance performance. The brief application of the model attests its explanatory merits.

Some methodological implications derived from this investigation strongly suggest that experimenters using instructions to motivate subjects, especially in vigilance research, should carefully evaluate their motivational qualities before using them. This investigation suggested that instructions designed to be motivating may not have this effect. If deception is involved, all cue elements in the experimental treatment setting must be mutually supporting to achieve the desired effect. The extent to which these implications are considered, can undoubtedly influence outcome valences and outcome expectancy probability associated with an experiment.

Closing Statement

The results of this investigation have important implications for the proponents of current theories of vigilance (See Frankmann & Adams, 1962), such as inhibition, attention or filter, expectancy, arousal, and arousal-expectancy theories. It was suggested by this investigation that base-level of motivation of monitors can determine level of vigilance performance, at least during the early states of a monitoring session. (It will be recalled that the watch period used here was only 48 minutes in length.) Although proponents of the current theories of vigilance do not, in general, totally ignore base-level motivation, they prefer not to deal with it in their theories. We believe that we have demonstrated that base-level effects on performance can be assessed and are not determinants of vigilance behavior to be slighted by mere lip-service tribute. Theory-oriented vigilance research is needed to systematically explore the relationship of base-level motivation to the various theoretical positions appearing in contemporary vigilance literature.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Problem

Review of the vigilance literature revealed that investigators generally agree that motivation of monitors plays a significant role in determining how well a vigilance task is performed. The role of one well-known motivational independent variable, pre-task instructions, has been neglected in vigilance research. Orne's (1962) formulation of <u>demand characteristics</u> suggested that perceived significance of the monitoring task was a significant dimension upon which to evaluate the motivational qualities of instructions.

The investigation was designed to test two hypotheses:

(a) Pre-task instructions to monitors can lead to enhanced vigilance performance.

(b) There will be measurable differences in motivation between monitors in a vigilance task who perceive the task to be "significant" and those who perceive the task to be "not significant" and such differences will be reflected in performance on a vigilance task.

An auxilliary analysis was conducted to evaluate the sensitivity of the Pearson "Feeling-tone Checklist" to assess quantitatively the soporific effect associated with performing a vigilance task and the sensitivity of the "Checklist" to psychological dimensions such as pre-task instruction effects.

Method

Subjects. Two hundred and three -- 104 males and 99 females -- University of Oklahoma undergraduates recruited from Psychology 1 sections under "pressure" from their instructors served as subjects in the experiment.

Vigilance Task. All subjects, in groups ranging in size from six to 27, performed a 48 minute watch on a Bakan-type cognitive stimulus auditory vigilance task containing 18 critical signals distributed across three subperiods. The 48 minute Main Listening Task was preceded by a three-stage training process which all subjects received. Subjects performed the vigilance task either under conditions of normal task load, in which they detected only critical signals, or under conditions of high task load, in which they detected critical signals and tallied the occurrence of the number "6".

Pre-task Instruction Treatments. Prior to receiving Main Listening Task traing, subjects were led to believe either (a) they could not be told the purpose of the experiment (Required Chore or RC Treatment); (b) the experiment was training methods research for a space project (Important Task or IT treatment); (c) they were expected to do well on the vigilance task, because they had scored high on a test related to vigilance performance (Subject Important of SI treatment); or, (d) they were participating in space-related training methods research, because they had scored high on a test related vigilance performance (Combined Treatments or CT treatment).

Arousal-interest Assessment. To assess the extent to which subjects perceived the experiment to be "arousing" or as having "interest value" the "OU Subject Pool Survey" was administered at the end of the treatment session. The survey contained items designed to assess this aspect of the experiment.

Feeling-tone Checklist. To measure psychological fatigue and the soporific effect associated with performing a vigilance task, the Feeling-tone Checklist was administered on three occasions during the experiment session -- (a) following pre-task instructions, (b) following task training, and (c) at the end of the Main Listening Task.

Data Analysis

The basic data analysis plan involved the following factors: (a) Four levels of pre-task instructions -- RC, IT, SI, and CT; (b) two levels of monitoring -- Normal Load and High Load; (c) male and female monitors; (d) three successive subperiods per watch; and, (e) number of subjects per cell. The principle method of data analysis used was analysis of variance using the unweighed means technique for multi-factor experiments with repeated measurements and without repeated measurements. Newman-Keuls procedure was used to compare means where required. Chi-square analysis was used to evaluate erroneous reports of signals and to evaluate item responses.

Results

Training Tasks. Analysis of training task data showed: (a) fewer signals were detected under high task load monitoring than under normal task load monitoring, and (b) the difference between high load and normal load monitoring was most marked during the first auditory training task.

Main Listening Task. (a) Significantly more critical signals were detected by subjects who received IT or CT pre-task instructions than by subjects who received RC or SI pre-task instructions. (b) Differences in critical signal detections tended to be found in case of subjects who performed normal task load monitoring following pre-task instructions rather than in the case of subjects who performed high task load monitoring. (c) Although signal detections deteriorated significantly with time, pre-task instruction effects were associated with overall signal detection performance rather than signal detection across time.

"Arousal-interest" Assessment. (a) Subjects who received either IT or CT instructions, indicated by item response, they found the experiment to be more "arousing" or having more "interest value" than subjects who received SI or RC pre-task instructions. (b) Male subjects, on the average, found the experiment more interesting than female subjects.

Independent Item Analysis. (a) Male subjects who received either IT or CT pre-task instructions indicated a greater willingness to participate in this type experiment again than RC or SI male subjects or female subjects. (b) IT and CT subjects were more inclined to report they were made to feel the experiment was important than were RC or SI subjects.

Feeling-tone Checklist. (a) Feeling-tone checklist scores declined significantly from administration to administration, indicating that psychological fatigue increased during the course of the experiment sessions. (b) Although no significant effects were obtained, directly attributable to pre-task instructions, inspection of performance plots suggested the possibility that male subjects were more susceptible to factors contributing to subjective fatigue than females. Furthermore, the same inspection suggested that instruction effects might be more discernable during latter administrations of the Checklist than during early administrations. (c) Significant interaction effects in the analysis of "Checklist" data were attributal to the FTC scores of CT males.

Erroneous Reports During Main Listening Task. (a) Female subjects were more likely to report signals erroneously than male subjects. (b) Analysis of ER rate suggested that male and female differences may be motivational in nature.

Conclusions

1. Pre-task instructions concerning task significance can lead to a significant increase in number of critical signals detected during a vigilance task. However, the effectiveness of instructions probably depends upon the extent to which the monitor perceives the outcome of performing the task as "worthwhile," and there is a high probability of the outcome actually occurring.

2. There were measurable differences in motivation between monitors who perceived the task to be "significant" and those perceived the task to be "not significant." Such differences were reflected in vigilance performance. This association was reflected by the IT and CT vs. RC and SI pattern in all analyses.

3. The compatability of experimental manipulations was probably a major contribution to the superiority of IT and CT treatments.

4. Women were less efficient monitors than men. This difference was probably due to sex-related motivation differences. The pre-task instructions were probably such that they had greater motivational

appeal for males rather than females.

5. The "Feeling-tone Checklist" reliably assessed changes in psychological fatigue across time during vigilance task. Whether level of psychological fatigue effects are associated with different pre-task instructions, is still open to question. Visual inspection of data plots suggested such differences were most likely to be found in terminal "checklist" administrations and differences might be sex-related. Additional evaluation of the "Checklist" is required prior to its further application in vigilance research.

6. Contemporary vigilance theorists should take into account the <u>base-level</u> motivation of monitors in contemporary theoretical formulations.

