ABSTRACT

PHYSIOLOGICAL RESPONSES OF ELECTRICAL SKIN CONDUCTANCE, HEART RATE, AND RESPIRATION RATE OF ALCOHOLICS AND NON-ALCOHOLICS TO AFFECTIVE STIMULUS FILMS

By

Larry Ralph Teitsma

This research was an attempt to contribute to the present understanding of a known behavior group's physiological response to emotion. More specifically, the study compared the physiological responses of an alcoholic and non-alcoholic group during the presentation of affective stimulus films. The investigation attempted to determine if there were certain physiological responses that were significantly different between the groups.

The major theoretical underpining of this study was that there was a relationship between physiological behavior and social behavior. It was postulated that feelings influence behavior and that feelings were at least in large part physiological in nature. The implication of these statements bear on therapy in general, and alcoholics in particular.

The basic questions of the study were as follows: (1) Would the alcoholic group score significantly lower than the non-alcoholic group on electrical skin conductance measurements during the presentation of all the affective film

stimuli? (2) Would the alcoholic group score significantly higher than the non-alcoholic group for heart rate measurements during the presentation of all the affective film stimuli? (3) Would the alcoholic group score significantly different than the non-alcoholic group for respiration rate measurements during the presentation of all the affective film stimuli?

Past research has demonstrated a relationship between emotion and physiology. Some of the measures often used to measure this relationship were electrical skin conductance, heart rate, and respiration rate. It was hypothesized that these measures might differentiate the physiological responses of alcoholics from non-alcoholics. Previous research has also found films a useful source for emotional stimulation.

The population from which the subjects were randomly selected was the clients of the Lansing Office of the Michigan Division of Vocational Rehabilitation. The samples consisted of ten, white, male volunteers, thirty-five to fifty-five years of age, who were described by the agency as free from symptoms of gross emotional pathology.

The experimental (alcoholic) and the control (non-alcoholic) groups received the identical treatment. Each viewed eight affective vignettes, each vignette depicting mild or blatant affection or rejection enacted by a male or female actor. While the subjects were presented with the film stimulus, the three physiological responses of electrical

skin conductance, heart rate, and respiration rate were recorded using a Grass 5D Polygraph. Various dimensions of each of these three responses were measured which resulted in a total of fourteen measures recorded from each subject. After the treatment, a post-treatment check list was given. The list consisted of a collection of data which described the test setting and the physical and social status of the subject at the time of testing (see Appendix H). The data were collected and analyzed according to a repeated measures analysis of variance.

Results of the repeated measures analysis of variance indicated no significance on the group means at the .05 level. The electrical skin conductance measures based upon group means were all in the expected direction. All the heart measures and the respiration mean rate based upon group means were in the opposite direction from that hypothesized, while the number and mean length of apnea were non-directional. Since there was no significance on the sources of variation, except one, M (Measures), which was not meaningful, individual analysis of each hypothesis was not performed. A post hoc analysis on a subset of the measures was performed for the purpose of hypothesis generating. A multivariate analysis of variance and univariate F tests were performed. The results of the univariate F tests suggested that on the $\overline{X}$HR the alcoholic and non-alcoholic groups differed.

It is possible the hypotheses were incorrect and that there was no difference between the alcoholic and non-alcoholic. If this was true, then it must be assumed that many of the ideas of what makes an alcoholic an alcoholic need re-examination (i.e., perhaps alcoholism is largely a physical and/or chemical rather than a psychogenic disorder). It might also be possible that alcoholics and non-alcoholics have identical emotional makeup but simply find different ways of expressing it. It might, however, be possible that some of the limitations of the current design interfered and that the hypotheses still are valid.

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By

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DEDICATION

To Anne, my wife

and

my mother and father.

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At one time I felt that this page was written out of form or custom; however, after working on this study I have come to realize that often mere acknowledgment of appreciation for friendship, guidance, and cooperation is limited in conveying my heartfelt thanks.

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CHAPTER I

THE PROBLEM

General Statement

This study is an attempt to contribute to the present understanding of a known behavior group's physiological responses to emotion. More specifically, the study will compare the physiological responses of an alcoholic and non-alcoholic group recorded during the presentation of affective stimulus films. The investigation will attempt to determine the physiological responses that are significantly different between the groups.

Specific Problem

This investigation consisted of measuring physiological responses of alcoholics and non-alcoholics during the presentation of affective stimulus films. The physiological responses measured are electrical skin conductance, heart rate, and respiration rate. Various dimensions of each of these three responses are measured which results in a total of fourteen measures taken for each subject.

The subjects are all clients of the Lansing Office of the Michigan Division of Vocational Rehabilitation. The subjects are randomly selected for the study. They are white,

thirty-five to fifty-five year old males, and volunteers who are judged to be without gross emotional pathology.

The treatment is a standardized presentation of eight affective vignettes. The vignettes contain the subtle or blatant emotion of affection or rejection as portrayed on videotape by a male or female actor.

Definition of Terms

The special terms of this investigation are defined as follows:

Alcoholic: A person accepted as a client by the Lansing Office of the Michigan Division of Vocational Rehabilitation. The acceptance for vocational assistance was based on a decision that the person's primary disability is alcoholism. As a subject in this study, he also meets the criteria of being a white, thirty-five to fifty-five year old male, and a volunteer who is judged to be without gross emotional pathology.

Non-alcoholic: A person accepted as a client by the Lansing Office of the Michigan Division of Vocational Rehabilitation. The acceptance for vocational assistance was based on a physical disability other than alcoholism. As a subject in this study, he also meets the criteria of being a white, thirty-five to fifty-five year old male, and a volunteer who is judged to be without gross emotional pathology.

Coordinator: An employee of the Lansing Office of the Michigan Division of Vocational Rehabilitation who

coordinates the program of rehabilitation services for the clients assigned to him.

Vignette: A video tape segment of short duration on which is depicted the emotional stimuli used in the study.

Electrical Skin Conductance (ESC): The electrical conductance of the skin at a constant voltage. It is assumed that the amount of moisture in the skin determines its electrical conductivity.

Heart Rate (HR): The number of heart beats per minute as measured by a standard cardiotachometer. The EKG is integrated to provide a DC voltage which was proportional to heart rate.

Respiration Rate (RR): The number of exhalations in a one minute time period as measured by a mercury-in-rubber strain gauge attached to the subject's chest.

Delimitations

Generalizations of the study are delimited by the following:

1. The subjects are all clients of the Lansing Michigan Division of Vocational Rehabilitation. They are white, thirty-five to fifty-five year old, male, and volunteers who are judged to be absent of gross emotional pathology which is atypical for alcoholics as a group for it is recognized that there is a higher per cent of gross emotional pathology associated with alcoholism (Wallgren and Barry, 1970). Generalizations to older or younger subjects, to females, and to non-white populations are not proper.

2. The vignettes are limited to subtle and blatant levels of affection or rejection and limited in number. Generalizations to other levels and number of emotions are not proper.

3. Diurnal physiology variation is controlled in part by having the treatment during a specified time of day and during one month of the spring season. Generalizations to other periods of the day or year are not proper.

4. No attempt is made to determine that the non-alcoholic group are not also heavy drinkers or include alcoholics, only that their primary disability is not alcoholism. Generalizations of alcoholism beyond the limitation of primary disability is not proper, since "non-alcoholics" may also have been heavy drinkers.

Need for Research

The United States, as well as many nations of the world, is facing one of the greatest problems it has ever faced - that of drug abuse. According to the Department of Health, Education, and Welfare, the number one drug in this country continues to be alcohol. The extent of the alcohol problem, according to the National Institute on Alcohol Abuse and Alcoholism, is demonstrated by such facts as these: high alcohol content is found in the blood of half of all traffic-accident victims, alcoholics shorten their own lives by an average of ten to twelve years, nine million out of ninety-four million drinkers are classified as alcoholics,

and alcohol cost the American people an average of fifteen billion dollars a year in lost work, health and welfare aid, and additional property damage, (as reported in "Pot and Alcohol, some new views," Time, XCIX, p. 51, February 28, 1972). The greatest percentage of problem drinkers are thirty-five to fifty-five years old (Plaut, 1967) and male (Trice, 1966).

Alcoholism is an integral part of the mental health problem. Plaut (1967) reports that in 1964 there were slightly less than seventy thousand first admission of male patients to the nearly three hundred state mental hospitals, twenty-two per cent were given a diagnosis of alcoholism at admission. Wallgren and Barry (1970) report that the

> More profound mental pathology, associated with alcoholism, is seen in the high incidence among alcoholics of other mental illnesses, in particular depression, schizophrenia and psychopathic personality.

Cross (1968) reports that child neglect and abuse can often be traced to an alcoholic parent. He (Cross, 1968) states

> . . . two thirds of married alcoholics have children, and there is evidence that children of alcoholic parents are more likely than other children to suffer damaging personality effects brought on by social atmosphere which is markedly unstable and torn with dissension.

Cross (1968) reports problem drinking as contributing to over twenty per cent of family breakdowns. Wallgren and Barry (1970) state that, "All studies showing that pathology of childhood environment or adult personality is related to alcoholism thereby imply the converse relationship of mental health to the absence of alcoholism."

The therapeutic mental health approaches to the alcoholic have demonstrated limited effectiveness. Bowman and Jellinek (1941), and Gibbins (1953), review the range of therapeutic approaches to chronic alcoholism. Wallgren and Barry (1970) found that therapy, generally, has helped fewer than fifty per cent of alcoholics to lessen their problem or abstain from drinking while twenty per cent of all alcoholics recover without therapeutic help. In summary, they state that ". . . even a small improvement in the effectiveness of therapy would contribute a great benefit to society" (Wallgren and Barry, 1970).

The need of working toward better mental health is immense. Most authorities agree that there are probably more than twenty million people in the United States with some form of psychological disturbances needing treatment, about one half a million people in mental hospitals at any moment, and about two and a half million are admitted and receiving treatment in public and private hospitals and clinics a year, (Budgetary Hearings for the National Institute of Mental Health before a Subcommittee of The Committee on Appropriations, Ninety-first Congress, First Session, Washington, D. C., 1969, National Institute of Mental Health, 1970). Although alcoholism is only one portion of the mental health picture, what works effectively toward helping alcoholics achieve better mental health may also be effective towards helping others who are part of the total picture.

It is hoped that physiological responses to emotional stimuli can be used therapeutically in accelerating client growth. It is theorized that if a certain group, the alcoholic, responds similarly in certain physiological patterns to certain emotional stimuli; then, the resulting information can be used toward accelerating client growth. First, the task is to determine if there are distinctive physiological response patterns for this group. Next, if patterns are found, interviews between a therapist and a member of the group who is wired for physiological responses could be begun. During the interview, the therapist could help explore the emotional correlates of the distinctive patterns with the group member. This is done in order to help him become aware of and explore his major conflicts and anxieties. If awareness and subsequent ways of handling the conflicts are achieved, the client would be presumed to have grown by quickly looking at the basic conflicts and limiting the time needed with a therapist. One therapeutic method, already being practiced, which might be used to implement this approach is Interpersonal Process Recall (IPR), (Kagan, et al., 1967). This approach uses physiological referents, video taping, and recall in an effective therapeutic encounter.

Theory

The major theoretical underpining of this study is that there is a relationship between physiological

behavior and social behavior. It is postulated that feelings influence behavior and that feelings are at least in large part physiological in nature. The implication of these statements bear on therapy in general, and alcoholics in particular.

Archer et al. (1971) described the basic therapeutic theory as follows:

> If one of the basic goals of counseling and psychotherapy is to help clients to become aware of the incongruities between what they perceive and feel, on the one hand, and what they are willing or able to actually acknowledge and admit to themselves on the other, then it seemed logical and desirable to provide a client not only an opportunity to study his physical and verbal reactions to a real or simulated interpersonal engagement but to literally permit him to see what his internal responses were as well. If affect is indeed bodily status, internal as well as external, it seemed reasonable that provision to the client of measures of his physiological responses during the counseling session would aid him even more in the process of self-discovery and change.

Many researchers report that physiological changes accompany the shift in client interview mood as well as the content which he is sharing (Alexander, 1948; Lasswell, 1935; Malmo, et al., 1950; and Lacey, 1959).

Specifically, research shows that tension and palmar sweating are related (Mower, et al., 1953). Light, (as reported in Anderson, 1956) reports shifts in the interview-to-interview level of palmar perspiration as an indicator of tension in counseling subjects. Di Mascio et al. (1957) report that when the patient is expressing hostility and antagonism toward the therapists there is a decrease in

heart rate and an increase in heart rate variability which expression the therapist sees as tension reducing. They also report that much "tension release" results in a slowed heart rate while much "tension" results in a speeding up of heart rate. Anderson (1956) reports that defensive patients reduce tension by discussing the therapeutic situation or the therapists which results in a lower, more stable heart rate.

Archer et al. (1971) note that a combination of heart rate and eccrine sweat rate can indicate both emotional arousal and suppression of awareness. When eccrine sweat rate has been high and then drops, the accompanying psychological state is usually one of suppression or inhibition on the part of the subject. This is an elaboration of the work done by Kagan (1970) who observes the following relationship between heart rate and eccrine sweat rate:

> 1. When a person is affected by, but cannot or does not acknowledge the emotion; that is, where the emotion or environmental stimulus is perceived but not permitted into awareness, there is usually an increase in heart rate and a lowering or leveling off of eccrine sweat rate. It is as if, in the current vernacular, the person literally "cools it."
>
> 2. When a person is affected by an emotion or other in his environment, and acknowledges the impact or allows himself to feel, to "own-up" the impact of the stimulus, there is usually a decrease or leveling off of heart rate and always an increase in palmar eccrine sweat rate. To continue the metaphor, it is as if, in the overtly involved condition, the person allows himself to "sweat it."
>
> 3. People who more directly communicate (who are able to establish close interpersonal distance, to rely little on dual message to contact others) usually have

a more stable heart rate and a much more volatile, variable sweat rate than do those people who tend consistently to deny emotions. The latter tend to have a highly variable heart rate and a very stable eccrine sweat rate.

4. Most people are consistently more open (as defined here in terms of physiological relationships) to some stimuli or emotions and consistently closed to others.

5. As a person at first denies but then learns to acknowledge a stimulus, his heart rate usually decreases, or levels, and his eccrine sweat rate invariably increases.

6. Acknowledgement of emotions and impact by others (stable heart rate, volatile eccrine sweat rate) is reported by the person as a more satisfying, stimulating state than is denying of emotions. The latter is usually described as a bland, meaningless, though safe, "I could not care less," or "that sort of thing doesn't mean much to me" -- experience.

This study takes up the challenge to explore further these findings with a known behavior type, the alcoholic.