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APPENDIX

APPENDIX A

INSTRUCTIONS TO SUBJECTS: MAIN LISTENING TASK, NORMAL TASK LOAD

General Instructions

Your experimental task tonight will involve your performing an auditory vigilance task. In a few minutes I am going to turn on this tape recorder, and you will hear a voice saying single digit numbers, one right after another. Your job will be to listen to the voice and detect the occurrence of certain critical signals that will occur from time-to-time. A critical signal will be a sequence of three successive odd numbers, all of which are different, such as--591, 379, and so forth. Each time you hear a critical signal, you are to write it down on your answer sheet. Remember! A critical signal is any sequence of three successive odd numbers, all of which are different, like--179, 953, for example.

Visual Training Task

To make sure you understand what a critical signal is, I am passing out a sheet of paper with several columns of figures on it. Fill in the information at the bottom of the sheet first. After you have done this, go down each column, starting with column a, and draw a circle around each critical signal you find. You will note that the first critical signal--1-3-7--has been circled for you. You find the rest and circle them. Any questions? Hold up your hands when you have finished. Start work immediately.

All Subjects Finished

You should have circled the following critical signals: column a -- 137; column b -- 917; column c -- 573; column d -- none; column e -- none; column f --193; column g -- none; column h -- 395; column i -- 937; column j -- none; column k -- none; column l -- 157; column m -- 715; column n -- 137; and, column o -- 579. Any questions?

Five Minute Auditory Training

Now that you understand what kinds of critical signals you are listening for, I am going to give you five minutes of practice actually listening for critical signals. Start listening when you hear the tone. When you hear a critical signal, write it down in a blank space on "Vigilance Practice Answer Sheet, Form P". For this task, use the spaces under the section headed "Practice Task 1." Record the first critical signal you hear in the first empty blank in column 1. Write the next critical signal you hear in the following blank. Continue this way until you fill up column 1; then start column 2. Remember! Record the critical signals in the order in which you hear them. Do not write in the spaces containing an "X". Remember, also--a critical signal consists of three successive odd numbers, all of which are different.

Since this is a practice task, a female voice will break-in three digits after a critical signal has occurred and will tell you what you should have written down. This will give you an idea of how well you are doing. Write the critical signal down just as soon as you hear it. Do not wait for the voice to tell you what you should have written down. Be sure to listen carefully. If you don't pay attention and listen carefully, you may miss a critical signal. Remember! The object of the task is to detect all critical signals. Any questions? If not, start listening for critical signals when you hear the "beeps."

Sixteen Minute Auditory Training

Take off your watches, and put them where you can't see them. This time to make sure you understand the task, I'm going to have you practice the task sixteen minutes without interruption. For this practice task use the section headed "Practice Task 2" on your "Vigilance Practice Answer Sheet." Record the first critical signal you hear in the first empty blank in column 3. Record the critical signals in the order you hear them. After you fill column 3 go to column 4. Do not write in spaces containing an "X". Listen very carefully, so you won't miss any critical signals. At the end of the practice, you will be told the signals you should have written down by a voice on the tape. Remember! Write down each critical signal just as soon as you hear it. Any questions? Start listening when you hear the "beeps."

Main Listening Task

Now you will perform the main listening task. This will take slightly longer than 45 minutes. Be sure your watches are out of sight, where you can't see them. Also, you are on your honor to not look at the wall clock while you are listening. Incidently, don't be disturbed if you didn't get all the signals during the practice. We normally find that people do better during the main listening task than during the practice task. During the main listening task--do not smoke, converse, or make any unnecessary noise. You may disturb others. Also, keep your eyes on your own answer sheet, and don't look at your neighbor's answer sheet.

Record the critical signals you hear on the Standard Vigilance Answer Sheet." Write the first critical signal you hear in the first empty space in column 1. Record the critical signals in the order in which you hear them. After you fill column 1, go to column 2, then 3, and so on. <u>Remember</u>! A critical signal consists of a sequence of three odd numbers, all of which are different. The object of the task is to detect all critical signals. Stay awake and listen carefully so you won't miss any critical signals. Keep listening until a voice tells you to stop. <u>Don't write in spaces containing an "X"</u>. Start listening when you hear the "beeps."

APPENDIX B

INSTRUCTIONS TO SUBJECTS: MAIN LISTENING TASK,

HIGH TASK LOAD

General Instructions

Your experimental task tonight will involve your performing an auditory vigilance task. In a few minutes I am going to turn on this tape recorder, and you will hear a voice saying single digit numbers, one right after another. Your job will be to listen to the voice and detect the occurrence of certain critical signals that will occur from time-to-time. A critical signal will be a sequence of three successive odd numbers, all of which are different, such as -- 591, 379, and so forth. Each time you hear a critical signal, you are to write it down on your answer sheet. Remember! A critical signal is any sequence of three successive odd numbers, all of which are different, like -- 179, 953, for example.

In addition to listening for critical signals, you will do one additional thing. While listening for critical signals, I want you to tally the occurrence of the number "6". This means, every time you hear a number "6", put a tally mark on your answer sheet. Remember! It is more important for you to detect critical signals, but just the same keep a tally of as many "6's" as you can without it interfering with your listening for critical signals. It is better to miss a "6" than a critical signal.

Visual Training Task

To make sure you understand what a critical signal is and what to do about "6's", I am passing out a sheet of paper with several columns of figures on it. Fill in the information requested at the bottom of the sheet. After you have done this, go down each column, starting with column a, and draw a circle around each critical signal you find. Note that the first critical signal -- 1-3-7 -- has been circled for you. You find the rest and circle them. Also, cross-out each "6" you find. Any questions? Hold up your hands when you have finished. Start work immediately.

All Subjects Finished

You should have circled the following critical signals: column a -- 137; column b -- 917; column c -- 573; column d -- none; column e -- none; column f -- 193; column g -- none; column h -- 395; column i -- 937; column j -- none; column k -- none; column l -- 157; column m -- 715; column n -- 137; and column o -- 579. Any questions?

Five Minute Auditory Training

Now that you understand what kinds of critical signals you are listening for, I am going to give you five minutes of practice actually listening for critical signals and tallying "6's". Start listening when you hear the tone. When you hear a critical signal, write it down in a blank space on "Vigilance Practice Answer Sheet, Form P". For this task, use the spaces under the section headed "Practice Task 1".

Start tallying "6's" in the first empty blank in column 1. Write the first critical signal you hear in the next empty blank in column 1; then tally "6's" in the next empty blank. (Note: Experimenter demonstrates this procedure on the blackboard.) After you fill up column 1, start with column 2. Be sure you record the critical signals in the order in which you hear them. Do not write in spaces containing an "X". Remember, also--a critical signal consists of three successive odd numbers, all of which are different. Don't forget to tally "6's". Remember! It is more important to detect critical signals than tally "6's".

Since this is a practice task, a female voice will break-in three digits after a critical signal has occurred and will tell you what you should have written down. This will give you an idea of how well you are doing. Write the critical signal down just as soon as you hear it. Do not wait for the voice to tell you what you should have written down. Be sure to listen carefully. If you don't pay attention and listen carefully, you may miss a critical signal. Remember! The object of the task is to detect all critical signals. Any questions? If not, start listening for critical signals and tallying "6's" when you hear the "beeps."

Sixteen Minute Auditory Training

Take off your watches, and put them where you can't see them. This time to make sure you understand the task, I'm going to have you practice the task sixte n minutes without interruption. For this practice use the section headed "Practice Task 2" on your "Vigilance Practice Answer Sheet." Start tallying "6's" in the first empty blank in column 3. Record the first critical signal in the next empty space. Then, tally "6's" again until you hear the next critical signal. After you fill column 3, start column 4. Do not write in spaces containing an "X". Listen very carefully, so you won't miss any critical signals. Don't forget to tally "6's". Remember! The object of the task is to detect all critical signals. Write down the critical signals just as soon as you hear them. Remember! It is more important to detect critical signals than tally "6's". Any questions? Start listening when you hear the "beeps."