The Alcoholic

The subjects of this study, the alcoholics, are selected because of the immensity of the alcoholic problem (see Need for Research) and the emotional and physiological characteristics of the alcoholic as discussed here and in Chapter II. Although most theorists and researchers agree that there is no such identity as an alcoholic personality, they tend to agree on certain behavioral characteristics. The behavioral characteristics usually include loneliness or estrangement from others, dependency, depression, inner-directed hostility or aggression, problems in sexual identification, large amount of free floating anxiety, and a low capacity for handling tensions (Block, 1970; Chaftez and

Demone, 1962; Knight, 1938; and Wood and Duffy, 1966). Wallgren and Barry (1970) summarize the personal dynamics of the alcoholic as

> . . . being fixated at the infantile and oral state of personality development, associate with the craving for a passive role. The conflict of the tendency with harsh reality gives rise to denial of fantasies of omnipotence, and intense anger directed especially against oneself as manifested by the self-destructive behavior of excessive drinking.

Chaftez and Demone (1962) report that the alcoholic deals with anger in a very distinctive manner. He turns anger in on himself in drink. One patient states the problem succinctly, according to Chaftez, when he states, "It is more socially acceptable to get stinking drunk than to murder someone." This inner tension or blocking of expression of emotion, whether caused by pathology of childhood environment as shown by various studies (Wallgren and Barry, 1970) or other causes, has its concommitant physiological responses.

General Hypotheses

It is hypothesized that the alcoholic suppresses emotions and drives as an avoidance behavior and that this suppression is reflected in physiological behavior as evidenced in the electrical skin conductance, heart rate, and respiration.

I. The alcoholic group will score significantly lower than the non-alcoholic group for electrical skin conductance measurements during the presentation of all the affective film stimuli.

The rationale for this hypothesis is that the alcoholic appears to suppress or block emotions. This suppression appears generally to result in a lower level of ESC as reflected in the work by Kagan (1970) with eccrine sweat rate. It is, therefore, hypothesized that the alcoholic will respond physiologically in a similar manner.

II. The alcoholic group will score significantly higher than the non-alcoholic group for heart rate measurements during the presentation of all the affective film stimuli.

The rationale for this hypothesis is that the alcoholic tends to suppress or block emotional awareness. This suppression appears generally to result in the heart rate increasing and becoming less stable or increasing the number of peaks. This is reflected in the work by Kagan (1970) with people who were suppressing their emotional awareness. It is, therefore, hypothesized that alcoholics will respond physiologically in a similar manner.

III. The alcoholic group will score significantly different than the non-alcoholic group for respiration rate measurements during the presentation of all the affective film stimuli.

The rationale for this hypothesis is that the alcoholic tends to block or suppress emotional awareness. It is hypothesized that this suppression will be reflected as tenseness in such respiration responses as greater control in breathing, more body movements, and more time spent in the holding of the breath.

Overview

In Chapter II, the review of literature is focused on the relation of physiology to emotions, affective stimulus films, and alcoholism. Methodology, instrumentation, procedures, analysis techniques, and research hypotheses are described in Chapter III. The results of the statistical analysis are discussed in Chapter IV. In Chapter V, the summary, conclusions, discussion, and implications for future research are considered.

CHAPTER II

REVIEW OF THE LITERATURE

The review of the literature of the relationship between emotion and physiology in this chapter is focused on historical background, affective stimulus films, and alcoholism.

Historical Background

Lacey (1959) summarized the history of physiological responses to affective states by observing that:

> The search for differential patterns of bodily response in differently named affective states was abandoned quite early in the history of psychophysiology, with results that were generally conceded to be disappointing. This experimental enterprise has been effectively renewed in recent years, with rather dramatic results, that are, moreover, of interest and importance to the problems involved in the psychophysiological study of the therapeutic interview.

The early studies in this field were of gross physiological responses to emotional stimuli. According to Ax (1964), psychophysiology was developing better techniques of measurement in order that many of a person's somatic and psychic subsystems could be monitored and compared.

The early studies attempted to define emotion as either purely physiological, a distinct entity, or something-in-between. The relationship between emotion and physiology

was examined by such noted theoreticians and researchers as James and Lange, Cannon, Eppinger and Hess, Arnold, Freeman, Wenger, Davis, Darrow, Ax, and Lacey (Lindsley, 1951; Grossman, 1967).

The continuous investigations of men like Wenger did much to advance the field of psychophysiology before, during, and after the disappointing early attempts. Wenger contributed greatly to this field of study and founded his work upon the traditional framework of the activity of the two opposing subsystems of the Autonomic Nervous System (ANS): the Sympathetic Nervous System (SNS) and the Parasympathetic Nervous System (PNS). He proposed that the Autonomic Nervous System serves a homeostatic function for the individual. He developed the ($\overline{A}$) index, the autonomic factor score, which was computed from selected physiological measurements of an individual. Using a multiple correlation, individual physiological response scores were inserted into a regression equation. The resulting scores were termed measures of autonomic balance and were shown to be distributed in the population studied (Wenger, 1942b). This was an attempt to describe in a working formula the fluctuating activity of the autonomic system.

Various studies by Wenger (1942a, 1942b, 1943, 1948) demonstrated the usefulness of his formulations. These studies have partially confirmed clinical impressions of disturbances of general autonomic functioning in certain disorders. One of his investigations reported that children

with apparent PNS dominance showed more emotional inhibition, less emotional excitability, a lower frequency of activity with less fatigue, and more patience and neatness than those with marked apparent SNS dominance (Wenger, 1947). He also reported definite personality correlates associated with certain psychosomatic disorders (Wenger, et al., 1962) and "operational battle fatigue" (Wenger, 1948). All these disorders reflected lower ($\bar{A}$) scores or apparent SNS dominance. Disorders often considered as psychosomatic or having a psychosomatic component were metabolicedema, hypertension, regional enteritis, Raynaud's disease, hives, anorexia nervosa, acne, hyperthyroidism, psoriasis, asthma, eczema, constipation, colitis, backache, migrane, duodenal ulcer, and rheumatoid arthritis (Sterbach, 1966). Cutler (as reported in Gengerelli and Kerkner, 1954) described cancer patients as manifesting inability to discharge or deal appropriately with anger, aggressiveness or hostility covered over by a facade of pleasantness, unresolved hostile conflicts with the mother defended against by denial and unrealistic sacrifice, masochistic character structure, inhibited sexuality, and inhibited motherhood. Therefore, there was some support for the view that some emotional stress was associated with psychophysiological reactions and that the reactions are distinctive and may contribute to the development of such disorders as cancer or such drives as the need for alcohol. It was also possible that alcohol consumption may be a defense against psychophysiological

discomfort. Cathell (1954) reported that the development of alcoholism accompanied relief of gastric ulcers or other digestive disturbances. It appeared to be a pathological condition substitution but the relief may have indicated an incentive for excessive drinking.

The literature reviewed above concluded that there is a definite relationship between physiological reactions and general psychological conditions. Anger and fear were more specifically dealt with by other researchers. Sternbach (1966) reported that the emotion most frequently associated with psychosomatic types of responses was anger. It was at the point of the inability of the person to express anger or other feelings that somatic responses were often the alternative. According to Sternbach, this alternative was encouraged by society's attitude toward the need to repress anger. Sternbach (1966) described the dilemma of managing one's anger in his society as being that,

> The individual who is angered by his boss, or frightened by a crowd, cannot strike or flee. Such responses are incompatible with survival in the sense that our society imposes physical restraints on the person who acts that way. Consequently, although the individual may experience the emotions and have the accompanying intense physiological changes, he is unable to discharge the increased energy which has been mobilized by taking appropriate action. Therefore the organic changes persist and result in pathology.

The relationship between anger and physiological responses has been demonstrated in the laboratory by Ax (1953). He identified autonomic patterns which he described as anger and fear. Anger and fear were basically innervated

by different parts of the ANS: anger by the SNS and fear by the PNS. Anger resembled the reaction to the injection of adrenaline and noradrenaline while fear resembled the injection of only adrenaline. Anger produced diastolic blood pressure increase, decrease in heart rate, increase in muscle potential, and the number of increases in skin conductance. Fear resulted in skin conductance and respiration rate increases and a large number of muscle potential increases (Ax, 1953; Sternbach, 1966). Lacey (1959) reported that ". . . one very important line of investigation finds very significant differences among states of 'anger-directed-inwards,' 'anger-directed-outwards,' . . . ." These states were theoretically linked to a biochemical variable or the ratio of epinephrine to norepinephrine. Funkenstein (1956) reported "Anger Directed Outward" was accompanied by excessive secretion of nor-epinephrine-like substances while "Anger Directed Inward" was accompanied by excessive secretion of epinephrine-like substances. The term "like" is being used until almost all of Funkenstein's studies are replicated using direct measurements of epinephrine and nor-epinephrine in the blood. Funkenstein (1956) stated

> Epinephrine may be characterized as a "metabolite" because of the widespread physiological reactions it evokes, in many different systems, such as increased oxygen consumption of the brain, increase in pulse rate and cardiac output, decreased peripheral resistance, relaxation of the bronchioles, decrease in the clotting time of the blood, changes in glucose metabolism, etc. On the other hand, nor-epinephrine has

> no such widespread system effects; its principal effect being to increase peripheral resistance throughout the body.

Fear and anger showed differing amounts of integration with physiological measures. Ax reported that the consistently larger correlations for anger than for fear demonstrated a greater physiological integration during anger than fear. Lacey (1963) reported there was a high correlation between palmar conductance and heart responses of subjects to recordings of anger expressed between peers. Conversely, when the same recorded situation was described as a son expressing anger toward his mother, the correlation between palmar conductance and heart rate responses was practically zero. The difference between the two groups was theorized as being caused by a variation in the kind of aggression. In summary, it appears from the foregoing discussion that anger or hostility may have specific physiological concomitants.

If emotion and physiology were related, which were the most useful physiological variables to use if ultimate application to therapy was the long range goal of a study. Ax (1964) described the tenuous but promising outlook for the physiological differentiation of emotion by peripherally available measures. The literature emphasized the need to use more than one measure (Wenger, 1941). Sternbach (1966) and Malmo and Davis (1956) stated that due to low intercorrelation it was necessary to use more than one physiological variable when measuring the amount of activation or resting

autonomic balance. Sherrington (1948) reported that "Heart, blood vessels, respiration, muscles, and secretory glands take special part in the various emotions." The two physiological variables researched most consistently in the literature were electrical skin conductance and heart responses. Respiration, a commonly researched physiological variable, was also used by researchers not only in order to disclose any distinctive response patterns but to measure for artifact activity caused by physical movement in the physiological records.

Commenting on electrical skin conductance (ESC), Sternbach (1966) stated the following:

> Palmar sweat gland activity has been one of the most popular measures, for it can be easily recorded and quantified and is a sensitive responder to stimuli from both external and internal sources. It should be noted, however, that the sweat glands do not participate in the mass innervation of SNS activity caused by adrenal medullar secretions.

The sweating examined above was the so-called "emotional sweating areas" such as the palms of the hands rather than a heat regulator response. The locations of the heat regulator response such as the volar surface or inner part of the arm usually did not react to emotional stimulation. Lindsley (1951) stated:

> GSR is particularly sensitive to sensory and ideational stimuli, especially those associated with alertness, attention, apprehension, and arousal. The resistance level is lower, and the magnitude of response (drop in resistance) is greater to specific sensory stimuli. The GSR, perhaps more than any other indicator of bodily change (with possible exception of blood pressure and heart rate) is a sensitive index of cortical and higher-level mental functions.

He also noted that only sweating (GSR)* can be used adequately as an index of mild responsiveness.

Generally, the literature supported the idea that as intensity of stimuli increased, so did ESC. McCurdy (1950) reported that the "intensity of affective experience" was correlated with the magnitude of galvometric deflection. ESC increase was usually described as excitatory (Lacey, 1959). Stennett (1957) demonstrated that palmar conductance increased as motivational conditions were varied from low to very high levels. Lacey (1959) reported that palmar sweating and self-tension ratings were obviously related. As noted in Chapter I, Archer et al. (1971) observed that when sweat rate had been high and then dropped, the accompanying psychological state was usually one of suppression or inhibition by the subject.

Heart rate was another physiological variable often found useful and practical in psychophysiological research. Ax (1964) described heart rate as a ". . . manageable parameter of a major organ and clearly bears functional relationship to significant proceedings of the body." Malmo and Davis, (1956) reported that heart rate, like skin conductance was similarly responsive to changes in arousal conditions. Wenger (1942b) reported that heart rate was one of the most reliable measures in his seven-test battery.

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*The term used by Lindsley.

Sternbach (1966) observed that the heart rate reflected the functioning of the entire ANS. It was the single variable, in many studies, which contributed most to the autonomic factor (Wenger, 1966).

As with ESC, the direction of heart rate was important to consider. In reviewing the literature, Lacey (1959) reported heart rate acceleration, or highs, as basically inhibitory in nature. These accelerations corresponded to rejection of the environment while deceleration of the heart corresponded with environmental intake. Lacey et al. (1963) using neurophysiological evidence, suggested that increased heart rate served to diminish transmission along sensory pathways. This increase reduced the effectiveness of external stimuli while the opposite effect presumably occurred with lowered heart rate. Buckout (1966) reported that heart rate decreased when it was accompanied by attitude change.

A third variable frequently referred to in the literature as relevant to psychophysiological reactions and which was also practical was respiration. Malmo and Davis (1956) stated that respiration was similarly responsive to arousal conditions, as was heart rate and ESC. Respiration, the least covert of the physiological variables (Ax, 1964), served as a monitor function (Sternbach, 1966). Changes in respiration patterns immediately resulted in changes in virtually every other physiological variable being recorded

(Sternbach, 1966). It has been hypothesized that the alcoholics, like Kagan's blockers, would have more difficulty handling emotional material, with the result that anxiety or tension would be reflected in respiration.

As noted in the fear and anger discussion, physiological variables tended to have a low intercorrelation (Sternbach, 1966) which was very puzzling to many psychophysiologists. One relatively fruitful direction of research has been the examination of inverse relationships. It appeared that electrical skin conductance increase was excitatory whereas increase of cardiac rate was inhibitory in the transaction of the organism with the environment. Davis (as reported in Lacey, 1959) reported the inverse relationship of electrical skin conductance and heart rate during the stimulus conditions of visual attention, empathic listening, and thinking. The inverse relationship between electrical skin conductance and heart rate appeared to be a clue to what happened within the individual (Kagan, 1970) as noted in Chapter I.

In general, the relationship between apparent cause and effect for any and all psychophysical reactions may well be a very complex process. Numerous other variables can influence the amplitude of physiological responses. Roessler and others (1966) demonstrated this influence in GSR to specific stimuli. Wenger (1950) stated:

> . . . such terms as 'fear', 'anger', or 'jealousy' imply not only an emotion but also the external

> stimuli situation, the perception of that stimulus, the perception of the visceral action, overt expression and related ideation.

Ax (1964) and Wenger (1966) like many other researchers added to the list of variables: stimulus specifications, the individual specificities, the law of initial values generalized over many relevant variables, baselines, daily and seasonal factors, orientation responses, the effects of drugs, movement artifacts, and technical problems such as electrodes, transducers, and recorders.

Affective Stimulus Films

Sternbach (1966) stated that hypnotic suggestion and films have been the most popular means of inducing changes. Davis (as reported in Lacey, 1959) reported that college students who looked at affectively toned pictures showed vasioconstriction, increased palmar conductance, and cardiac deceleration on visual attention as well as emphatic listening and thinking. The stimulus for the present investigation was the affective stimulus films. This grew out of the work of Norman Kagan *et al*. (1967).

In using such material as stimulus films it was important to take into account prestimulus levels since otherwise there might be distortion of the accuracy of the numerical representation of the homeostatic process (Lacey, 1956). Wenger *et al*. (1962) reported that ". . . the greatest differences in autonomic functions are demonstrable under controlled resting states." Sternbach (1966) stated that

if one started ". . . from a resting-yet-awake baseline, the degree of activation will be in a large part a function of the nature of the stimulation . . . ." Lazarus et al. (1965) found that the information given prior to the stimuli or orientation information could affect the impact of the stimulus.

The importance of a built-in orientation period was reported in the study by McDonald et al. (1964). They stated that the orientating response (OR) was first reported by Palov ". . . who observed that his subjects showed an orientational or 'What is it?' response to novel stimuli." Galvanic skin response was one of the components of the OR response. Sternbach (1966) reported that the phrase "Get ready, now," would cause a resting individual to respond in a manner like activation. He stated that if the phrase was repeated at regular or irregular intervals, the responses would decrease in magnitude and eventually disappear and that adaptation was not always a smooth steady decrease. Martin (1956) observed a decrease in ESC during subsequent interviews and concluded that adaptation had taken place.

Danish and Kagan (1969) reported the use of rejection and being rejected as the most successful, first film, sequences, especially with Division of Vocational Rehabilitation clients. The present investigation also used stimuli depicting the strong emotion of affection which incorporated certain words such as kiss and love which almost

universally produced more response than other words such as afraid, dance, or hunger (Lacey, 1959). McCurdy (1950) believed that the differential magnitude of galvanometric deflection to words was one of the most reliable of physiological phenomena.

The Alcoholic

Alcohol made the alcoholic feel that he was coping with his "external frustrations" or "internal inhibitions" (Fenichel, 1945). Other societies than American such as Italian, Chinese, and Jewish frowned upon the choice of alcohol and did not use alcohol extensively (Trice, 1966; Wallgren and Barry, 1970). Alcohol functioned as a sedative and anxiety reducer to stressful situations as was reflected in ESC and other physiological responses (Wallgren and Barry, 1970; Gerad, et al., 1962). Takala et al. (as reported in Wallgren and Barry, 1970) found that on the Thematic Apperception Test (TAT) drinking alcohol affected the alcoholic by increasing the expression of inhibited material such as sexual behavior, aggression, and self-assertion. Trice (1966) reported that alcohol acts to reduce learned inhibitions. Witkin et al. (1959) reported that in tests of ability to cope with the perceived environment where there are conflicting visual relationships, the alcoholics have been shown to perform these tasks more poorly than normals and non-alcoholic psychiatric patients.

Summary

Past research has demonstrated a relationship between emotion and physiology. Measures which might be relevant to differentiate the alcoholic from the non-alcoholic and practical to use were electrical skin conductance, heart rate, and respiration. Films seemed to be a useful source for emotional stimulation.

CHAPTER III

METHODOLOGY

Population

The population for this study was the clients of the Lansing Office of the Division of Vocational Rehabilitation. The subjects were chosen from the one thousand five hundred ninety open cases on February 19, 1971. The alcoholic population was defined as those individuals warranting vocational assistance because of their alcoholic problem. The control population was defined as all the clients excluding those whose primary area of assistance was alcoholism.

Sample

Two groups, alcoholic and non-alcoholic, were randomly selected from the defined populations. The subjects of both groups were male, white, thirty-five to fifty-five years of age, judged to be absent of gross emotional pathology, and volunteered on invitation of their coordinator.

Experimental Group

Fifteen clients of the alcoholic population met the criteria. In addition, they were required to be presently sober and in town. Ten were selected by means of a standardized randomizing procedure.

Control Group

The random sampling consisted of choosing every fifth client starting at the third client in the client list computer printout of February 19, 1971. Twenty-seven subjects were chosen. The coordinator with whom the client was working called the client and asked if he would be willing to participate. The coordinator followed a uniform procedure for information given the client concerning the study (see Appendix A). Of the eleven volunteers, the first ten were chosen.

Experimental Design

In order to test the hypotheses stated in Chapter I, a research design was formulated that would permit a comparison between the experimental and control groups. These groups were compared on the basis of three physiological responses using a total of fourteen measures between and within these groups. The Greenhouse and Geiser method was used on a repeated measures design in which all the subjects in both groups received the same treatment and were measured across all fourteen measures. The design was a 2 x 3 x 8 x 10 x 14, a group by time by film by subject by measures. (See Appendix B for diagram of the experimental design).

Instrumentation

Various types of mechanical apparatus were used in this study. This equipment was used to present the

treatment and to record the physiological responses. The classification of equipment followed two divisions.

I. The equipment used in presenting the stimulus was as follows:

(A) A video-tape recorder-player (VTR) was used to make the continuous treatment video tape (a copy of the original filmed vignettes). The VTR was used to play the tape through the television monitor during the treatment sessions (see Appendix C).

(B) The treatment tape was presented on a twenty-three inch television monitor placed five feet from the subject (see room arrangement, Appendix D).

(C) The studio room arrangement is described in Appendix D. The only light used in the studio was a sixty-watt bulb in the lamp on the table. The studio and instrumentation rooms shared central air conditioning set at 71^{o}F.

(D) A buzzer type communication system between the two rooms was used. It was activated by the subject by pressing a button causing a radio-transmitted signal to buzz in the instrumentation room.

II. The equipment used in recording the physiological responses was as follows:

(A) The Grass Model 5D Polygraph, four channel, strip chart recorder (Grass Instrument Co., Quincy, Mass.) was used for recording the three physiological responses. The machine consisted of three basic components

constituting a channel: (1) the transducer converted the physical energy being monitored into an electrical signal, (2) an amplifier, and (3) a recorder. The recorder's location in the equipment organization can be noted in the flow chart in Appendix E.

(B) Electrical skin conductance was measured by using bipolar electrodes. One silver silver chloride (Ag-AgCl) electrode (Beckman) was connected to the palmar surface of the right hand and the other to the volar surface of the forearm, presumed to be a non-emotional sweating skin site (Sternbach, 1966). The electrode application procedures were given under the section entitled, "Preparing the Subject." The electrodes were connected to an appropriate electronic bridge, Hagfors Bridge (Adams, 1971), and in turn to one channel of a strip chart recorder (see Section II. A., above).

(C) Heart rate was measured by using bipolar, precordial leads with one electrode (Ag-AgCl, Beckman) positioned on the seventh rib below the left nipple. The other electrode (Ag-AgCl, Beckman) was positioned on the sterum on or near the attachment of the fourth rib. They were attached to a cardiotachometer (Heart Rate Monitor Model 500, Parks Electronics Laboratory) which was connected to one channel of a strip chart recorder (see Section II. A., above). The EKG was integrated to provide a DC voltage which was proportional to heart rate. Cardiotachograms were calibrated using a Model

5M5 Grass Stimulator connected to the cardiotachometer as shown in Appendix E.

(D) Respiration rate was measured by using a mercury-in-rubber strain gauge (Ax, 1964) placed around the subject's chest, below the line of the armpits and approximately one inch above the nipples. The gauge was attached to a Plethysmograph (Model 270, Parks Electronics Laboratory) which was connected to channel three of the strip chart recorder (see Section II. A., above).

(E) The materials used in the application of the skin conductance and heart rate electrodes were a solution of alcohol (ethanol) for cleaning the surface of the skin and a standard electrode paste for a conducting medium on the electrode.

Experimental Procedure

All the subjects in the experimental and control groups received the same treatment. The treatment sessions were carried out between May 3, 1971, and June 3, 1971. They took place in the audio-visual laboratory consisting of a studio and instrumentation room in Giltner Hall on the Campus of Michigan State University in East Lansing (see Appendix D). Each subject received the treatment individually during the evening between 6 P.M. and 8 P.M. This time was chosen for the quietness of the hour, availability of

employed subjects, and the same time of the day for the treatment for each subject.

Equipment Preparation

The equipment (see Instrumentation) was warmed up one-half hour before the arrival of the subject. The air conditioner was turned on and set for 71°F. The Grass Model 5D Polygraph was turned on and calibrated according to set procedures for each of the physiological responses and the corresponding channels (see Appendix F). The Hagfors Bridge and the plethysmograph were used in the calibration and then turned off while the subject was being prepared. The tape was checked on the monitor in the studio (experimental room) for picture clarity and sound level. The tape was set on the video-tape player at the established starting point. The buzzer for communication between the instrumentation room and the experimental room was set up and tested. The chair, light, and angle of the monitor were arranged (see diagram of room arrangement, Appendix D). A "Stop Experiment in Progress Please Do Not Open the Door, if you need someone or something ask in Room 103" sign was placed on the door of the hall leading to the studio and the instrumentation rooms. Janitors were asked not to disturb the area when the experiment was in progress.

Subject Preparation

The subjects either came to the experimental setting by their own transportation or were transported by the

experimenter. In the later situation, the experimenter's assistant, a graduate student, would follow the rehearsed, written-out, warm-up procedures.

The experimenter invited the subject into the experimental room where he was told that he would be shown a series of films. The experimenter asked the subject for permission to record his physiological reactions during the showing of the films and to share verbal reactions after the films were shown. After permission was received, the subject was asked to go across the hall and wash his hands. He was casually watched in order that he did it well.

After returning to the studio, the physiological measurement devices were attached to the subject. The heart rate (HR) and electrical skin conductance (ESC) electrodes were applied (see Instrumentation) with the subject's shirt and undershirt removed. After putting on his undershirt, the strain gauge, described under Instrumentation, was put into place.

The electrodes and gauge were then connected to the equipment. If the electrodes and the strain gauge were working properly as indicated on the polygraph record, the subject was asked the following: whether he was hard of hearing and whether he was comfortable. He was asked to refrain from smoking. He was told he would see a series of situations. He was to try to pretend that he was alone in the room with the person on the screen and pretend that he was talking to him directly and privately. After each

situation, he would be asked to relax. When told to sit back and relax, he was to relax, to sit quietly and not to move around. After a couple of minutes, he would hear a click, followed by the instructions "OK, get ready." This signaled a new situation to be presented shortly. If the monitor malfunctioned, he was to press the buzzer. He was asked, "Are you ready to begin?" After an affirmative answer, the experimenter left the room.

Treatment

When the subject was relaxing and the equipment appeared to be functioning well, the video tape player was begun and continued until the treatment was over. The continuous treatment tape sequence proceeded in the following manner.

The continuous treatment tape consisted of T_1, T_2, and T_3. T_1 was a rest period with a two-minute presentation of a soft fuzzy screen. T_2 was a fifteen-second orientation period which consisted of an initial click followed by the statement "OK, get ready," recorded on the tape. T_3 was a presentation of one of the affective vignettes. After the first and each successive vignette, the directions "OK, sit back and relax" were presented. This was followed by the second T_1. When the eighth film was concluded, a final T_1 was presented and recorded as additional data.

The treatment consisted of eight vignettes of affective stimulus films. The two basic emotions of affection and rejection were presented on the films. They were each presented in four different forms, two by each sex. The vignette presentations were not randomized. The following diagram describes the order in which the various film sequences were presented, e.g., F_1 then F_2, through F_8:

		MALE	FEMALE
AFFECTION	Subtle	F_1	F_3
	Blatant	F_2	F_4
REJECTION	Subtle	F_5	F_7
	Blatant	F_6	F_8

The actors were as follows: a male, twenty-five years of age, white, middle-class, dressed in a grey suit, "good looking," and a convincing actor; and a female, twenty-five years of age, white, "attractive," middle-class, modestly dressed, and a convincing actress. A description of the affect and verbal content of each vignette is found in Appendix G.

During the treatment session, the graph paper on the strip chart recorder was manually and systematically marked at the end of each time period (T_1, T_2, and T_3). If there were any extraneous variables such as coughing or a loud noise which might have some impact upon the record, they were also noted. There was no visual viewing of

subjects by the experimenter during the treatment session. All subjects received the identical treatment.

Post-Treatment Session

After the treatment session, the experimenter entered the studio and did a limited session of Interpersonal Process Recall (Kagan, et al., 1967). Although this was not part of the treatment procedure, it permitted an exploration of the subject's reactions to the films. The reacting to the films was the task the subjects had initially agreed to do when invited to join the study (see Appendix A). Finally, a post-treatment checklist (Appendix H) was given.

Scoring Procedures

A total of fourteen measures was taken on the three physiological responses, electrical skin conductance (ESC), heart rate (HR), and respiration rate (RR).

The scoring of these measures was done by two researchers. One researcher scored the data on a certain measure for both of the groups in order to insure consistent scoring. The data for each subject was placed on a data sheet (see Appendix I).

The scoring followed certain general and physiological response grouping procedures. The following general measurement procedures were applied to all the measures.

First, if body movement was encountered, as recognized by non-physiological changes in RR and concomitant

changes in HR and ESC, the period of the movement was determined as the "omit period," and was omitted from the record as artifact (Ax, 1964). When movement was determined, a ten-second lag was added to the "omit period" in order to compensate for the artifact of movement (Lindsley, 1950). The number of movements was included as an individual measure (M_{14}), for it may have been affected by the treatment.

Secondly, if there was movement, the segments of the time sequence still scorable were averaged. Third, the data which was unscorable was replaced with the group mean (see Appendix J).

Finally, entire records were rejected either because responses were given in a blatantly uncooperative manner or were unscorable due to artifact problems either physiological or mechanical. Four subjects, two from each subject group, were rejected.

Each physiological response used several measurements. The measurements consisted of six electrical skin conductance measures (M_1 - M_6), four heart rate measures (M_7 - M_{10}), three respiration rate measures (M_{11} - M_{13}), and the movement measure (M_{14}). The six electrical skin conductance measures were: the mean rate (M_1); the high point (M_2); the low point (M_3); the baseline slope (M_4); the conservative number of peaks (M_5); and the liberal number of peaks (M_6). The heart rate measures were: the mean rate (M_7); the highest rate (M_8); the lowest rate (M_9); and

the number of peaks (M_{10}). The respiration rate measures were: the mean rate (M_{11}); the number of apnea (M_{12}); the mean length of apnea (M_{13}); and the number of movement omits (M_{14}).

During the data collection procedures for the electrical skin conductance, no measurement was taken of the first three and a half seconds of each time sequence (T_1, T_2, and T_3) because electrical skin conductance typically lags stress (Adams, 1971). A micromho scale was developed for collecting ESC data from the record. The procedures for the electrical skin conductance measures are described in Appendix K.

Preliminary to the heart rate data collection procedures, the linearity of the heart rate was determined. This was accomplished by using the precalibration data, obtained during the calibration of the Grass 5D Polygraph (see procedures, channel #1, Appendix F). A graph was drawn with the heart rate as the x axis and the paper deflection in centimeters from the lower portion of channel #1 as the y axis. The procedures for the heart rate measures are described in Appendix K.

The data collection procedures for the respiration rate are described in Appendix K.