Main Listening Task

Now you will perform the main listening task. This will take slightly longer than 45 minutes. Be sure your watches are out of sight, where you can't see them. Also, you are on your honor to not look at the wall clock while you are listening. Incidentally, don't be disturbed if you didn't get all the signals during the practice. We normally find that people do better during the main listening task than during the practice task. During the main listening task--do not smoke; converse, or make any unnecessary noise. You may disturb others. Also, keep your eyes on your own answer sheet, and don't look at your neighbor's answer sheet.

Record the critical signals you hear on the "Standard Vigilance Answer Sheet." Start tallying "6's" in the first empty blank in column 1. Record the first critical signal you hear in the next empty space. Then, tally "6's" again until you hear the next critical signal. After you fill column 1, start column 2, then 3, and so on. Remember! A critical signal consists of a sequence of three odd numbers, all of which are different. The object of the task is to detect all critical signals. Tally as many "6's" as you can without interfering with listening for critical signals. Stay awake and listen carefully so you won't miss any critical signals. Keep listening until a voice tells you to stop. Don't write in spaces containing an "X". Start listening when you hear the "beeps."

APPENDIX C

Names: ______________________________ Date: ______________

Section: ______ Sex: ______ Date of Birth: ______________

Col. 1	Col. 2	Col. 3	Col. 4
SAMPLE			
1 - 3 - 5			
Start Below			

STANDARD VIGILANCE ANSWER SHEET FORM A

APPENDIX D

NAME: ____________________ DATE: __________

SECTION: ________ SEX: ________ DATE OF BIRTH: __________

Col. 1	Col. 2	Col. 3	Col. 4
SAMPLE			
1 - 3 - 5			
Start Below			

STANDARD VIGILANCE ANSWER SHEET FORM B

APPENDIX E

CRITICAL SIGNAL KEY AND INTERSIGNAL INTERVALS FOR FIVE AND SIXTEEN MINUTE AUDITORY PRACTICE TASKS AND FORTY-EIGHT MINUTE MAIN LISTENING TASK

Five Minute Auditory Practice Task

Critical Signal	Intersignal Interval (In seconds)
197	60"
751	98"
371	43"
973	14"
715	137"

Sixteen Minute Auditory Practice Task

Critical Signal	Intersignal Interval (In seconds)
957	74"
173	70"
759	150"
379	24"
973	179"
357	107"
739	110"
971	44"
913	14"
719	138"

Main Listening Task

Critical Signals Sixteen Minute Subperiods			Intersignal Intervals (in seconds)
1	2	3	
975	915	751	74"(140")
173	173	753	68"
973	935	719	146"
137	139	159	24"
375	731	917	176"
751	715	379	398"

APPENDIX F

Vigilance Practice -- Visual Form Q

Name:____________________________ Date:______________

Section:______________ Sex:______________ Date of Birth:______

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
6	9	5	4	5	6	2	4	5	6	7	9	2	5	3
8	1	6	3	4	3	4	4	5	2	7	1	7	9	3
1	7	5	7	5	6	5	3	1	7	7	8	2	9	9
8	8	7	7	3	6	7	9	4	8	6	8	5	3	6
1	8	2	4	5	8	6	5	4	7	2	4	4	8	2
8	7	5	8	3	1	3	8	9	5	7	4	3	1	8
5	2	1	4	5	2	1	3	9	8	3	1	1	3	9
2	5	1	4	5	2	6	4	9	2	2	8	1	7	2
4	6	5	9	1	1	6	8	2	7	7	5	6	6	1
1	1	6	5	1	8	8	7	1	8	8	4	7	9	4
3	4	8	8	9	6	1	7	9	4	7	1	1	8	6
7	2	6	6	9	8	2	7	8	6	5	2	4	1	7
8	5	8	3	7	9	2	6	3	4	2	3	9	6	9
5	4	2	2	9	5	1	2	3	5	1	3	4	9	6
6	5	9	6	4	8	6	4	4	9	5	6	8	8	1
2	2	7	8	7	1	6	3	7	1	8	6	8	1	2
2	4	3	4	7	4	8	2	8	2	4	1	8	6	8
4	1	6	3	4	1	9	7	9	8	7	5	5	3	5
3	8	2	1	5	9	4	8	3	3	8	7	5	9	7
2	8	9	8	7	3	8	7	7	8	4	7	6	9	9
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o

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APPENDIX G

NAME: DATE:

SECTION: SEX: DATE OF BIRTH:

PRACTICE TASK 1		PRACTICE TASK 2	
COL 1 SAMPLE	COL 2	COL 3 START BELOW	COL 4
1-3-5			
START BELOW			

VIGILANCE PRACTICE ANSWER SHEET FORM P

APPENDIX H

INSTRUCTIONS TO SUBJECTS: PRETASK "REQUIRED CHORE"

Let me begin by saying, participation in this experiment will satisfy the Psychology 1 requirement to participate in an experiment. The purpose of the experiment will not be disclosed to you until the experiment is over. We'll mention how you can find out about the experiment later. Let me assure you that you will not be shocked or subjected to physical pain tonight. All you need do is pay close attention and follow instructions.

Incidentally, make sure you put your name on all the forms you will fill out tonight. This will insure you get credit for the experiment. You must complete the experiment to receive credit.

Let's get started, and I'll tell you what you're going to do.

Special Instructions to Experimenter

The experimenter should sit in front of the group of subjects and read a text book, such as a statistics text, as the subjects perform the main listening task.

APPENDIX I

INSTRUCTIONS TO SUBJECTS: PRETASK "IMPORTANT TASK"

Let me begin by saying, participation in this experiment will satisfy the Psychology 1 requirement to participate in an experiment. Let me assure you that you will not be shocked or subjected to physical pain.

As you all probably know, the University of Oklahoma Research Institute has various government contracts with agencies such as the Army, Navy, Air Force, FAA, and NASA. Our group is doing a series of experiments related to human factors problems associated with the manned orbiting laboratory you have been reading about recently.

We are developing training procedures for the operation of certain communication systems which may be used in the manned orbiting laboratory. One of the proposed communication devices requires that astronauts monitor digital orbital data. With this system the astronaut must listen for changes in voice digital information which will tell him how to adjust his orbit.

We have developed a short training procedure that should rapidly teach the astronaut how to listen for the information. We want to try this procedure out on you tonight.

We're going to give you the training procedure, and then have you monitor a signal similar to that which an astronaut will monitor for approximately one orbit around the earth. If our estimates are correct, this training procedure should simplify the listening task for you. It will help you perform the task, if you imagine you are an astronaut and your survival will depend on how well you perform the task.

Let's get started, and I'll tell you what you are going to do.

Special Instructions to Experimenter

NASA and Air Force publications with titles referring to outer space research should be on the experimenter's table in plain sight so that subjects see them as they enter the room. While the subjects are participating in the main listening task, the experimenter should sit in front of the group and read one of the reports. It is desirable that the report being read have a picture of an astronaut, a space capsule, or rocket on the front cover.

APPENDIX J

INSTRUCTIONS TO SUBJECTS:

PRETASK "SUBJECT IMPORTANT"

Let me begin by saying, participation in this experiment will satisfy the Psychology 1 requirement to participate in an experiment. Let me assure you that you will not be shocked or subjected to physical pain.

Did everyone get a reminder phone call this afternoon? If any of you didn't, I apologize. You were all supposed to be called.

We've gone to a lot of trouble to get some information on you before you came here tonight. We have developed a special test scoring key that is used to predict how proficient a person should be in the ability <u>to attend to perceptual detail</u>. To do this, the scoring key is applied to the freshman orientation tests you took, and we obtain a <u>special</u> "attention to perceptual detail" score.

Tonight we want to check out this score. All of you should have high "attention to perceptual detail" scores, and we are particularly interested in those persons with the high scores. A high score is one of 90 or higher. Your score is the <u>red</u> number on slip of paper fastened to your form booklet. Make sure you write your score on <u>each</u> form you fill out tonight. Before we go any further, write your student ID number on the slip of paper that contains your score. Turn the slip of paper in as you leave tonight. Your ID number permits us to double-check your score.

Tonight you will perform a task that requires high attention to perceptual detail ability. Since you all received high scores, I don't anticipate you will have any difficulty with the task. You should do extremely well.

Let's get started, and I'll tell you what you are going to do.

Special Instructions to Experimenter

After E receives the lists of subjects scheduled to attend an experimental session, each subject should be contacted by telephone and reminded to attend the session they signed-up for. After subjects have been contacted, E should look up the name of each person on the subject roster in the student directory. The subject's name as it appears in the student directory, should be written on a three by five inch slip of paper as follows--last name, first name, middle initial. This slip of paper is affixed to a form packet by stapling. Each person is arbitrarily assigned a score of 90 through 99 at random. This is written on the slip of paper in red pencil or ink.

At the site of the experiment, E calls off the names of the subjects, and he hands out the form packet to the person called. After all subjects have received their individual packets, E should call off the names of those who did not show up, and express concern that these individuals did not arrive. If E was unable to contact all subjects by telephone, he should apologize to those subjects not called. In this case he should suggest a secretary was at fault.

As subjects perform the main listening task, E should read a textbook, such as a statistics text, in plain view of the subjects.

APPENDIX K

INSTRUCTIONS TO SUBJECTS: PRETASK

"COMBINED TREATMENTS"

Let me begin by saying, participation in this experiment will satisfy the Psychology 1 requirement to participate in an experiment. Let me assure you that you will not be shocked or subjected to physical pain.

Did everyone get a reminder phone call this afternoon? If any of you didn't, I apologize. You were all supposed to be called.

We've gone to a lot of trouble to get some information on you before you came here tonight. As you will see, the purpose of the experiment is twofold. We have developed a special test scoring key that is used to predict how proficient a person should be in the ability <u>to attend to perceptual detail</u>. To do this, the scoring key is applied to the freshman orientation tests you took, and we obtain a <u>special</u> "attention to perceptual detail" score for you.

All of you should have high "attention to perceptual detail" scores, and we are most interested in those with the high scores. A high score is one of 90 or higher. Your score is the <u>red</u> number on the slip of paper fastened to your form booklet. Make sure you write your score on <u>each</u> form you fill out tonight. Before we go any further, write your student ID number on the slip of paper containing your score. Turn the slip of paper in as you leave tonight. Your ID number permits us to double-check your score.

Tonight you will perform a task that requires high attention to perceptual detail ability. Since you all received high scores, I don't anticipate you will have any difficulty with the task. You should do extremely well.

Concerning the other reason for the experiment--As you all probably know, the University of Oklahoma Research Institute has various government contracts with agencies such as the Army, Navy, Air Force, FAA, and NASA. Our group is doing research on a series of human factors problems associated with the manner orbiting laboratory you have been reading about recently.

We are developing training procedures for the operation of certain communication systems which may be used in the manned orbiting laboratory. One of the proposed communication devices requires the astronaut to monitor digital orbital data. With this system the astronaut must listen for changes in voice digital information which will tell him how to adjust his orbit.

We have developed a short training procedure that should rapidly teach the astronaut how to listen for the information. We want to try this procedure out tonight.

We're going to give you the training procedure, and then you will monitor a signal similar to that which an astronaut will monitor for approximately one orbit around the earth. If our estimates are correct, this training procedure should simplify the listening task for you. We are particularly interested in how persons who score high in "attention to perceptual detail" react to the training procedure. Those with high scores and training should have no trouble with the listening task. It will help you perform the task, if you imagine you are an astronaut and your survival will depend on how well you perform the task.

Let's get started, and I'll tell you what you are going to do.

Special Instructions to Experimenter

After E receives the lists of subjects scheduled to attend the experimental session, each subject should be contacted by telephone and reminded to attend the session they signed up for. After subjects have been contacted, E should look up the name of each person on the subject roster in the student directory. The subject's name as it appears in the student directory, should be written on 3 x 5 inch slip of paper as follows--last name, first name, middle initial. This slip of paper is stapled to the front of a form packet to be given to the subject. Each subject is arbitrarily assigned a score between 90 and 99 at random, and this score is written on the slip of paper in red pencil or ink.

At the site of the experiment, E calls-off the names of the subjects, and he hands out the form packet to the person called. After all subjects have received their individual packets, E should call off the names of those who didn't show up, and express concern over their absence. If E was unable to contact all subjects by telephone, he should apologize to those subjects not called. In this case, he should suggest a secretary was at fault.

NASA and Air Force publications with titles referring to outer space research should be on the experimenter's table in plain sight of the subjects as they enter the room. While the subjects are participating in the main listening task, E should sit in front of the group and read one of the reports. It is desirable that the report being read have a picture of an astronaut, space capsule, or rocket on the front cover.

APPENDIX L

NAME:____________________________ BIRTHDATE:____________________

SEX: ________________ SECTION: ____________________

FEELING TONE CHECKLIST A

INSTRUCTIONS: The statements to follow are to help you decide how you feel at this time - not yesterday, not an hour ago - but right now. For each statement you must determine whether you feel (1) "Better than," (2) "Same as," or (3) "Worse than" the feeling described by that statement.

As an example, take a person who feels a little tired. He might respond to the following items as follows:

	Better than	Same as	Worse than	Statement
a)	( )	( )	(X)	extremely fresh
b)	( )	(X)	( )	slightly tired
c)	(X)	( )	( )	complete exhausted

In other words, this person feels worse than "extremely fresh," about the same as "slightly tired," but, on the other hand, better than "completely exhausted."

Now, answer each of the following statements as follows:

If you feel better than the statement, place an "X" in the "better than" column.

If you feel about the same as the statement, place an "X" in the "same as" column.

If you feel worse than the statement, place an "X" in the "worse than" column.

Remember, answer <u>each</u> question with regard to how you feel at this instant.

	Better than	Same as	Worse than	Statement
1.	( )	( )	( )	slightly tired
2.	( )	( )	( )	like I'm bursting with energy
3.	( )	( )	( )	extremely tired
4.	( )	( )	( )	quite fresh
5.	( )	( )	( )	slightly pooped
6.	( )	( )	( )	extremely peppy
7.	( )	( )	( )	somewhat fresh
8.	( )	( )	( )	petered out
9.	( )	( )	( )	very refreshed
10.	( )	( )	( )	ready to drop
11.	( )	( )	( )	fairly well pooped
12.	( )	( )	( )	very lively
13.	( )	( )	( )	very tired.

APPENDIX M

NAME:______________________________ BIRTHDATE:____________

SEX: _______________ SECTION: ____________

FEELING TONE CHECKLIST B

INSTRUCTIONS: The statements to follow are to help you decide how you feel at this time--not yesterday, not an hour ago--but right now. For each statement you must determine whether you feel (1) "Better than," (2) "Same as," or (3) "Worse than" the feeling described by that statement.

As an example, take a person who feels a little tired. He might respond to the following items as follows:

	Better than	Same as	Worse than	Statement
a)	( )	( )	(X)	extremely fresh
b)	( )	(X)	( )	slightly tired
c)	(X)	( )	( )	completely exhausted

In other words, this person feels worse than "extremely fresh," about the same as "slightly tired," but, on the other hand, better than "completely exhausted."

Now, answer each of the following statements as follows:

If you feel better than the statement, place an "X" in the "better than" column.

If you feel about the same as the statement, place an "X" in the "same as" column.

If you feel worse than the statement, place an "X" in the "worse than" column.

Remember, answer <u>each</u> question with regard to how you feel at this instant.