Analysis of Data

The data was analyzed by standardizing the scores of dependent variables. This was achieved by dividing

through each measured score by the standard deviation for the total time period of that respective measurement for all subjects. This was done to all the measurements to put them all on the same metric. The Greenhouse and Geiser method was used to determine the degree of freedom necessary for the repeated measures factor.

General and Specific Hypotheses

I. The alcoholic group (G_1) will score significantly lower than the non-alcoholic group (G_2) in electrical skin conductance as measured by various methods during the presentation of all the affective film stimuli.

A. The alcoholic group will score significantly lower than the non-alcoholic group in the mean electrical skin conductance (M_1) during the presentation of all the affective film stimuli.

$$H_1 = G_1 < G_2$$

B. The alcoholic group will score significantly lower than the non-alcoholic group in the difference between the high (M_2) and low (M_3) points of the electrical skin conductance during the presentation of all the affective film stimuli.

$$H_2 = G_1 < G_2$$

C. The alcoholic group will score significantly lower than the non-alcoholic group in the high point scores

(M_2) of the electrical skin conductance during the presentation of all the affective film stimuli.

$$H_3 = G_1 < G_2$$

D. The alcoholic group will score significantly lower than the non-alcoholic group in the low point scores (M_3) of the electrical skin conductance during the presentation of all the affective film stimuli.

$$H_4 = G_1 < G_2$$

E. The alcoholic group will score significantly lower than the non-alcoholic group in the direction of the slope (M_4) of the electrical skin conductance during the presentation of all the affective film stimuli.

$$H_5 = G_1 < G_2$$

F. The alcoholic group will score significantly lower than the non-alcoholic group in the number of conservative peaks (M_5) of the electrical skin conductance during the presentation of all the affective film stimuli.

$$H_6 = G_1 < G_2$$

G. The alcoholic group will score significantly lower than the non-alcoholic group in the number of liberal peaks (M_6) of the electrical skin conductance during the presentation of all the affective film stimuli.

$$H_7 = G_1 < G_2$$

II. The alcoholic group (G_1) will score significantly higher than the non-alcoholic group (G_2) in their heart rate as measured by various methods during the presentation of all the affective film stimuli.

A. The alcoholic group will score significantly higher than the non-alcoholic group in the mean heart rate (M_7) during the presentation of all the affective film stimuli.

$$H_8 = G_1 > G_2$$

B. The alcoholic group will score significantly higher than the non-alcoholic group in the difference between the high (M_8) and low (M_9) peak scores of the heart rate during the presentation of all the affective film stimuli.

$$H_9 = G_1 > G_2$$

C. The alcoholic group will score significantly higher than the non-alcoholic group in the high point scores (M_8) of the heart rate during the presentation of all the affective film stimuli.

$$H_{10} = G_1 > G_2$$

D. The alcoholic group will score significantly higher than the non-alcoholic group in the low point scores (M_9) of the heart rate during the presentation of all the affective film stimuli.

$$H_{11} = G_1 > G_2$$

E. The alcoholic group will score significantly higher than the non-alcoholic group in the amount of heart rate

peaks (M_{10}) during the presentation of all the affective film stimuli.

$$H_{12} = G_1 > G_2$$

III. The alcoholic group (G_1) will score significantly different than the non-alcoholic group (G_2) in their respiration rate as measured by various methods during the presentation of all the affective vignette stimuli.

A. The alcoholic group will score significantly lower than the non-alcoholic group in the mean respiration rate (M_{11}) during the presentation of all the affective film stimuli.

$$H_{13} = G_1 < G_2$$

B. The alcoholic group will score significantly higher than the non-alcoholic group in the number of apnea (M_{12}) during the presentation of all the affective film stimuli.

$$H_{14} = G_1 > G_2$$

C. The alcoholic group will score significantly higher than the non-alcoholic group in the mean length of apnea (M_{13}) during the presentation of all the affective film stimuli.

$$H_{15} = G_1 > G_2$$

D. The alcoholic group will score significantly higher than the non-alcoholic group in the number of movements (M_{14}) during the presentation of all the affective film stimuli.

$$H_{16} = G_1 > G_2$$

Summary

The population from which the subjects were randomly selected was the clients of the Lansing Office of the Michigan Division of Vocational Rehabilitation. The samples consisted of ten, white, male volunteers, thirty-five to fifty-five years of age, and judged to be absent of gross emotional pathology.

The experimental (alcoholic) and the control (non-alcoholic) groups received the identical treatment. Each viewed eight affective vignettes depicting affection or rejection by a male or female actor. While the subjects were presented with the film stimulus, the three physiological responses of electrical skin conductance, heart, and respiration were recorded using a Grass 5D Polygraph. A total of fourteen measures was taken. After the treatment, a post-treatment checklist was given. The data was collected and analyzed according to an Analysis of Variance with a repeated measures design.

CHAPTER IV

ANALYSIS

Analysis of the Results

An analysis of the data is presented in this chapter. The analysis of variance results, tables, and an analysis for generating hypotheses for future research are presented.

A repeated measures analysis of variance was used. Table 4.1 presents the analysis of variance table of transformed scores. The table includes the source of variation, reduced sum of squares, degrees of freedom mean squares, and the F-ratios.

A conservative test was used with the degrees of freedom held at 1 and 14 and the critical F-value at .05 was 4.60, as indicated on Table 4.1. The effects which are significant on the conservative test are definitely significant. The effects which are not significant on the conservative test may possibly be significant on a liberal test. The liberal test uses the degrees of freedom of the design as given in Table 4.1. If the tests are significant on the liberal test, they are potentially significant and worthy of future study. If they are not significant on the liberal test, there is no possibility that they are significant.

Table 4.1

ANOVA Table of Transformed Scores

Sources of Variation	Reduced Sum of Squares	Degrees of Freedom	Mean Square	F Ratio
G [Groups]	204.206	1	204.206	4.089**
S(G) [Subjects within Groups]	699.258	14	49.947	
F [Films]	14.192	7	2.027	1.202
FG	21.118	7	3.017	1.789
FS(G)	165.244	98	1.686	
T [Times]	37.496	2	18.748	3.368**
TG	.567	2	.284	.051
TS(G)	155.863	28	5.567	
TF	45.191	14	3.228	1.744
TFG	30.848	14	2.203	1.191
TFS(G)	362.684	196	1.850	
M [Measures]	27368.770	13	2105.290	98.281*
MG	326.011	13	25.078	1.171
MS(G)	3898.621	182	21.421	
MF	175.573	91	1.929	1.346**
MFG	157.210	91	1.728	1.206
MFS(G)	1825.648	1274	1.433	
MT	481.800	26	18.531	4.526**
MTG	70.996	26	2.731	.667
MTS(G)	1490.227	364	4.094	

Table 4.1 (Continued)

ANOVA Table of Transformed Scores

Sources of Variation	Reduced Sum of Squares	Degrees of Freedom	Mean Square	F Ratio
MTF	293.403	182	1.612	1.339**
MTFG	268.472	182	1.475	1.319**
MTFS(G)	3726.199	2548	1.475	
TOTAL	41819.644	5375	7.780	

Code: G = Groups; S = Subjects; F = Treatment Films; T = Time; M = Measures; * = significance at .05 on conservative test; ** = significance at .05 on liberal test.

The repeated measures design showed no significant differences on the conservative test in groups, times, films, or any of their interactions. Additionally, there was no significance on any measure times any independent variable interaction. An examination of Table 4.1 indicates a significant difference in the M (Measures) source of variation; however, it is not meaningful to compare electrical skin conductance, heart rate, and respiration rate, even in a dimension free quantity as the standard score. Two other F-ratios, G and MT, actually approach significance; therefore, it is of interest to look at them.

The group effect, G, showed the control (non-alcoholic) group as having a higher average score than the experimental (alcoholic) group. A closer inspection of

the MG interaction, indicates a higher mean score on all the electrical skin conductance and heart rate measures for the control (non-alcoholic) than experimental (alcoholic) group while all the respiration rate mean scores were lower for the control (non-alcoholic) group.

MT (Measures by Time) has an F-ratio which approached significance when a conservative test is used with alpha at .05 but it is difficult to understand. The graph of the MT interaction is found in Figure 4.1 and an enlargement of one section of that graph appears in Figure 4.2. Inspection of Figure 4.1 and 4.2 indicates that M_1 (the mean electrical skin conductance), M_2 (the high point of the electrical skin conductance), M_3 (the low point of the electrical skin conductance), M_7 (the mean heart rate), M_8 (the high point of the heart rate), and M_{11} (the mean respiration rate) do not appear to be contributing very much to the measures by time interaction. They are relatively constant across time. However, as can be seen in Figure 4.2, which is an enlargement of the lower section of Figure 4.1, M_5, M_6, M_{10}, and M_{14} intersect and indicate interaction between measures and time. The interaction of measures M_5 and M_6 with measures M_{10} and M_{14} is disordinal, implying that the relative elevation of these measures is a function of the time of observation. M_{10} and M_{14} are not parallel and non-intersecting as are M_5 and M_6. One dimension, M_6, is consistently higher than M_5. One dimension,

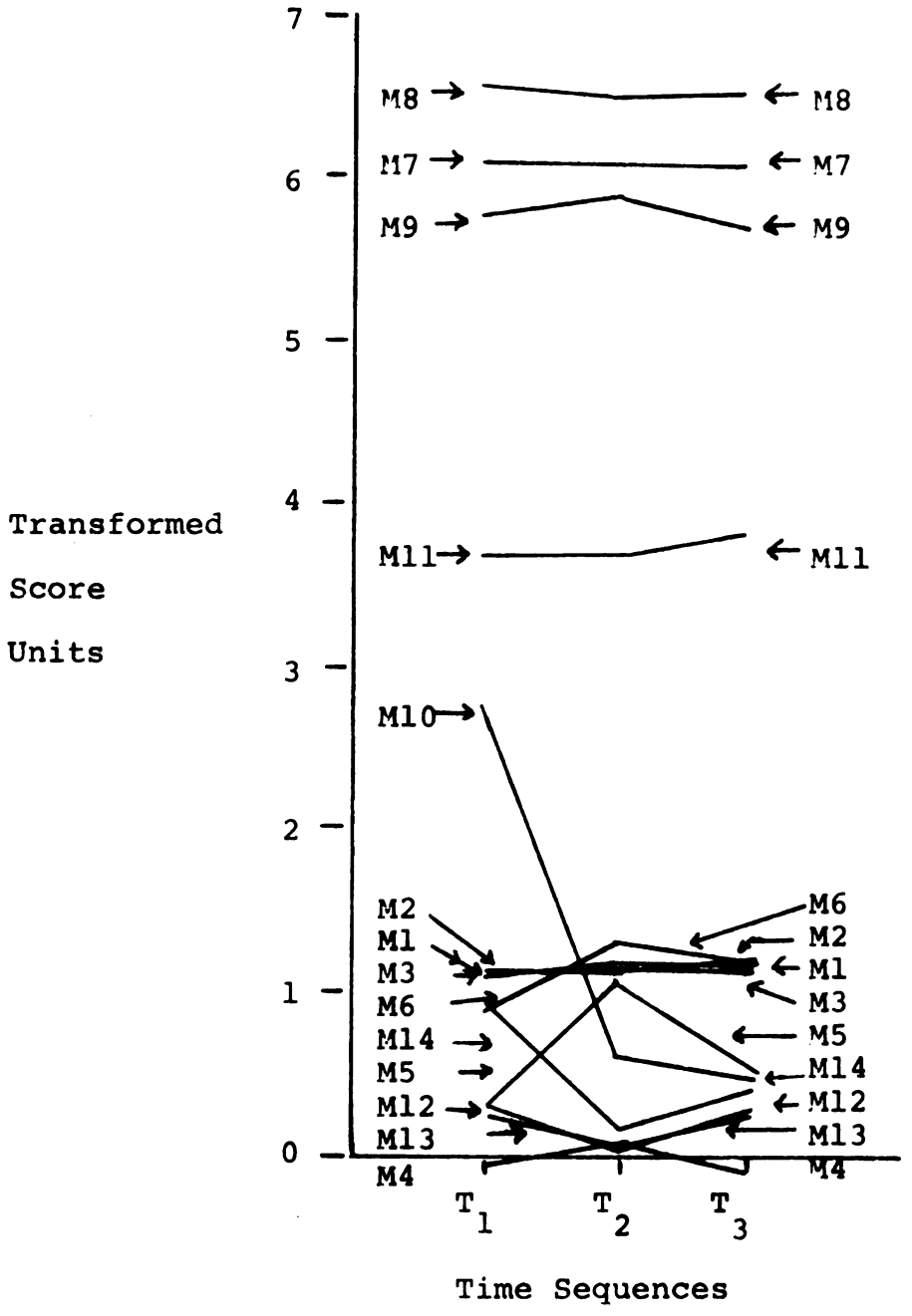


Figure 4.1

Transformed Scores for the Measures at the Three Time Sequences (MT)

Code for Figure 4.1 and 4.2

Time 1 = Baseline

Time 2 = Orientation

Time 3 = Stimulus presentation

M_1 ($\bar{X}$ESC) = Measure one is the mean electrical skin conductance.

M_2 (HIESC) = Measure two is the high points of the electrical skin conductance.

M_3 (LOESC) = Measure three is the low points of the electrical skin conductance.

M_4 (SESC) = Measure four is the slope of the electrical skin conductance.

M_5 (CPKESC) = Measure five is the number of conservative peaks on the electrical skin conductance.

M_6 (LPKESC) = Measure six is the number of liberal peaks on the electrical skin conductance.

M_7 ($\bar{X}$HR) = Measure seven is the mean heart rate.

M_8 (HIHR) = Measure eight is the high point of the heart rate.

M_9 (LOHR) = Measure nine is the low point of the heart rate.

M_{10} (PKHR) = Measure ten is the number of peaks in the heart rate.

M_{11} ($\bar{X}$RR) = Measure eleven is the mean of the respiration rate.

M_{12} (NA) = Measure twelve is the number of apnea.

M_{13} ($\bar{X}$AL) = Measure thirteen is the mean length of apnea.

M_{14} (MALL) = Measure fourteen is the number of movements.