	Better than	Same as	Worse than	Statement
1.	( )	( )	( )	a little tired
2.	( )	( )	( )	I never felt fresher
3.	( )	( )	( )	weary to the bone
4.	( )	( )	( )	quite fresh
5.	( )	( )	( )	a little pooped
6.	( )	( )	( )	extremely lively
7.	( )	( )	( )	somewhat refreshed
8.	( )	( )	( )	awfully tired
9.	( )	( )	( )	very rested
10.	( )	( )	( )	dead tired
11.	( )	( )	( )	fairly well pooped
12.	( )	( )	( )	very fresh
13.	( )	( )	( )	tuckered out

APPENDIX N

INSTRUCTIONS TO SUBJECTS:

OU SUBJECT POOL SURVEY

I have been asked to have you complete this questionnaire, I'm passing out. The instructions on the questionnaire will tell you what it is all about. It's self-explanatory.

After you complete it, you may leave. Leave the questionnaire face down on the desk as you leave. I am not supposed to see how you filled it out. Thank you!

APPENDIX O

Name ______________________ Birthdate____________Sex____Section_____

OU SUBJECT POOL SURVEY

The Department of Psychology is interested in finding out how students feel about the experiments in which they are asked to participate. How you answer the statements below will help determine what kinds of experiments students will be asked to take part in in the future.

Part 1

Instructions: The statements listed below pertain to the experiment you just completed. Read each statement. If you agree with a statement as it pertains to the experiment, circle "yes." If you disagree, circle "no." We want to find out how you feel about this experiment. Answer all statements.

1. I enjoyed doing this task. (.841) Yes No
2. This was an interesting task. (.710) Yes No
3. I found this task quite challenging. (.415) Yes No
4. I feel that the time I spend at this task was wasted. (-.540) Yes No
5. If the period were any longer I would certainly stop paying attention. (-.435) Yes No
6. There were times I was completely lost in my daydreaming. (-.424) Yes No
7. At times there was a strong temptation to fall asleep. (-.372) Yes No
8. I felt as though I would like to get up and walk out. (-.365) Yes No
9. At times I felt like giving up and just sitting there till it was over. (-.364) Yes No

10. I would like to participate in this kind of experiment again. Yes No

11. I was made to feel this was an important experiment. Yes No

12. I feel that I have made a useful contribution to scientific psychology by serving as a subject in this experiment. Yes No

Part 2

What do you think was the purpose of this experiment? (Write your answer on the back. Be Brief!)

APPENDIX P

INSTRUCTIONS TO SUBJECTS:

E'S FINAL REMARKS

Since it is getting late, I will not be able to discuss the experiment with you. If you are interested in finding out more about the experiment, write down on the back of the last form you filled out, whether you want to do this during a regular class session or special meeting. I'll do my best to arrange something. I'll let you know what was worked out through your instructor.

Please do not discuss this experiment with your friends, classmates, or roommates. This could ruin the experiment. We find we get the best results if people come to the experiment "cold" and do not know what to expect. Thank you for participating and being so cooperative.

APPENDIX Q

CRITICAL VALUES FOR ANALYSIS OF VARIANCE

$\underline{F_{.95}}(1,187) = 3.89$

$\underline{F_{.99}}(1,187) = 6.77$

$F_{.95}(3,187) = 2.65$

$\underline{F_{.99}}(3,187) = 3.89$

$\underline{F_{.95}}(2,374) = 3.02$

$\underline{F_{.99}}(2,374) = 4.66$

$\underline{F_{.95}}(6,374) = 2.12$

$\underline{F_{.99}}(6,374) = 2.85$

APPENDIX R

BASIC CELL MEAN TABLES FOR ALL VIGILANCE TASKS (AT5, AT16, and MLT) THE FEELING-TONE CHECKLIST, AND AROUSAL-INTEREST QUESTIONNAIRE

1. Five Minute Auditory Training Task--Mean Signals Detection

Task Load	Sex of S	Instruction Treatment			
		RC	IT	SI	CT
Normal	Male	4.63	5.00	4.80	4.92
	Female	4.80	4.64	4.67	4.82
High	Male	4.57	4.64	3.91	4.22
	Female	4.16	4.09	4.50	4.17

2. Sixteen Minute Auditory Training Task--Mean Signals Detection

Task Load	Sex of S	Instruction Treatment			
		RC	IT	SI	CT
Normal	Male	7.64	9.69	9.50	8.86
	Female	8.50	9.21	7.83	8.36
High	Male	7.57	7.88	7.06	8.11
	Female	7.63	5.91	8.00	8.17

3. Main Listening Task -- Mean Signals Detected

Instruction Treatment	Task Load	Sex of S	Subperiods P1	P2	P3
RC	Normal	Male	4.82	4.09	4.27
		Female	5.00	4.90	3.70
	High	Male	4.86	4.64	4.57
		Female	5.26	4.79	4.89
IT	Normal	Male	5.77	5.62	5.38
		Female	5.00	4.36	4.09
	High	Male	5.50	4.50	5.20
		Female	5.00	4.36	4.09
SI	Normal	Male	5.50	4.50	5.20
		Female	4.67	3.50	4.17
	High	Male	5.09	4.64	4.09
		Female	5.00	4.70	4.80
CT	Normal	Male	5.15	5.08	5.46
		Female	5.36	4.73	5.00
	High	Male	5.44	4.94	4.94
		Female	5.00	5.00	4.92

4. Feeling-tone Checklist -- Administration Means

Instruction Treatment	Task Load	Sex of S	Administration		
			1st	2nd	3rd
RC	Normal	Male	12.82	8.73	6.55
		Female	10.30	9.30	6.70
	High	Male	11.93	9.29	6.14
		Female	14.26	10.32	7.47
IT	Normal	Male	11.92	11.00	10.54
		Female	12.21	9.00	6.00
	High	Male	11.14	9.00	7.00
		Female	13.45	9.73	7.00
SI	Normal	Male	11.60	9.40	8.40
		Female	11.75	10.25	7.25
	High	Male	12.54	11.27	8.73
		Female	12.80	9.40	6.30
CT	Normal	Male	13.62	10.77	12.62
		Female	11.73	9.82	7.27
	High	Male	12.39	10.61	9.39
		Female	13.42	11.17	6.75

5. Arousal-interest Questionnaire Means

Task Load	Sex of S	Instruction Treatment			
		RC	IT	SI	CT
Normal	Male	5.00	6.54	5.30	6.46
	Female	4.30	4.79	4.67	5.09
High	Male	5.00	6.79	5.73	6.26
	Female	5.26	5.54	5.20	6.25

APPENDIX R

RAW DATA

Raw Data Code

Column

1 -- Subject number

2 -- Instruction treatment code: RC, IT, SI, or CT

3 -- Task load code: Normal (N) or High (+)

4 -- Sex of subject: Male (M) or Female (F)

5 -- Number critical signals detected, 5 min. Aud. Tng

6 -- Number critical signals detected, 16 min. Aud. Tng.

7 -- Number critical signals detected, 1st subperiod, MLT

8 -- Number critical signals detected, 2nd subperiod, MLT

9 -- Number critical signals detected, 3rd subperiod, MLT

10 -- Number erroneous reports, MLT

11 -- FTC score 1st administration

12 -- FTC score 2nd administration

13 -- FTC score 3rd (terminal) administration

14 -- Arousal-interest score, OU Subject Pool Survey

A -- Item 1 response, OU Subject Pool Survey (OUSPS): Yes (1) or No (0)

B -- Item 2, OUSPS: Yes (1) or No (0)

C -- Item 3, OUSPS: Yes (1) or No (0)

D -- Item 4, OUSPS: Yes (1) or No (0)

E -- Item 5, OUSPS: Yes (1) or No (0)

F -- Item 6, OUSPS: Yes (1) or No (0)

G -- Item 7, OUSPS: Yes (1) or No (0)

H -- Item 8, OUSPS: Yes (1) or No (0)

I -- Item 9, OUSPS: Yes (1) or No (0)

J -- Item 10, OUSPS: Yes (1) or No (0)

K -- Item 11, OUSPS: Yes (1) or No (0)

L -- Item 12, OUSPS: Yes (1) or No (0)

Raw Data

1	2	3	4	5	6	7	8	9	10	11	12	13	14	A	B	C	D	E	F	G	H	I	J	K	L
001	RC	N	M	5	6	2	0	1	8	13	4	0	4	1	0	0	0	0	1	1	0	1	0	1	1
002				5	4	3	4	5	2	12	10	10	3	0	1	1	0	1	1	1	1	1	0	1	0
003				5	10	5	5	5	1	21	12	9	7	1	1	1	0	0	1	0	0	1	1	0	1
004				5	6	4	2	3	0	12	10	4	5	1	1	1	0	0	1	1	1	1	1	1	1
005				5	8	5	5	5	0	13	11	8	6	1	1	1	0	0	1	0	1	1	1	1	1
006				5	10	6	5	5	1	12	0	0	2	0	0	1	0	1	1	1	1	1	0	0	1
025				4	8	4	4	3	0	11	4	3	4	0	0	0	0	0	1	1	0	0	0	0	0
026				4	9	6	6	4	0	13	12	11	6	0	0	0	0	0	0	0	0	0	1	1	1
027				5	9	6	4	6	1	12	13	13	6	1	0	1	0	0	0	0	1	1	1	0	0
028				4	8	6	4	4	1	6	7	11	5	1	0	1	0	0	1	1	0	1	1	1	1
029				4	6	6	6	6	15	16	13	3	7	1	0	1	0	0	0	0	0	1	1	0	1
007	RC	N	F	5	10	6	6	4	0	11	9	5	5	1	0	0	0	0	0	0	1	1	0	0	0
008				5	9	3	5	3	1	7	11	5	5	0	0	1	0	0	0	1	1	0	1	0	1
009				5	10	6	5	3	0	6	7	6	5	0	0	1	0	0	0	1	0	1	0	1	1
010				5	8	4	5	4	0	13	5	11	1	0	0	1	1	1	1	1	1	1	0	0	1
011				5	6	3	5	2	2	3	4	0	2	0	0	0	0	0	1	1	1	1	0	0	0
030				5	10	6	5	5	0	11	11	7	5	1	0	1	0	1	0	1	1	0	1	0	0
031				5	8	6	4	4	0	17	12	12	5	0	0	1	0	0	1	1	0	0	0	0	0
032				5	8	5	5	2	4	18	13	7	2	0	0	1	0	1	1	1	1	1	1	1	1
033				4	10	6	6	6	0	8	9	6	7	0	0	1	0	0	0	0	0	0	1	0	1
034				5	6	5	3	4	1	9	12	8	6	0	1	1	0	1	1	0	0	0	1	1	1
012	RC	+	M	5	8	1	4	4	3	13	9	1	0	0	0	0	1	1	1	1	1	1	0	0	0
013				5	9	6	5	6	0	14	14	9	8	1	1	1	0	0	0	1	0	0	0	0	1
014				4	4	2	1	2	1	12	9	5	2	0	0	1	0	1	1	1	1	1	0	1	0
015				5	10	6	6	6	0	13	11	9	4	0	0	1	1	0	0	0	1	1	0	0	0
016				5	8	5	5	4	0	12	9	6	6	1	1	1	0	0	1	1	0	1	1	1	1
017				5	8	6	5	6	0	13	9	4	2	0	0	1	0	1	1	1	1	1	0	0	0
018				4	6	6	4	3	2	6	5	4	4	0	0	0	0	1	1	0	0	0	0	0	0
087				5	10	5	5	6	0	6	6	6	8	1	1	1	0	0	1	0	0	0	1	0	1
088				4	5	4	5	3	3	14	10	11	3	0	0	0	0	1	0	0	1	1	0	0	0
187				5	7	6	4	5	3	12	11	11	4	0	0	1	0	1	0	1	0	1	1	0	1
188				5	9	4	6	6	1	17	9	7	8	0	1	1	0	0	0	0	0	0	0	0	0
189				3	2	6	6	4	1	12	8	4	5	1	0	1	1	0	0	0	1	1	1	1	1
190				5	10	5	3	5	1	11	11	5	9	1	1	1	0	0	0	0	0	0	1	0	1
191				4	10	6	6	4	1	12	9	4	7	1	1	1	0	1	0	1	0	0	1	1	1
019	RC	+	F	5	9	5	3	5	0	17	11	7	4	0	1	1	1	1	0	1	0	1	0	0	0
020				5	7	5	6	6	2	10	11	5	4	1	0	1	0	1	0	1	1	1	1	1	1
021				3	4	5	3	3	4	12	8	9	2	0	0	1	0	1	1	1	1	1	0	0	0
022				3	6	2	3	1	0	21	9	4	2	0	0	0	0	1	1	0	1	1	0	0	1
023				5	10	4	4	6	0	19	13	11	6	1	1	1	0	1	0	1	0	1	1	0	0
024				3	5	6	5	5	0	17	10	4	4	0	0	1	1	1	0	1	0	0	0	1	1
089				4	9	6	5	6	0	17	11	3	7	1	1	1	0	0	0	1	1	0	1	1	1
090				5	9	6	6	6	0	16	12	5	8	1	1	1	0	0	1	0	0	0	1	1	1

Raw Data -- Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	A	B	C	D	E	F	G	H	I	J	K	L
091	RC	+	F	4	5	5	3	3	4	12	6	4	4	0	0	0	0	0	0	1	0	1	0	0	1
192				5	10	6	6	6	3	20	19	19	8	1	1	1	0	1	0	0	0	0	1	1	1
193				5	5	5	4	5	1	18	11	10	7	1	1	1	0	0	1	0	0	1	1	1	1
194				4	10	6	6	6	0	10	6	5	2	0	0	1	0	0	1	1	1	1	0	0	1
195				3	10	6	6	6	0	18	12	7	7	0	1	1	0	0	0	0	0	1	1	0	1
196				4	9	5	6	5	1	12	12	12	8	1	1	1	0	1	0	0	0	0	1	0	0
197				5	9	6	5	4	6	10	8	4	5	0	0	1	0	0	0	1	1	0	1	1	1
198				3	5	5	6	4	1	11	11	11	3	0	0	1	1	1	0	0	1	1	0	0	1
199				5	7	5	4	5	1	11	7	7	5	0	1	1	0	1	0	0	1	1	0	0	0
200				3	8	6	4	4	2	7	7	6	7	1	0	1	0	1	0	0	0	0	1	1	1
201				5	8	5	6	6	0	13	12	9	7	1	1	1	0	1	0	0	0	1	1	0	1
060	IT	N	M	5	10	6	5	4	0	5	7	5	5	0	1	0	0	0	0	1	0	1	1	1	1
061				5	9	6	6	6	0	12	12	12	8	1	1	1	0	0	0	1	0	0	1	1	1
062				5	9	6	6	6	0	15	10	11	7	1	0	0	0	0	0	0	0	0	1	1	1
063				5	10	6	6	6	0	6	5	12	6	0	0	0	0	0	0	0	0	0	1	0	0
064				5	10	5	6	6	0	12	12	12	9	1	1	1	0	0	0	0	0	0	1	1	1
065				5	10	6	6	6	0	10	10	10	6	0	1	1	1	0	0	1	0	0	0	0	0
066				5	9	5	6	6	0	13	14	11	7	0	1	1	0	0	0	1	0	0	1	1	1
067				5	10	6	6	6	0	10	3	4	3	0	0	0	1	1	0	1	0	0	0	1	1
068				5	10	6	6	4	0	18	16	7	6	1	1	1	0	0	1	1	0	1	1	1	0
069				5	10	6	3	4	0	13	12	11	7	1	1	1	1	0	0	1	0	0	1	1	1
070				5	10	5	6	6	0	19	18	19	7	0	0	1	1	0	0	0	0	0	1	0	1
071				5	10	5	5	5	1	10	12	12	5	0	1	1	0	0	1	1	0	1	1	1	1
072				5	9	6	6	5	0	12	11	11	9	1	1	1	0	0	0	0	0	0	1	1	1
073	IT	N	F	5	7	6	4	3	1	12	12	10	7	1	1	1	0	1	0	1	0	0	1	1	1
074				5	9	6	5	6	2	14	12	7	2	0	1	0	1	1	0	1	1	1	0	0	1
075				5	9	4	5	5	5	12	10	5	1	0	0	0	0	1	1	1	1	1	1	1	1
076				3	10	5	5	6	0	9	4	5	4	0	0	1	0	0	0	1	1	1	0	1	1
077				5	10	6	6	5	0	17	14	13	6	1	1	1	0	1	0	0	1	1	1	1	1
078				5	9	6	6	6	1	14	14	14	5	0	1	0	0	0	0	1	1	0	0	0	1
079				5	10	6	5	6	1	7	9	9	6	1	1	0	0	1	1	0	0	0	1	0	0
080				4	10	5	5	6	1	12	13	4	8	1	1	1	0	0	1	0	0	0	1	1	1
081				5	10	6	3	5	0	12	10	10	3	0	0	1	1	1	1	0	0	1	1	0	0
082				5	10	6	4	6	1	13	19	13	8	1	1	0	0	0	0	0	0	0	1	0	1
083				5	8	6	6	6	1	10	6	4	3	0	0	0	1	1	0	1	0	0	0	0	1
084				5	10	6	6	5	0	15	12	15	5	0	1	1	0	1	1	1	0	0	1	1	1
085				5	10	6	6	5	0	12	8	12	5	0	0	1	1	0	1	0	0	0	1	0	0
086				5	9	6	6	6	0	12	12	3	4	0	0	1	0	0	0	1	1	1	0	1	0
035	IT	+	M	4	10	6	5	2	1	6	5	3	4	0	0	1	0	1	0	1	1	0	0	1	1
036				5	9	5	5	4	2	13	12	9	5	0	1	1	0	1	0	1	0	1	1	1	1
037				5	10	4	5	6	0	14	8	4	8	1	1	1	0	0	0	0	0	1	1	1	1
038				5	8	6	5	3	0	6	12	5	7	1	1	1	0	1	0	1	0	0	1	1	1
039				4	8	4	5	3	0	2	2	2	6	1	1	1	0	1	1	0	0	1	1	0	1