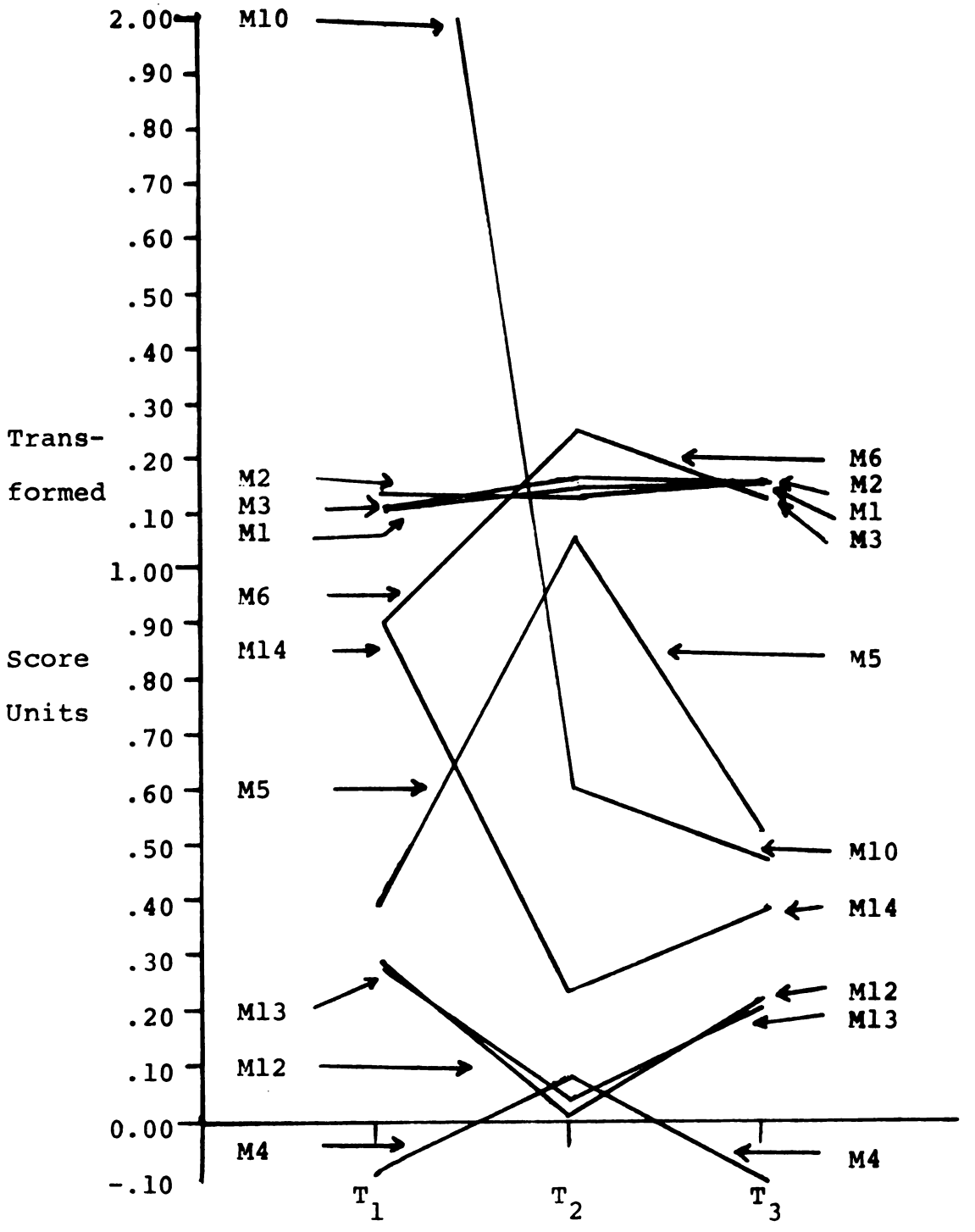


Figure 4.2

Enlargement of Figure 4.1

M_{10}, is consistently higher than M_{14}. The interaction of M_4 with M_{12} and M_{13} is disordinal.

The sources of variation G, T, MF, MT, MTF, and MTFG are significant on the liberal test and are worthy of future investigation. Since these sources are not significant on the conservative test, it results in an inability to draw a definitive conclusion. (When the conservative test does not reject the null hypothesis and the liberal test does reject the null hypothesis, the results are unclear and there is difficulty in interpretation.)

Table 4.2 presents the group means in transformed scores which were used in the analysis of variance. This table presents Group I (alcoholic) and Group II (non-alcoholic) mean scores on all the measures (M_1 - M_{14}) over the three time periods (T_1 - baseline, T_2 - orientation, and T_3 - presentation of the treatment stimulus).

Table 4.3 presents the total range of responses over a time sequence on the high and low point scores of the electrical skin conductance and the heart rate measures. The range (difference between the subject's high and low scores during a time sequence, e.g., T_1, T_2, and T_3) was calculated. The resulting group means of this range are presented in Table 4.3.

Table 4.2

Transformed Scores of the
Group Means for the Repeated Measures ANOVA

Measures	Group I (Experimental)			Group II (Control)		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
M_1 ($\bar{X}$ESC)	.991	1.013	.996	1.247	1.297	1.336
M_2 (HIESC)	.991	.983	.987	1.287	1.288	1.371
M_3 (LOESC)	.988	1.027	1.003	1.240	1.286	1.322
M_4 (SESC)	-.006	-.170	-.107	-.150	.332	-.113
M_5 (CPKESC)	.197	.668	.189	.579	1.465	.885
M_6 (LPKESC)	.769	1.098	.899	1.017	1.431	1.388
M_7 ($\bar{X}$HR)	5.446	5.442	5.385	6.668	6.666	6.622
M_8 (HIHR)	5.945	5.742	5.769	7.222	6.973	7.128
M_9 (LOHR)	5.175	5.223	5.015	6.331	6.432	6.278
M_{10} (PKHR)	2.194	.731	.731	3.350	.487	.244
M_{11} ($\bar{X}$RR)	3.806	3.821	3.816	5.547	3.462	3.728
M_{12} (NA)	.346	.000	.231	.231	.070	.231
M_{13} ($\bar{X}$AL)	.360	.000	.255	.211	.070	.189
M_{14} (MALL)	1.152	.123	.392	.686	.270	.392

Code: See Page 50.

Table 4.3

Group Means of the Range of the High and Low Point Responses of the Electrical Skin Conductance and Heart Rate During the Three Time Sequences

Measures	Group I (Experimental)			Group II (Control)		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
ESC	.614	.286	.484	1.092	.785	1.155
HR	1.846	.787	1.487	1.705	.688	1.593

Code: ESC = Electrical Skin Conductance; HR = Heart Rate.

Analysis for Generating Hypotheses

Additional statistical analyses were performed in order to get further insight into the pattern of the relationship of a number of variables. Since they are post hoc, they must be thought of as hypothesis generating rather than hypothesis testing.

A multivariate analysis of variance was performed using the variables of M_1($\bar{X}$ESC), difference of M_2(HIESC) minus M_3(LOESC), M_5(CPKESC), M_6(LPKESC), M_8($\bar{X}$HR), difference of M_8(HIHR) minus M_9(LOHR), and M_{10}(PKHR). Group I (alcoholic) and Group II (non-alcoholic) were compared on the group means of the seven variables at T_3 (the presentation of the affective film stimuli).

The results of the multivariate analyses of variance and the univariate F tests are presented in

Table 4.4. The multivariate F test statistic for testing the equality of mean vectors was 2.2099 with 7.000 and 8.000 degrees of freedom. This test was not significant at the .05 level indicating the groups did not differ in the multivariate case. A series of univariate F tests were performed to test the difference between Group I (alcoholic) and Group II (non-alcoholic) on the seven variables at T_3

Table 4.4

Multivariate and Univariate F Tests for the Analysis of Differences between Groups on Seven Measures Judged Most Important

Multivariate Test			
F Ratio for Multivariate Test = 2.2099 D.F. = 7, 8 p Less Than .1445			
Univariate Tests			
Variable	Hypothesis Mean Square	Univariate F Test	p Less Than
$\bar{X}$ESC	.4614	.4120	.5314
DIFESC	1.8010	2.0188	.1773
CPKESC	.9584	1.1622	.2993
LPKESC	1.9398	3.4579	.0841
$\bar{X}$HR	6.1194	9.9290	.0071*
DIFHR	.0444	.1875	.6717
PKHR	.9506	.7368	.4052

*Significant at the .05 level.

(Table 4.4). This procedure required that the sum of the alpha levels in the seven univariate F tests did not exceed the overall alpha level (.05). Therefore, the alpha level set for each of the F tests was .0071. The results of the univariate tests suggested that on the $\overline{X}$HR the groups differed at .0071. The $\overline{X}$HR of the groups differed also during the initial baseline, see Table 4.2, which appears to be a difference due to the groups rather than a treatment effect. The differences of the other six variables were not near significance.

Summary

A repeated measure analysis of variance was used to test the difference in group means on the fourteen physiological measures between the alcoholic group and non-alcoholic group. There was no significance found between the two groups.

Additional analysis was performed for the purpose of hypothesis generating. A multivariate analysis of variance and univariate F tests were performed. The multivariate test was not significant but there was significance on a single univariate F test. This significance will be discussed under implications for future research in Chapter V.

CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSION, IMPLICATIONS

Summary

This research was an attempt to contribute to the present understanding of a known behavior group's physiological response to emotion. More specifically, the study compared the physiological responses of an alcoholic and non-alcoholic group during the presentation of affective stimulus films. The investigation attempted to determine if there were certain physiological responses that were significantly different between the groups.

The major theoretical underpining of this study was that there was a relationship between physiological behavior and social behavior. It was postulated that feelings influence behavior and that feelings were at least in large part physiological in nature. The implication of these statements bear on therapy in general, and alcoholics in particular.

The basic questions of the study were as follows: (1) Would the alcoholic group score significantly lower than the non-alcoholic group on electrical skin conductance measurements during the presentation of all the affective film

stimuli? (2) Would the alcoholic group score significantly higher than the non-alcoholic group for heart rate measurements during the presentation of all the affective film stimuli? (3) Would the alcoholic group score significantly different than the non-alcoholic group for respiration rate measurements during the presentation of all the affective film stimuli?

Past research has demonstrated a relationship between emotion and physiology. Some of the measures often used to measure this relationship were electrical skin conductance, heart rate, and respiration rate. It was hypothesized that these measures might differentiate the physiological responses of alcoholics from non-alcoholics. Previous research has also found films a useful source for emotional stimulation.

The population from which the subjects were randomly selected was the list of clients of the Lansing Office of the Michigan Division of Vocational Rehabilitation. The samples consisted of ten, white, male volunteers, thirty-five to fifty-five years of age, who were described by the agency as free from symptoms of gross emotional pathology.

The experimental (alcoholic) and the control (non-alcoholic) groups received the identical treatment. Each viewed eight affective vignettes, each vignette depicting mild or blatant affection or rejection enacted by a male or female actor. While the subjects were presented

with the film stimulus, the three physiological responses of electrical skin conductance, heart rate, and respiration rate were recorded using a Grass 5D Polygraph. Various dimensions of each of these three responses were measured which resulted in a total of fourteen measures recorded from each subject. After the treatment, a post-treatment check list was given. The list consisted of a collection of data which described the test setting and the physical and social status of the subject at the time of testing (see Appendix H). The data were collected and analyzed according to a repeated measures analysis of variance.

Results of the repeated measures analysis of variance indicated no significant difference on the group means at the .05 level. Since there was no significance, individual analysis of each hypothesis was not performed. A post hoc analysis on a subset of the measures was performed for the purpose of hypothesis generating.

Conclusions

The experimental (alcoholic) and control (non-alcoholic) groups were not found to be significantly different as hypothesized in the study. The various physiological measures of electrical skin conductance, heart rate, and respiration rate failed to show a significant difference (at .05) in the presence of specified emotional stimuli as was hypothesized. An attempt will be made in the following section

to understand these results in relationship to the major theoretical underpining of the study.

Discussion

This section will attempt to describe the results in relationship to the major theoretical underpining by considering possible limitations, possible confounding variables, and the investigator's non-hypothesized interpretations of the study.

Theory

The major theoretical underpining of this study was that there was a relationship between physiological behavior and social behavior. It was postulated that feelings influence behavior and that feelings were at least in large part physiological in nature. This relationship between feeling and physiology of the alcoholic and non-alcoholic was hypothesized in this study. It was hypothesized that the alcoholic suppresses emotions as an avoidance behavior and that this suppression was reflected in physiological behavior as evidenced in the electrical skin conductance, heart rate, and respiration rate. First, the alcoholic group would have lower electrical skin conductance response than the non-alcoholic group because the alcoholic appeared to suppress or block emotions. This suppression appeared generally to result in a lower level of ESC as reflected in the work by Kagan (1970). Secondly,

the alcoholic group would have increased heart rate and a less stable heart rate than the non-alcoholic group as a concomitant of suppressing or blocking emotional awareness. This suppression appeared generally to result in the heart rate increasing and becoming less stable or increasing the number of peaks (Kagan, 1970). Finally, the alcoholic would have greater control in breathing, more body movements, and more time spent in the holding of the breath than the non-alcoholic because the alcoholic tended to suppress or block emotional awareness. This suppression was hypothesized to be reflected as tenseness in respiration, increased body movement, and increased time spent holding of the breath. Why did the findings not support these hypotheses? It is possible the hypotheses were incorrect and that there was no difference between the alcoholic and non-alcoholic. If this was true, then it might be necessary to re-examine many of the ideas of what makes an alcoholic an alcoholic (i.e., perhaps alcoholism is largely a physical and/or chemical rather than a psychogenic disorder). It might also be possible that alcoholics and non-alcoholics have identical emotional makeup but simply find different ways of expressing it. It might , however, be possible that some of the limitations of the current design interfered and that the hypotheses still are valid.

Limitations

Some limitations which might have contributed to the results are the socioeconomic level of the two groups, the influence of drugs upon physiological responses, the possible inclusion of alcoholics in the control group, the age factor, the act of volunteering, the laboratory setting of the experiment, and the inclusion of the orientation measure in the analysis.

1. The socioeconomic factor might have limited the results. The alcoholic group generally contained individuals who had a lower educational level than the non-alcoholics, longer periods of unemployment, more skilled employed versus unskilled, a greater number considered disadvantaged, and a median rating of severe on a disability scale of mild, moderate, and severe. The non-alcoholic group had more recent employment, more unskilled employment, a fewer number considered disadvantaged, and a median rating of moderate on a disability scale. In addition, the actors on the stimulus films might have reflected a different socioeconomic level than the subjects which might have influenced the responsiveness of all the subjects to the affective stimuli.
2. The limitations of the possible influence of drugs upon physiological response was revealed in the post-treatment check list. The clients of the

Division of Vocational Rehabilitation might have been taking more medication than would have ideally been desired and expected. The physiological data from each group was confounded by the recent intake of coffee, tobacco, and/or various medications. The check list data showed that in the experimental group, seven members had coffee shortly before the sessions, eight had tobacco, and two had one or more types of medication that day. In the control group, all members had coffee shortly before the treatment session, six had tobacco, and six had one or more types of medication on that day.

3. The results might have been limited by the inclusion of alcoholics in the control group. Plaut (1967) states

> In most instances these figures probably grossly underestimate the number of problem drinkers in contact with a particular agency. There continues to be a strong tendency not to give the diagnosis of alcoholism to patients and clients.

A typical population would have a certain number of alcoholics; however, the inclusion of some heavy drinkers or even alcoholics in the study may have confounded the results. For example, it was learned later that one of the subjects in Group II had two "shots" of gin one half hour before the treatment session. Other controls admitted to drinking alcohol although the amount was not quantified and a classification of alcoholism was not made.