Raw Data -- <u>Continued</u>

1	2	3	4	5	6	7	8	9	10	11	12	13	14	A	B	C	D	E	F	G	H	I	J	K	L
040	IT	+	M	4	8	5	6	6	0	11	11	11	9	1	1	1	0	0	0	0	0	0	1	1	1
041				5	9	6	5	4	0	16	15	9	8	1	1	1	0	1	0	0	0	0	0	1	1
044				5	0	4	4	4	1	12	7	7	6	1	0	0	0	0	0	1	0	0	1	1	1
045				5	6	5	6	6	1	15	13	7	9	1	1	1	0	0	0	0	0	0	1	1	1
046				5	7	6	4	5	1	13	6	3	6	0	0	1	0	0	0	0	1	0	0	1	1
047				5	9	6	6	6	0	12	12	9	7	0	0	1	0	0	0	0	0	0	0	1	1
048				5	9	6	5	6	3	13	3	0	4	0	1	1	0	1	1	1	0	1	1	1	1
049				5	9	6	6	6	0	12	11	11	8	1	1	1	0	0	0	0	1	0	1	1	1
050				3	8	6	6	2	0	11	9	4	8	1	1	1	0	1	0	0	0	0	1	1	1
042	IT	+	F	5	6	5	6	6	3	14	9	8	5	0	0	1	0	0	0	1	1	0	0	0	1
043				3	7	4	6	5	1	10	7	9	6	0	0	1	0	0	0	0	1	0	1	1	1
051				5	9	5	5	6	0	15	18	8	9	1	1	1	0	0	0	0	0	0	1	0	1
052				5	7	6	1	2	0	11	9	6	3	0	1	1	0	1	1	1	1	1	0	1	1
053				3	9	5	6	5	2	13	5	5	2	0	0	0	0	1	0	1	1	0	0	0	1
054				5	4	4	4	3	5	12	7	6	3	0	0	1	0	1	1	1	0	1	0	0	1
055				5	1	6	3	4	4	18	9	7	6	1	1	1	0	1	1	0	0	1	1	1	1
056				5	8	5	4	5	0	15	9	6	7	1	1	0	0	1	0	0	0	0	1	1	1
057				5	7	6	5	5	1	9	12	7	8	1	1	1	0	1	0	0	0	0	1	1	1
058				3	5	5	3	3	0	13	11	7	7	1	1	1	0	0	0	1	0	1	1	1	1
059				1	2	4	3	2	1	18	11	8	5	0	0	0	0	1	0	0	0	0	0	1	1
092	SI	N	M	5	10	6	5	4	2	15	12	6	4	1	1	1	1	1	1	1	0	1	0	1	0
093				5	9	6	6	6	0	11	7	7	8	1	1	1	0	0	0	0	0	1	1	0	1
094				5	9	6	4	6	0	12	12	12	4	1	0	1	0	1	1	0	1	1	0	0	0
095				5	10	6	6	5	0	13	5	7	7	0	0	1	0	0	0	0	0	0	0	1	1
096				5	10	3	0	3	5	5	4	2	3	0	0	1	0	1	1	1	0	1	0	1	0
097				5	10	5	6	6	0	13	7	2	7	1	1	1	0	1	0	0	1	0	1	1	1
098				5	9	6	4	6	0	12	12	12	4	1	0	1	0	1	1	0	1	1	1	1	0
099				5	9	6	5	4	0	12	11	11	5	0	0	1	0	0	1	0	0	1	0	0	1
100				5	10	6	4	6	0	12	12	12	8	1	1	1	0	0	0	1	0	0	1	1	1
132				3	9	5	5	6	8	11	12	13	3	0	0	1	0	0	1	1	1	1	0	1	1
101	SI	N	F	4	7	5	3	4	4	20	11	12	4	0	1	0	0	1	1	0	0	1	0	0	0
102				5	10	6	4	6	2	11	11	6	4	0	0	1	0	1	1	1	0	0	0	1	1
103				5	9	5	5	6	1	14	13	11	5	0	1	0	0	0	0	1	0	1	0	0	1
104				5	6	6	5	5	3	16	11	7	5	1	1	1	0	1	1	1	0	1	1	1	1
105				5	7	4	4	4	1	21	19	11	8	1	1	1	0	0	1	0	0	0	1	0	1
106				5	10	6	6	6	0	13	14	9	9	1	1	1	0	0	0	0	0	0	1	1	1
107				5	3	3	0	3	10	8	6	7	7	1	1	1	0	0	1	1	0	0	1	1	1
108				4	7	4	1	1	1	5	4	4	0	0	0	0	0	1	1	1	1	1	1	0	1
109				5	8	1	0	2	2	8	6	5	0	0	0	0	1	1	1	1	1	1	1	0	0
133				3	10	6	6	6	0	14	13	11	5	1	1	0	0	1	0	0	1	1	1	0	0
134				5	10	5	6	6	0	6	7	4	7	0	1	1	0	0	1	0	0	0	1	1	1
135				9	5	7	5	2	1	5	8	0	2	0	1	0	0	1	1	1	1	1	0	0	0