4. The factor of age might have been a limiting factor on the physiological responses. Good physiological records are more difficult to obtain as age increases (Sternbach, 1966). The alcoholic and non-alcoholic groups had respective mean ages of forty-seven and forty-three point six. The alcoholic group had fifty per cent of its members over fifty years of age while only one of the non-alcoholic group was over fifty.
5. The act of volunteering by subjects might have been related to rapport between coordinator and client and the coordinator's willingness to cooperate in the study. Subjectively, the higher level of coordinator-client rapport seemed to be in the same direction as the amount of willingness by the subject to cooperate in the study.
6. There was a further limitation of presenting two levels of two emotions in a laboratory setting rather than in the normal environment. Sternbach (1966) raises the concern as to how representative the laboratory results are of true emotion. Would the alcoholic or control respond physiologically differently if he was at home and a male or female friend were saying what the actors did?
7. The inclusion of the orientation response, T_2, as part of the analysis of the data, might have

introduced a large amount of measurement error which might have adversely affected the results of the study. It was more difficult to get a typical scorable response for T_2 than for T_1 (baseline) or T_3 (stimulus presentation). The greater amount of bodily movements of the subjects during T_2 resulted in records with a large amount of unscorable data necessitating the substitution of the group means for the missing data. In future research, efforts should be made to reduce the amount of unscorable data in T_2 to a level comparable to that in T_1 and T_3.

Confounding Variables

As Wenger and others have shown, the relationship between emotion and physiology is an exceedingly complex phenomenon with many parameters (see Chapter II). The issues of stimulus response specificity (an individual will react differently to different stimuli), individual response specificity (each individual has his own unique responses), law of initial values (". . . the higher the prestimulus level of functioning, the smaller the response to a function-increasing stimulus . . . ."), may be some confounding variables that operated during the treatment session (Sternbach, 1966).

Lacey (1959) states that the higher the pre-stimulus tensions the smaller the magnitude of responses. Lacey (1959)

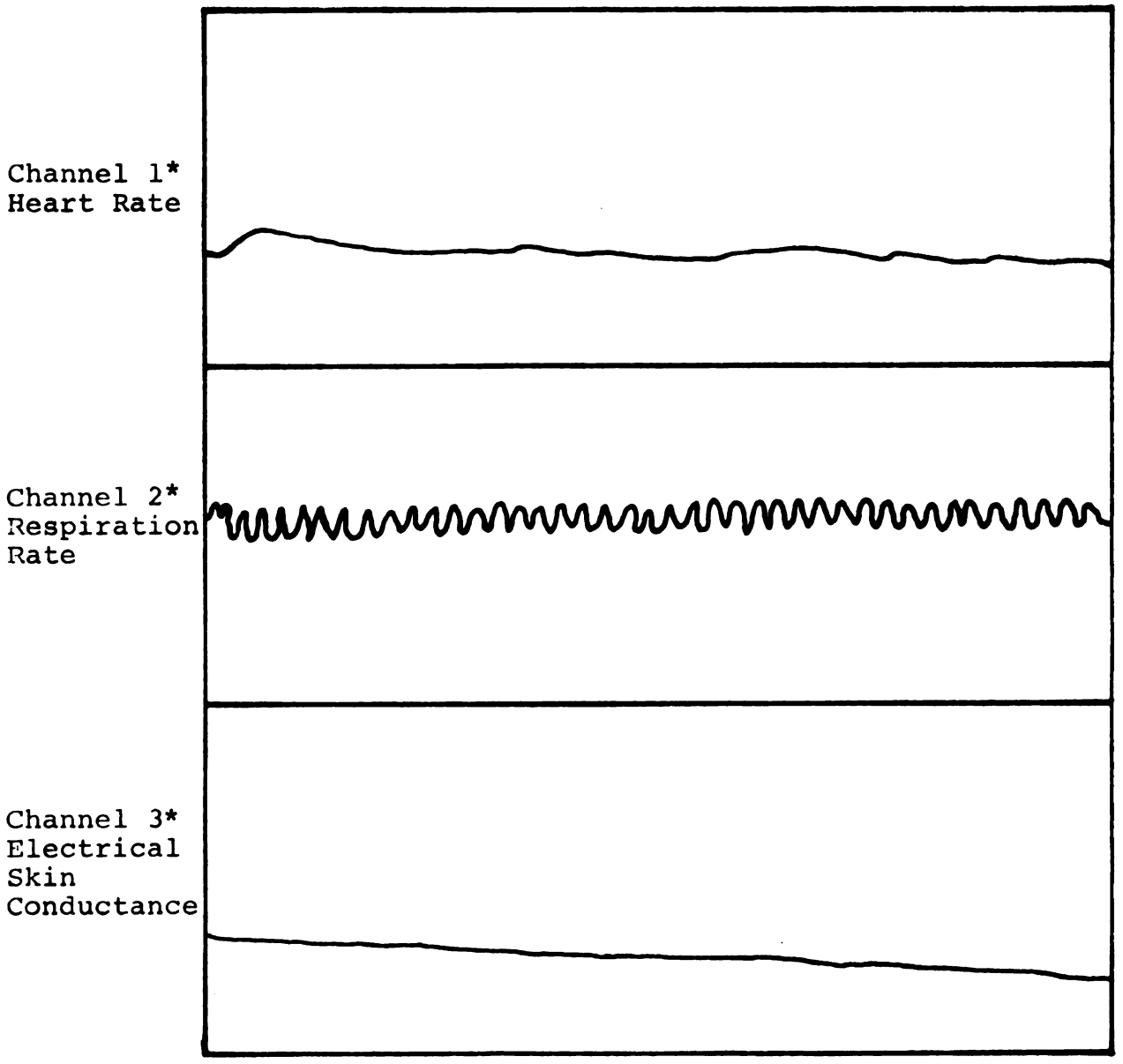
further reports that subjects become bored with lengthy intervals between stimuli. He also (Lacey, in Sternbach, 1966) reports the limitation of films because the subject must attend to the films (an audio-visual complex) and attending is associated with a configuration of physiological responses of its own.

Physiologically, people with a tendency toward heart problems would tend to be more reactive on heart measures (Sternbach, 1966). The present study had subjects with heart problems in both groups. There is also the variable of the physiological difference in the groups due to the extent of physiological damage done by alcohol to members of the experimental group.

Observations and Implications

The following is a list of some of the investigator's non-hypothesized observations about the investigation and possible interpretations.

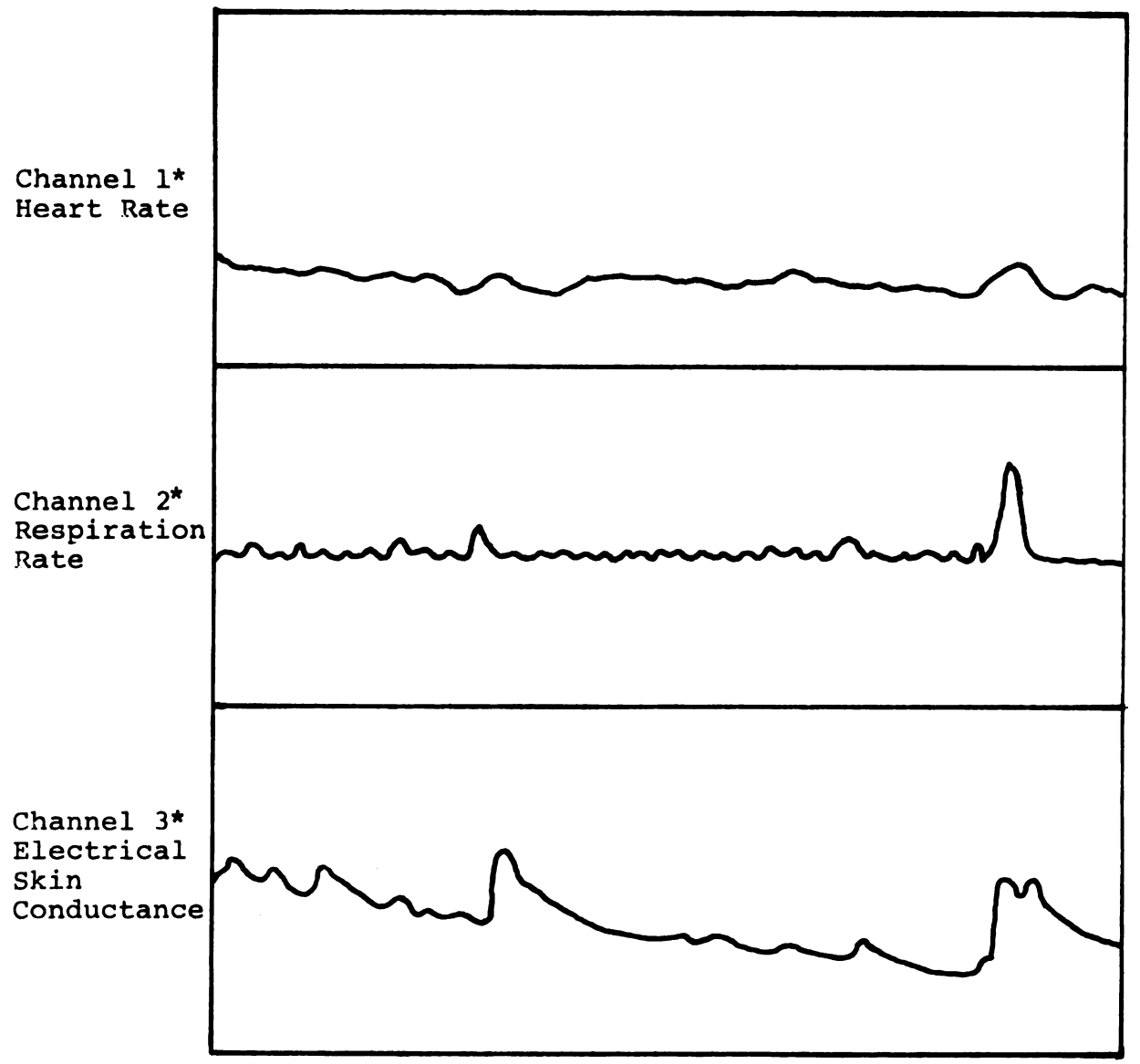
1. Certain subjects in each group did reflect the hypothesized physiological responses. Figure 5.1 is a copy of an actual record and reflects the expected physiological reaction on the three physiological responses for a member of Group I (alcoholic). Figure 5.2 is a copy of an actual record and reflects the expected physiological reaction on the three physiological responses for a member



*Subject #4 on F8

Figure 5.1

A Copy of an Actual Record for a Member of Group I During T3.



*Subject #8 on F8.

Figure 5.2

A Copy of an Actual Record for a Member of Group II During T3.

of Group II (non-alcoholic) suggesting that there may be several types among each group.

2. The analyses of the data may have been biased further by substituting group mean scores based on small sample sizes for missing or unscorable data. In one instance where the heart rate was not able to be recorded, the group mean heart rate was substituted.
3. Although the mean respiration rate for each group was not significantly different (but in the hypothesized direction), there was nonetheless an apparent difference in the quality of the rate. The alcoholics' breathing appeared to be very regular while the non-alcoholics' breathing had a greater variability in the inhalation and exhalation during a time segment. There seemed to be a sense of controlling the respiration response during the time sequence by the alcoholic. The inhalations and exhalations were very uniform in size and length. If true, this may have been due to the laboratory situation and a desire to appear to respond in a certain manner to the investigator. Perhaps, the respiration rate reflects the alcoholic group members fear of disclosing what they may have been feeling. If true, this would fit the theoretical model postulated in Chapter I. Of course, this is highly speculative.

4. During the presentation of F_3 (female, mild affection), the non-alcoholic group responded with increased electrical skin conductance, increased heart rate, and more irregular respiration than during F_2 (male, blatant affection). On the other hand, the alcoholic group, except for two members, did not respond as the controls had done from F_2 to F_3. The non-alcoholic may have been attending to more of the feeling that was being expressed and their own feelings whereas the alcoholic group may have been dealing less with the feelings being expressed and their own feelings, according to the theoretical model.
5. All the subjects as a group on the Times by Films (TF) interaction responded with a higher group mean score of the sum of the measures, during T_1 (baseline), than during T_2 (orientation), and T_3 (stimulus presentation). There was an exception to the above statement. During the initial T_1 (baseline) at F_1 (male, mild affection) there was a lower group mean score of the sum of the measures than during the initial T_2 (orientation) and T_3 (stimulus presentation) at F_1 (male, mild affection). This may have been caused by the subjects being more completely at rest and, therefore, may have been a good baseline.

6. The word "kiss" did cause various subjects to show ESC increase. The literature (Lacey, 1959) reported that certain words like "kiss" would result in increased reactivity.
7. The post-treatment session provided the investigator with the impression that certain of the non-alcoholics were also inhibitors of emotional material. Is it possible that there were more of these inhibitors in this particular non-alcoholic group than there would have been in other non-alcoholic groups or the population at large? This may have confounded the results.
8. The alcoholics, generally, were more observant of their appointments and were more cooperative than were the controls.

Implications for Future Research

The results of this study seemed to raise several questions which might be considered in future research. An analysis of the results of this investigation arouses speculation, emphasizes a need for refinement of the design, and concludes with some additional research questions.

In speculating about the results as reported in Chapter IV, the significant or near significant results will be examined. The results of the repeated measures ANOVA were presented in Table 4.1 (p.46). The one significant F-ratio at .05, Measures (M), was probably demonstrating only the

difference among various measures of electrical skin conductance, heart rate, and respiration rate. It may not be reasonable to compare such measures with each other even when they have been converted to a common metric. Although this F-ratio is significant, it is very doubtful how helpful this source of variation would be in future research, where the measures before transformation are on a variety of scales.

Groups (G) and Measures by Times (MT) were near the .05 level and would have been significant at .10. G appears to function as a statement of a particular group's general physiological reactivity as measured on the three physiological responses. The higher G score or group mean for the non-alcoholic group might reflect their attending to what is happening now, in regards to the stimuli and the laboratory setting. This response may fit the theoretical model for they might be attending more to their feelings about what is happening and, therefore, more generally reactive than were the alcoholic group. It should be noted that the non-alcoholic group was initially more reactive, having a higher heart rate which might be a sampling error or a function of the group members attending more to their feelings. If the latter consideration is true, Groups (G) might be a good statement of general physiological responsiveness and potentially valuable for future research. Some hypotheses for future research might be that there is a

significant difference between the two groups in mean responsiveness and that the non-alcoholic group is significantly more responsive on the overall mean responsiveness than the alcoholic group.

Measures by Times (MT) was near significance and would have been significant at .10. Seven of the measures (M_4, M_5, M_6, M_{10}, M_{12}, M_{13}, and M_{14}) in this source of variation are worthy of exploration as to the possible meaning of their patterns of scores and interactions (see Figure 4.2). M_4 (SESC), the slope of the electrical skin conductance, increases from T_1 to T_2 and then decreases from T_2 to T_3. The slope upward from T_1 to T_2 may reflect an activation or preparation by the subject at the "get ready" signal. According to the theoretical position described in Chapter I, the downward movement from T_2 to T_3 may reflect less attention being paid to the feeling being expressed and thus a downward slope beyond that at T_1. The interaction of M_4 with M_{12} (NA), the number of apnea, and M_{13} ($\overline{X}$AL), the mean length of apnea, might reflect that at times of preparation there is a smaller number and length of holding one's breath, or apnea, at the same time there is greater sweating. This might also reflect the unreliability of the short T_2 period and thus increase the error here. A future research hypothesis might be that as the number and mean length of apnea increase the slope of the electrical skin conductance decreases significantly. The converse hypothesis may also be important to investigate.

M_5 (CPKESC), the number of conservative peaks on the electrical skin conductance, and M_6 (LPKESC), the number of liberal peaks on the electrical skin conductance are disordinate and, therefore, non-parallel and non-intersecting. M_5 and M_6 increase from T_1 to T_2 and decrease from T_2 to T_3. It might indicate that in "getting ready" or in preparation (like M_4 above) people sweat more resulting in an increase of both conservative and liberal peaks. T_2 is a time sequence of limited usefulness for measurement here (see Limitation Number 7). A research hypothesis might be that as the sweating increases the number of conservative peaks on the electrical skin conductance increases significantly. It might also be hypothesized that as the sweating increases the number of liberal peaks on the electrical skin conductance increases significantly.

M_6 intersects with M_1 ($\bar{X}$ESC), the mean electrical skin conductance, M_2 (HIESC), the high points of the electrical skin conductance, and M_3 (LOESC), the low points of the electrical skin conductance (see Figure 4.2). This suggests that at T_2 (orientation) there is a greater increase in the number of peaks while there is a very slight decrease in sweating in M_1 and M_2 and a slight increase in M_3. This might suggest that although there is very little difference in the amount of sweating, the type of sweating may be different (i.e., a more erratic type of sweating). As preparation ends the amount of sweating remains almost

constant, but the type of sweating becomes more stable. M_5 decreases from T_2 to T_3 while M_1, M_2, and M_3 increase very slightly from T_2 to T_3. An investigator of a future research project might hypothesize that during times of preparation the quantity of sweating may not vary significantly from resting but the quality of sweating will be significantly different.

M_{10} (PKHR), the number of peaks in the heart rate, and M_{14} (MALL), the number of movements are disordinate, that is non-parallel and non-intersecting. M_{10} decreases dramatically from T_1 to T_2 and decreases even further from T_2 to T_3. This might indicate a greater amount of attending to the stimuli and, therefore, following the theoretical model of a more stable rate when one is attending to feelings. A researcher might hypothesize that as the number of peaks in the heart rate decrease there is a significantly greater amount of attention being given to one's feelings. M_{14} (MALL) decreases from T_1 to T_2 and increases slightly from T_2 to T_3. It appears that during the time of preparation and attending to what is happening the subject has a fewer number of movements than when resting and not attending.

M_{12} (NA), the number of apnea, and M_{13} ($\bar{X}$AL), the mean length of apnea both drop from T_1 to T_2 and then rises again from T_2 to T_3, yet not as high as the original T_1. It appears, as stated above in discussion M_4, that at times

of preparation there is a smaller number and length of holding one's breath than during baseline (T_1) or during the presentation of stimuli (T_3). The lower T_2 might also reflect the limitations of T_2 as a measure described under Limitations. A helpful research hypothesis might be that during periods of preparation the number of apnea and the mean length decreases significantly from times of non-preparation.

Some sources of variation which would also be significant at .05 on the traditional repeated measures design (liberal) test were G, T, MF, MT, MTF, and MTFG. Perhaps an investigator in a study with fewer measures and/or increased subjects could find out if there were substantial differences on these dimensions.

The analysis for hypothesis generation (Table 4.4) showed the multivariate analysis did not reach the .05 level of significance. Although a difference was not discovered, it is entirely possible that with more subjects or with a more rigorous definition of the alcoholic and non-alcoholic groups (i.e., excluding drinkers in the non-alcoholic group and eliminating the medication problem) a group of distinctive physiological measures may be found which distinguish significantly the alcoholic group from the non-alcoholic group. A research hypothesis might be that there is a distinctive group of physiological measures, when combined, are able to distinguish significantly an alcoholic group from a

non-alcoholic group. The analysis of the data for hypothesis generation of the univariate test (see Table 4.4) indicated that the mean heart rate showed a significant .05 difference between the two groups during the presentation of all the affective film stimuli. It appears the difference was not a function of the affective film stimuli and subject interaction. For some reason, the controls had a higher mean heart rate, even initially in the baseline. Perhaps, they were responding more to their feelings about the testing situation. One explanation which further blurrs the response here is that although the mean age of the controls was younger, they had the higher heart rate which would not be expected and is opposite of what one would expect to find in the age-heart rate norms. It is recommended that the same measure should be repeated in another study to test the hypothesis that the $\bar{X}$HR of the group resulted from a biased sample. There was no other measure in the univariate test which even approached a meaningful level of significance.

The refinement of the design would include increasing the number of subjects, decreasing the number of measures in the study, and matching the subjects on the criteria described in this chapter under Limitations as well as having control subjects who are definitely not alcoholic and perhaps also a sample of subjects who are considered self-actualizers (emotionally mature).

In summary, new research questions may include the following based upon the limitations and the results of the analysis: (1) Is there greater breathing control in the alcoholic group? (2) What is the relationship between more reactive baseline and lower reactivity during emotional stimuli? (3) What is the relationship between the two groups on the overall mean of responsiveness, or, what is the meaning of a difference in overall mean physiological responsiveness? (4) Does the slope of the electrical skin conductance increase or decrease in relation to the number and mean length of apnea? (5) If the amount of sweating increases does the number of conservative peaks in the electrical skin conductance increase? In like manner, if the amount of sweating increases does the number of liberal peaks in the electrical skin conductance also increase? (6) Does the quantity of sweating remain the same during preparation (orientation) as during resting? If the quantity of sweating remain the same, is there a difference in quality (i.e., type and number of peaks) during preparation (orientation) than during resting (baseline)? (7) Does a decrease in the number of peaks in the heart rate signify a greater amount of attention being given to a subject's feelings? (8) If a person is attending to the stimuli or his feelings, is there significantly less bodily movement than when he is not attending? (9) Does the number

of apnea and the mean length during periods of preparation decrease significantly from times of non-preparation?

Additional research questions might include further study of the hypotheses of this study. The electrical skin conductance measures based upon group means were all in the expected direction. All the heart measures and the respiration mean rate based upon group measures were in the opposite direction from that hypothesized, while the number and mean length of apnea measures were non-directional. Would these trends again be observed in new samples of alcoholics and non-alcoholics?

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APPENDICES

APPENDIX A

MEMO TO COORDINATORS CONCERNING CLIENT CONTACTS ON VOLUNTEERING FOR THE STUDY

APPENDIX A

MEMO TO COORDINATORS CONCERNING

CLIENT CONTACTS ON VOLUNTEERING FOR THE STUDY

Some brief notes to help in talking to clients about volunteering for the research project being coordinated by Mr. S. This list of comments is designed to help you when talking to the clients about the study.

1. Ask them if they would like to take part in a research study of D. V. R. clients being conducted at Michigan State University.

2. Everything will be kept strictly confidential. They will be assigned a number so as to keep confidentiality.

3. The study is designed to get the reactions of the clients to some films. If they have a lot of questions about the films, please mention to them the fact that we want to get their reaction to the film and that you, as the coordinator, may influence the study by giving them (the client) a pre-determined set or attitude toward the film.

4. It will take only one session of approximately one to one and a half hour of their time.

5. The study will be used in helping to develop counseling procedures.

6. Ask them when they will be available, i.e., early evening (preferred).

7. They will be provided with a ride if they would like it.

Dear Coordinator,

Your cooperation is greatly appreciated. Thank you.

APPENDIX B

EXPERIMENTAL DESIGN

APPENDIX B

EXPERIMENTAL DESIGN

		T_1			T_2			T_3		
		M_1	M_2	$\ldots M_{14}$	M_1	M_2	$\ldots M_{14}$	M_1	M_2	$\ldots M_{14}$
		$F_1 \ldots F_8$	$F_1 \ldots F_8$	$F_1 \ldots F_8$	$F_1 \ldots F_8$	$F_1 \ldots F_8$	$F_1 \ldots F_8$	$F_1 \ldots F_8$	$F_1 \ldots F_8$	$F_1 \ldots F_8$
G_1	S_1									
	S_2									
	S_3									
	S_4									
	S_5									
	S_6									
	S_7									
	S_8									
	S_9									
	S_{10}									
G_2	S_1									
	S_2									
	S_3									
	S_4									
	S_5									
	S_6									
	S_7									
	S_8									
	S_9									
	S_{10}									

CODE

G_1 = Experimental Group

G_2 = Control Group

F_1 = First Film MAS

F_2 = Second Film MAB

F_3 = Third Film FAS

F_4 = Fourth Film FAB

F_5 = Fifth Film MRS

F_6 = Sixth Film MRB

F_7 = Seventh Film FRS

F_8 = Eighth Film FRB

T_1 = Rest Period (2 min.)

T_2 = Orientation Period

T_3 = Film Period

M_1 = Mean Electrical Skin Conductance ($\bar{X}$ESC)

M_2 = High Reading for Electrical Skin Conductance (HIESC)

M_3 = Low Reading for Electrical Skin Conductance (LOESC)

M_4 = Baseline $\frac{y_2 - y_1}{t} = x$ (SESC)

y_1 = beginning of run

y_2 = end of run

t = time of run

x = baseline -down
+upward

M_5 = Conservative Number of Peaks (CPKESC)

M_6 = Liberal Number of Peaks (LPKESC)

M_7 = Mean Heart Rate ($\bar{X}$HR)

M_8 = High Heart Rate Level (HIHR)

M_9 = Low Heart Rate Level (LOHR)

M_{10} = Number of "Peaks" for Heart Rate (PKHR)

M_{11} = Mean Respiratory Rate ($\bar{X}$RR)

M_{12} = Number of Apnea (NA)

M_{13} = Mean Apnea Length ($\bar{X}$AL)

M_{14} = Periods of Movement (MALL)

APPENDIX C

VIDEO TAPE PLAYER PROCEDURES

APPENDIX C

VIDEO TAPE PLAYER PROCEDURES

1. Put the tape on the machine (tape loose).
2. Turn on the machine.
3. Clean the tape heads.
4. Be certain the machine is on release.
5. Check on take up reel and be certain it is all set to go.
6. Put the monitor on in the control room.
7. Turn on buzzer in control room.
8. Put the monitor on in the studio room.
9. Turn on buzzer in the studio room.
10. Check the speaker in the interview room to be certain it is connected.
11. Check and be certain the speaker in the classroom is disconnected.
12. Put the output audio on 3.
13. Put the knob on ready and start to play the tape by pushing the P button.
14. After the test pattern is over, do the following:
    a. Check tracking by turning until the needle stops and start down.
    b. Check sound in studio room during test pattern.
    c. Stop the tape by pushing the S button.
    d. Put the tape player on release by turning the knob to release.

15. Put the knob on ready and push the P button as soon as possible, i.e., do both of the above in order and as quickly as possible. BUT ONLY AFTER THE PERSON RUNNING THE GRASS RECORDER SAYS TO DO SO.

16. After the last film is over T_3 (V_8), i.e., girl and anger, watch the clock and allow the tape to run for two minutes. Then, immediately, stop the tape (push the S button) and put the knob on release.

APPENDIX D

ROOM ARRANGEMENTS: STUDIO AND INSTRUMENTATION

APPENDIX D

ROOM ARRANGEMENTS: STUDIO AND INSTRUMENTATION

Room arrangements showing the location of various equipment during the treatment sessions.

B = Buzzer

C = Chair

INSTR = Instrumentation Room

M = T.V. Monitor

PSC Rec = Physiological Receiver

SC = Subject's Chair

ST = Studio Room

T = Table

VT = Video Tape Player

APPENDIX E

FLOW CHART FOR DATA COLLECTION

APPENDIX E

FLOW CHART FOR DATA COLLECTION

Flow chart showing the relationship between the subject, the Grass 5D Polygraph strip chart recorder, and each of the transducers and electronic bridges used to record electrical skin conductance, heart rate, and respiration rate, respectively.