Raw Data -- Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	A	B	C	D	E	F	G	H	I	J	K	L
110	SI	+	M	5	10	5	5	3	3	18	11	9	5	1	1	1	0	1	1	0	1	1	0	0	1
112				3	7	6	5	2	0	19	12	7	6	1	1	1	0	1	1	0	0	1	1	0	1
113				5	3	4	3	2	1	15	12	11	3	0	0	1	0	1	1	0	1	1	0	0	1
114				5	8	5	4	6	0	11	11	10	9	1	1	1	0	0	0	0	0	0	1	1	1
115				4	9	4	4	2	3	13	12	5	5	0	0	1	0	0	0	0	1	1	0	0	1
121				2	9	6	6	6	0	10	11	10	8	1	1	0	0	0	0	0	0	0	1	0	1
122				4	10	5	5	5	3	11	11	11	5	1	0	0	0	1	0	0	1	0	0	0	0
123				5	3	4	3	4	0	8	10	7	3	1	1	0	1	0	1	1	1	1	0	1	0
124				2	7	6	5	5	0	11	11	9	4	0	1	1	0	1	1	1	1	0	0	0	1
125				4	8	5	5	4	0	10	10	7	7	1	1	1	0	0	1	1	0	0	1	0	1
126				4	10	6	6	6	0	13	13	10	8	1	0	1	0	0	0	0	0	0	0	1	1
116	SI	+	F	5	10	6	5	6	0	20	9	5	6	1	1	1	0	1	0	1	0	1	1	1	1
117				5	8	5	3	5	2	9	5	2	4	0	0	1	1	0	1	1	0	0	0	1	1
118				5	8	6	4	3	1	14	11	6	6	0	1	1	0	0	0	0	1	1	0	0	1
119				4	5	4	3	5	1	7	6	4	8	1	1	1	0	1	0	0	0	0	1	1	1
120				5	8	5	5	5	0	12	8	4	2	0	0	1	1	1	1	0	1	1	1	1	1
127				5	7	4	5	4	0	12	12	11	7	1	1	1	1	1	0	0	0	0	1	0	1
130				5	8	5	6	6	1	15	11	7	7	1	1	1	0	1	1	0	0	0	1	1	1
131				5	9	6	5	6	2	15	11	7	5	1	1	1	0	1	1	1	1	0	1	1	1
132	CT	N	M	5	10	6	5	5	0	11	11	11	9	1	1	1	0	0	0	0	0	0	1	0	1
133				5	10	3	6	4	1	17	12	15	6	0	0	0	0	0	0	0	0	0	1	0	1
134				5	5	5	5	6	0	18	9	5	2	0	1	1	1	1	1	1	1	1	0	1	1
135				5	10	5	5	6	0	15	13	13	3	0	1	1	0	1	1	1	1	1	0	1	1
136				5	10	5	5	6	0	14	12	12	7	1	1	1	0	1	1	0	0	0	1	1	1
137				5	9	4	6	4	0	14	12	14	6	1	1	0	0	1	1	0	0	0	1	1	0
138				5	10	6	6	5	1	14	12	22	9	1	1	1	0	0	0	0	0	1	0	0	1
139				5	10	5	5	6	0	11	12	11	7	1	1	1	0	1	0	1	0	0	1	1	1
140				5	9	6	2	6	1	11	4	12	6	1	1	1	0	0	1	1	1	0	1	1	1
141				5	4	5	4	6	1	13	6	16	6	0	1	1	0	0	1	1	0	0	1	1	1
142				5	9	6	6	6	1	11	11	9	5	0	1	1	0	1	0	1	0	1	1	1	1
143				4	10	5	5	5	1	16	15	12	9	1	1	1	0	0	0	0	0	0	1	1	1
144				5	9	6	6	6	0	12	11	12	9	1	1	1	0	0	0	0	0	0	1	1	1
145	CT	N	F	5	10	6	6	6	0	13	13	3	5	0	1	1	0	1	0	0	1	1	0	1	1
146				5	8	6	5	6	0	9	4	11	5	1	1	1	0	1	1	0	1	1	1	1	1
147				4	7	6	4	5	0	13	12	7	3	0	1	1	0	1	1	1	1	1	0	1	1
148				5	9	6	4	4	4	13	12	9	5	1	1	0	0	0	1	1	0	1	1	0	0
149				5	7	5	6	5	0	13	11	7	8	1	1	1	0	0	1	0	0	0	1	1	1
150				5	10	6	6	6	0	13	12	12	8	0	1	1	0	0	0	0	0	0	0	0	0
151				4	10	6	5	5	3	13	12	6	6	0	0	1	0	1	0	0	0	0	1	1	1
152				5	8	5	4	4	3	6	4	3	3	0	1	1	0	1	1	1	1	1	1	1	1
153				5	4	3	4	5	2	12	10	6	1	0	0	0	1	1	1	1	0	1	0	0	0
154				5	9	4	4	5	0	12	10	7	7	1	1	1	0	0	1	1	0	0	1	1	1
155				5	10	6	4	4	1	13	12	5	5	1	1	1	0	1	1	0	1	1	0	1	0

Raw Data -- Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	A	B	C	D	E	F	G	H	I	J	K	L
156	CT	+	M	5	8	6	3	6	0	12	12	12	3	1	1	0	0	1	1	1	1	1	1	1	1
157				3	9	6	6	5	0	11	11	7	6	0	1	0	0	1	0	0	0	0	1	1	0
158				4	8	6	5	6	2	17	12	12	6	1	1	1	0	0	1	0	1	1	1	1	1
159				5	8	6	5	4	0	11	11	11	7	0	1	1	0	0	0	0	1	1	1	1	1
160				5	7	6	6	6	1	13	9	6	2	0	0	0	0	1	1	0	1	1	0	0	0
162				5	8	6	6	6	0	11	15	13	6	1	0	0	0	0	1	0	0	0	1	1	0
165				5	10	6	6	6	0	12	10	6	5	0	1	0	0	1	0	1	0	1	1	1	1
166				5	10	6	5	6	0	13	11	8	9	1	1	1	0	0	0	0	0	0	1	1	1
167				5	4	2	3	2	1	17	13	14	7	1	1	1	0	0	1	0	0	1	1	1	1
168				5	9	6	4	5	0	10	6	10	5	0	1	1	0	1	1	1	0	0	1	0	1
179				3	9	5	6	6	1	15	12	12	6	1	0	0	1	0	0	0	0	0	1	0	1
180				5	9	4	6	5	0	12	8	8	5	1	0	0	0	0	1	1	0	0	1	1	1
181				5	4	3	4	2	0	13	11	7	4	0	0	1	0	1	1	1	0	0	0	0	0
182				4	10	6	6	4	0	12	12	12	8	0	1	1	0	0	0	0	0	0	1	0	0
183				0	9	6	4	5	0	6	1	0	5	0	0	1	1	0	0	1	0	0	0	1	0
184				5	9	5	5	5	0	11	12	11	6	1	1	1	0	1	0	1	0	1	1	0	1
185				2	8	6	6	5	0	12	11	10	5	1	1	0	0	1	0	1	0	1	1	1	1
186				5	7	6	3	5	0	15	14	10	7	1	1	0	0	0	1	0	0	0	1	0	0
163	CT	+	F	4	10	6	6	4	0	13	11	4	7	1	0	1	0	0	0	1	0	0	0	1	1
164				5	10	6	6	6	1	12	14	6	6	1	1	0	0	1	0	1	0	0	1	1	1
169				5	7	5	4	4	1	13	19	11	6	1	1	1	0	1	0	1	0	1	1	1	1
170				5	8	4	6	5	0	12	12	9	8	0	1	1	0	0	0	0	0	0	0	0	1
171				2	8	5	5	5	3	12	8	3	1	0	0	0	0	1	1	1	1	1	0	1	0
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173				3	8	5	5	5	1	15	13	3	4	0	1	1	0	1	0	1	1	1	0	0	0
174				5	9	6	6	6	2	15	13	10	6	1	1	1	0	1	1	1	0	0	1	1	1
175				5	7	4	2	5	2	16	5	5	5	1	0	1	0	1	0	1	0	1	1	1	1
176				5	8	4	5	4	1	16	12	11	6	0	1	1	0	1	0	0	0	1	0	1	0
177				5	9	6	6	6	1	21	13	8	9	1	1	1	0	0	0	0	0	1	1	1	1
178				1	5	4	4	3	4	14	12	6	8	1	1	1	0	0	0	0	0	1	1	1	1