C = Cardiotachometer

GPR = Grass 5D Polygraph

GS = Grass Stimulator

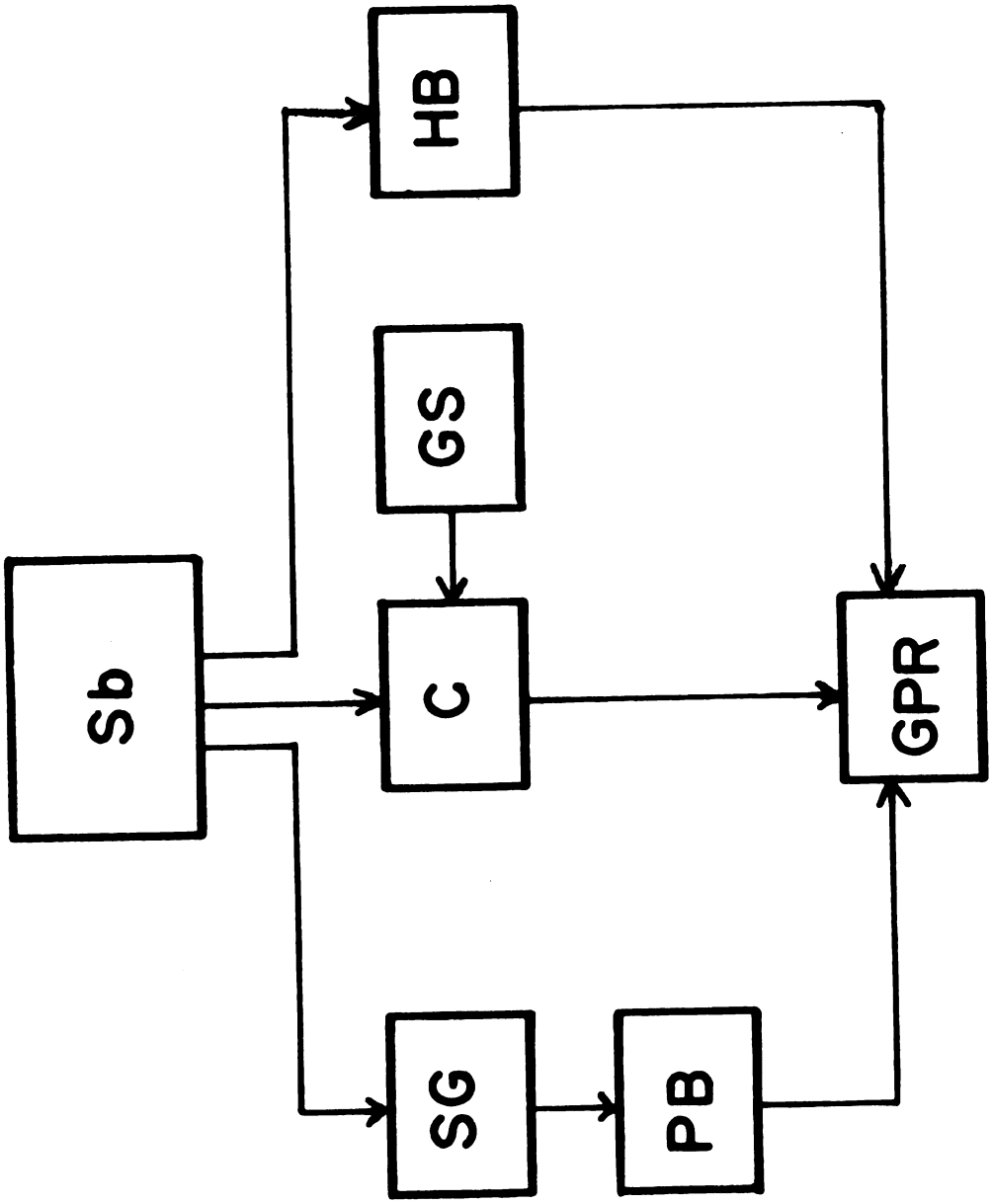
HB = Hagfors Bridge

PB = Plethysmograph Bridge

Sb = Subject

SG = Strain Gauge

FLOW CHART FOR DATA COLLECTION



APPENDIX F

GRASS 5D POLYGRAPH PROCEDURES

APPENDIX F

GRASS 5D POLYGRAPH PROCEDURES

I. Write subject's name and date on beginning of record.

II. Prepare Channel #1 - Heart Rate.

A. Turn heart monitor on.

B. Calibrate polygraph amplifier.

1. Set Input on 20 DK and Voltage on 00.

2. Set Polarity in Down and Cal position.

3. Set Hi-frequency on 60.

4. Set baseline in center of pen area.

5. Adjust for 2 cm. deflection.

C. Calibrate polygraph pre-amplifier.

1. Turn on the power switch of stimulator (warm it up).

2. Set the dials at .1, 1, 1, respectively, beginning with the left dial.

3. Set Polarity in Use position.

4. Set black Sensitivity knob on Cal position.

5. Adjust for 2 cm. deflection.

6. After completing, set black Sensitivity knob on 0.2 millivolts.

D. On the polygraph amplifier, set Hi-frequency knob on 0.5.

E. Calibrate for heart rate.

1. Connect positive and negative lines from stimulator to input on heart rate monitor.

2. Turn on repeat switch.

3. Turn heart rate monitor on.

4. Adjust the baseline for 60 beats per minute at 5 millimeters from the bottom of the pen area.

5. Calibrate for heart rate of 60, 70, 80, 90, 100, and 110.

F. Turn off the stimulator and disconnect stimulator lines from heart rate monitor.

G. After preparing the subject, connect the heart rate leads from the subject to the heart rate monitor.

H. Adjust sensitivity on the heart rate monitor (turn dial to right if dropping or turn dial to left if rising).

III. Prepare Channel #2 - Respiration Rate.

A. Calibrate polygraph amplifier.

1. Set Input on 20 DK and Voltage on 00.

2. Set baseline knob at negative .5.

3. Set Sensitivity knob at 2.

4. Set Hi-frequency on 60.

5. Set Polarity in Up and Use position.

6. Do not calibrate deflection.

B. Calibrate the polygraph pre-amplifier.

1. Set black Sensitivity knob on 10 or 20 (can be increased or decreased as needed for sensitivity during run).

2. Set adjust cal on 2.

C. Turn on the bridge.

D. Balance pen with course bridge adjust (in order to get a "good reading," i.e., balanced).

E. After preparing the subject, connect the strain gauge leads from the subject to the bridge.

IV. Prepare Channel #3 - Electrical Skin Conductance.

A. Calibrate the polygraph amplifier.

1. Set Input on 20 DK.

2. Set Hi-frequency on 60.

3. Set Polarity in Down and Cal position.

4. Calibrate 2 cm. deflection.

5. Set Polarity in Use position.

B. Calibrate the polygraph pre-amplifier.

1. Set black Sensitivity knob in Cal position.

2. Calibrate for a 2 cm. deflection (Caution: do not adjust baseline; but take the deflection from where the pen is on the channel).

3. With black Sensitivity knob in Cal position, move baseline to center of the pen area with baseline position adjust.

4. Set black Sensitivity knob on 0.5 millivolts per cm.

C. Calibrate the bridge.

1. Take subject out with the In-Out switch on the bridge.

2. Set bridge black knobs to 0 (zero).

3. Set pen in the center of channel with bridge 0 (zero) Adjust.

4. After preparing the subject, connect the electrical skin conductance leads from the subject to the bridge.

5. Put the subject in with the In-Out switch on the bridge.

6. Adjust pen to center of channel with micromho dial.

7. Record one micromho on record by turning micromho dial up one micromho and returning it down again.

8. Write down present micromho reading on the record.

D. Write on the record the time when the treatment begins.

APPENDIX G

CONTENTS OF TREATMENT VIGNETTES

APPENDIX G

CONTENTS OF TREATMENT VIGNETTES

The vignettes and their contents are given below in the order presented in the treatment.

Setting: A male or female actor is seated and talks from behind a table which is barely visible at the bottom of the monitor screen. The picture is black and white.

Film 1. Male, Affection - Subtle. Time: 1 Minute, 17 Seconds.

> Content: You are so neat. (Laughs, head down, hands folded, and a laughing smile) pause - You know in a day and age like this there just aren't many people like you (looking straight ahead, slight smile on face, and hands folded and pointed toward subject). Am I glad I found one of them. I'd like to - pause - you know, just forget about everybody else and just stay here with you.

Film 2. Male, Affection - Blatant. Time: 1 Minute, 58 Seconds.

> Content: Have you got any idea - pause - the way that you get to me? You know. I just can't be near you for five minutes. I go right out of my mind (smoking cigarette, rubbing hands together, and looking straight at the subject). I want to touch you - pause - all the time. I just want - pause - I want to be near you to feel you, you sitting next to me (picks up cigarette). On the street (hands touching each other) just everywhere, and that way you hit me - pause - the way you get to me (sincere, with slight smile). Nobody does it like that, not that way, not that strongly. It's like animals, you know? Now doesn't that really make you feel the same way (right hand holding left wrist). At least you act - pause - like it does. Whether you feel it or not, I don't know but - pause - if I can take your feelings from your actions I know - pause - the way you seem (looking very sincere).

Film 3. Female, Affection - Subtle. Time: 1 Minute, 42 Seconds.

Content: I don't know what to say to you (warm smile, happy appearance, nervous expiration of breath, and puts left hand to face and neck) - pause - Why don't we just sit here for a while (puts hands on lap) and talk about something else - pause - I don't know how to tell you - pause - (smiling nervously but happily). Why don't you say something? - pause - (Puts hand and arms on the arm of chair during this long pause, hand movement up and down the arm of the chair, and two deep audible expirations).

Film 4. Female, Affection - Blatant. Time: 1 Minute, 46 Seconds.

Content: I've liked you for such a long time (audible breathing). I just like to be with you (playing with hands seductively, smiling very much, hands folded and playing with hands, a "come and get kind of look," and nervous laugh, hands to mouth) umm. I don't know how to tell you. I don't go around telling people things like this (hands to her mouth and laughs). Every time I'm with you I get so hot (deep audible breath) - pause - and if you don't come over here and kiss me pretty soon I'm going to go out of my mind (deep audible breath, and then puts hands under chin).

Film 5. Male, Rejection - Subtle. Time: 1 Minute, 53 Seconds.

Content: I really don't think that's true. I - pause - (arms crossed, smoking cigarette). I think that probably you are very wrong - pause - in that. (Slight artificial smile) I suppose you can go right on believing that way if you want to but (slight frowning of head) you really can't expect for me to go along with you, - pause - but then you know what you think - pause - and certainly no one is going to tell you not to think what you honestly believe, but I think maybe - pause - you should reexamine some of the things which you believe, huh? (Rather cold, and shaking head back and forth) because most of us couldn't bring ourselves to think that way. How about it, huh? - pause - (looking sinister, shakes ashes off cigarette, and folds arms). Well ah, you think about it - pause - you think about it.

Film 6. Male, Rejection - Blatant. Time: 41 Seconds.

Content: (Removes cigarette from mouth.) Well, you son-of-a-bitch! (Anger in his eyes.) Somebody ought

to kick your face right in! Honest to - pause - I'd just like to - pause - (clenched fists). Will you get the hell out of here before I come over there and just - pause - clobber (looks like he's starting to climb over the table to get at the subject) the shit out of you (very angrily spoken)! Now get (shouting and moving head dramatically) away! - pause - Go on!

Film 7. Female, Rejection - Subtle. Time: 52 Seconds.

Content: Oh (surprise), well, yes, we do need people. Umm, we're rather short-handed now and oh - pause - (slight smile, indifferent look, and hands out from body) if you would like to come - pause - umm - pause - (spread arms in opening type of gesture) we'd be delighted to have you (smile, but hesitancy in it). I'm sure there is something we could find for you - pause - oh - pause - if you'd like to stick with it, umm - pause - of course if you're too busy we could get along, but we do need people to come - pause - umm - pause - (movement of head up and down and sideways). Well why don't you try it and - umm - pause - see if you can come.

Film 8. Female, Rejection - Blatant. Time: 48 Seconds.

Content: (Deep audible expiration.) It isn't funny anymore - pause - (deep expiration, surprised anger). Well, you son-of-a-bitch! (Pounds fists, deep expiration) I wish you'd just go - long pause - (clenching fists and rubbing her hands on the arm of the chair, looks very angry, deep audible expirations, and shaking head back and forth).

APPENDIX H

POST-TREATMENT CHECKLIST

APPENDIX H

POST-TREATMENT CHECKLIST

Date_____Room Temperature_____Only Table Light_____

Name of Subject_____

Married_____Never Married_____Divorced_____Separated_____

Age_____Occupation_____

Are you presently taking any medication?_____What?_____
When?_____
(This includes aspirin, cough medication, tranquilizers, etc.)

Do you smoke?_____When was the last time?_____

When did you have your last cup of coffee or tea?_____

When was the last time you had alcohol?_____What?_____

Do you have high blood pressure?_____

Have you had treatment for emotional problems?____When?_____

APPENDIX I

DATA RECORD

APPENDIX I

DATA RECORD

Code

M_{sub} = One of the measures determined by the subscript number (see Appendix B for coding of each of the 14 measures).

T_1 = Baseline

T_2 = Orientation

T_3 = Stimulus Presentation

O = Data with the value of zero

X = Data missing or unscorable

Raw data placed in appropriate boxes.

Raw data carried out to four decimal places and rounded off to three.

DATA RECORD

Subject's Name_____ No.____ Date of Run_____
Subject's Category E_____ C_____ Time of Run_____

			M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8	M_9	M_{10}	M_{11}	M_{12}	M_{13}	M_{14}
ROW	FILM	TIM. PER.	$\bar{X}$ ESC	HIESC	LOESC	SESC	CPKESC	LPKESC	$\bar{X}$ HR	HIHR	LOHR	PKHR	$\bar{X}$ RR	NA	$\bar{X}$ AL	MALL
1		T_1														
2		T_2														
3	1	T_3														
4		T_1														
5		T_2														
6	2	T_3														
7		T_1														
8		T_2														
9	3	T_3														
10		T_1														
11		T_2														
12	4	T_3														
13		T_1														
14		T_2														
15	5	T_3														
16		T_1														
17		T_2														
18	6	T_3														
19		T_1														
20		T_2														
21	7	T_3														
22		T_1														
23		T_2														
24	8	T_3														

APPENDIX J

GROUP MEAN SUBSTITUTION FOR MISSING OR UNSCORABLE DATA IDENTIFIED ACCORDING TO DATA SHEET LOCATIONS

APPENDIX J

GROUP MEAN SUBSTITUTION FOR MISSING OR UNSCORABLE DATA IDENTIFIED ACCORDING TO DATA SHEET LOCATIONS

Group	Subject Number	Row Number	Measure
I	2	8	11
I	3	2	7, 11-13
I	5	14	1-10, 14
I	6	1-24	7-10
II	1	1-24	7-10
II	2	1-24	7-10
II	6	5	4, 11
		8	4-6, 11
		10	8, 9
		11	4, 7-9, 11
		13	7-9
		14	4, 7-9, 11
		19-28 (Except 21-24)	1-14 (Except 14)
II	7	11	1-14
		17	1-14
II	8	14	11

Code: Group I = Experimental, Group II = Control.

APPENDIX K

SCORING PROCEDURES FOR MEASURE 1 THROUGH MEASURE 14

APPENDIX K

SCORING PROCEDURES FOR MEASURE 1 THROUGH MEASURE 14

Measure 1

The mean rate for electrical skin conductance ($\bar{X}$ESC) was achieved by drawing a baseline. The baseline approximated an equal amount of recorded area above and below the line during a time sequence. For an acceptable baseline, five seconds or more were needed for a particular time sequence.

Measure 2

The high point (HIESC) was the highest micromho reading for a time sequence.

Measure 3

The low point (LOESC) was the lowest micromho reading for a time sequence.

Measure 4

The slope (SESC) was determined by the formula $\frac{Y2 - Y1}{time} = B$ or baseline slope. B was the ESC reading at the end of the time sequence minus the reading at the beginning of the time sequence divided by the number of seconds in the time sequence. A positive score signified an upward slope and a negative score a downward slope. If interrupted by movement, the various acceptable segments of time were averaged in order to get the data.

Measure 5

The conservative number of peaks (CPKESC) was any deviation of the ESC recording which deviated .3 or more of a micromho in a particular time sequence.

Measure 6

The liberal number of peaks (LPKESC) was any deviation of .1 or more of a micromho in a time sequence.

Measure 7

The mean heart rate per minute ($\bar{X}$HR) during a time sequence was obtained by drawing a baseline with approximately equal area above and below the line. The procedure for reading the baseline rate off the record was done by counting from the lower portion of the channel the number of centimeters on the linear graph previously constructed. This was the procedure used for reading all of the heart rate measures. It also added to the consistency of the measures.

Measure 8

The highest heart rate (HIHR) during a time sequence was the highest point reached during that time period excluding artifact. (See Measure 7 for the procedures for reading the rate off the record.)

Measure 9

The lowest heart rate (LOHR) during the time sequence was the lowest point reached during that time period excluding artifact. (See Measure 7 for procedures for reading the rate off the record.)

Measure 10

The last heart rate measure was the number of heart rate "peaks" (PKHR) during a time sequence. A "peak" was defined as an increase of five or more centimeters during a five-second period of a time sequence. If, for example, there was one continuous peak of ten centimeters during a ten-second period, it was recorded as one peak.

Measure 11

The mean respiration rate per minute ($\bar{X}$RR) was the number of exhalation peaks divided by the time in seconds during which the peaks were counted. This was multiplied by the number of seconds in a minute.

$$\frac{\text{number of peaks}}{\text{time where peaks counted}} \times \frac{60}{1} = \bar{X}RR$$

If an omit period (see Chapter III, pp. 37-38) was encountered during the time sequence, the most typical thirty-second or less period (following the general procedures on movement) was selected and the peaks counted. A peak was considered included in a time sequence if the line ending the sequence passed through one-half or more of the apex of the peak.

Measure 12

The number of apneas (NA) was the number of times the subject held his breath for five seconds or more during a time sequence.

Measure 13

The mean length of apnea ($\overline{X}$AL) was obtained by dividing the total amount of apneas for a time sequence by the number of apnea in the sequence.

Measure 14

The final measurement was the number of movement omits observed during a time sequence (MALL).