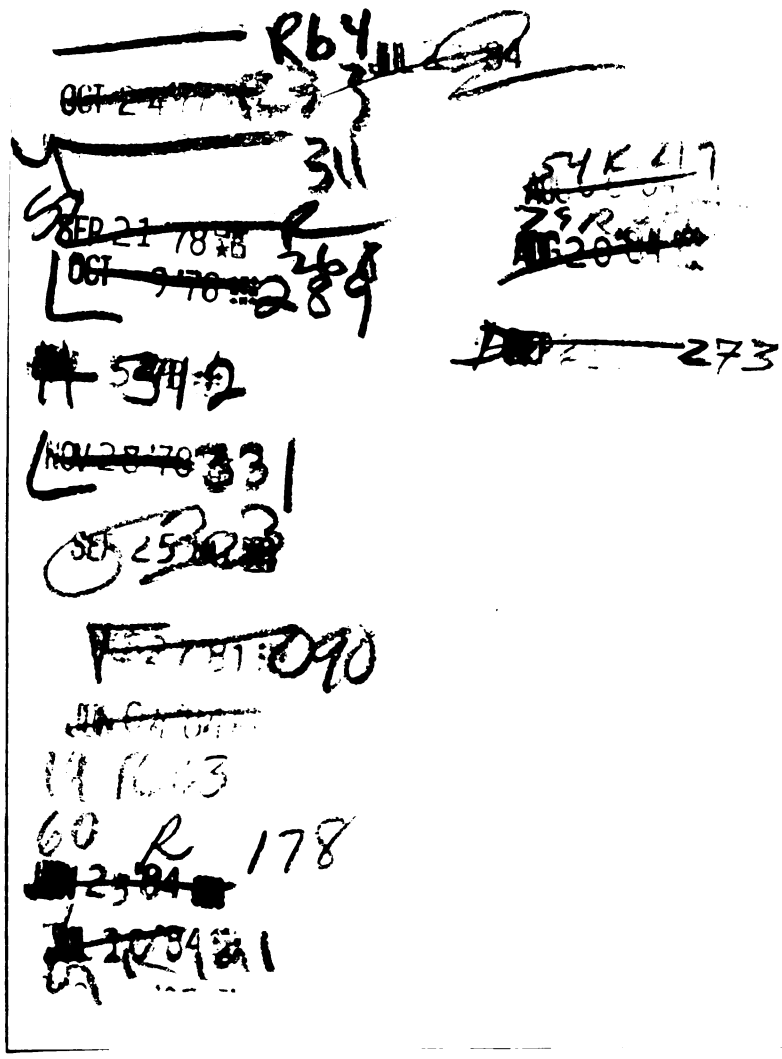

ABSTRACT

ELECTRICAL SKIN CONDUCTANCE AND CARDIAC RESPONSES OF REPRESSERS, MIDLINES, AND SENSITIZERS TO AFFECTIVE STIMULUS FILMS

By

Yonkel Goldstein

Personality theorists have paid much attention to psychological defensiveness. One conceptualization of defensiveness which was reviewed here is Byrne's notion that defensiveness may be viewed as a behavioral continuum ranging from repressing and ignoring behaviors to sensitizing and distorting behaviors. Psychophysiologists have devoted much attention to the correlates of an organism's accepting and/or rejecting stimulus input. This study was an attempt to investigate the relationship between Byrne's conceptualization of defensiveness and hypothesized psychophysiological correlates of shutting out or accepting environmental stimulation.

Two physiological measures--heart rate and electrical skin conductance--were analyzed. Literature was reviewed which suggested that heart rate increases when an organism shuts out stimuli; conversely, when an organism attends to stimuli heart rate decreases. Therefore, one hypothesis of

the study was that when a subject was involved with a filmed vignette, heart rate should decrease. When a subject was not involved with a vignette heart rate should increase.

Evidence from the literature was also reviewed suggesting that when subjects are defensive electrical skin conductance (ESC) activity maintains its rate or increases. When a subject accepts environmental input ESC activity decreases. Therefore, a second hypothesis of the study was that when a subject was involved with a filmed vignette, ESC should decrease; when a subject was uninvolved, ESC activity should remain the same or increase.

The literature also suggested that repressers show more physiological arousal than sensitizers, both before and during stimulation. This, then, became a third hypothesis.

A fourth hypothesis tested in this study was that repressers' physiological patterns when they are involved with vignettes differs from sensitizers' patterns when they are involved and that repressers' physiological patterns when they are uninvolved differs from sensitizers' patterns when they are uninvolved.

A fifth hypothesis was that subjects' involvement with the vignettes could be predicted from their personality type as measured by the Byrne Repression-Sensitization Scale, cardiac change scores, and ESC change scores.

Forty-five female subjects from Education 484 classes were picked, on the basis of their scores on the Byrne Repression-Sensitization Scale, such that fifteen could be

considered repressers, fifteen midlines, and fifteen sensitizers. Each subject was shown twelve stimulus vignettes while her heart rate and ESC were being recorded; simultaneously, she was videotaped. After watching the vignettes and taking a memory test about them, she watched the videotape of herself viewing the film, stopping the tape to describe her experiences while watching the film. A tape recording of this "recall" was then rated by two judges. From their ratings two vignettes per subject were designated as "involved"--meaning that the subject verbalized an emotional reaction to them--and two are designated as "uninvolved"--meaning that the subject failed to verbalize any reaction to them.

A multivariate analysis of variance was carried out on these data. The results indicate that repressers are more labile than other groups--ie. they had larger electrical skin conductance standardized standard deviations than sensitizers or midlines--during the base rate and while watching the films. The results also indicated that subjects have a lower mean skin conductance level when uninvolved with the vignettes than when they are involved with them. No statistically significant interaction was found in this analysis.

A multiple regression analysis based on the same six vignettes for all subjects was performed, attempting to predict overall involvement ratings from Repression-Sensitization scores, electrical skin conductance change scores, and cardiac change scores. For all subjects approximately

one-third of the involvement variance was accounted for by Repression-Sensitization and ESC change scores. However, when separate analyses were run on the different personality groups, ESC change scores accounted for approximately 76% of the involvement variance for repressers, 6% of the involvement variance of midlines, and 1% of the involvement variance for sensitizers.

The implications of these findings were discussed. These results gave no support to the interpretation of cardiac activity on which these hypotheses were based; however, there were sufficient differences between this study and others so that neither do they damage the basis of those hypotheses. These results confirm the findings reported in the literature that repressers are more physiologically reactive than other personality groups. In spite of the lack of a significant interaction between involvement and personality group in the MANOVA, results are interpreted, based primarily on the multiple regression, suggesting that personality groups do differ in their physiological correlates of involvement--specifically as evidenced by ESC change scores. A clear pattern of a decreasing number of ESC responses were found in vignettes with which repressers became involved; no such clear pattern was found for the other personality groups.

ELECTRICAL SKIN CONDUCTANCE AND CARDIAC RESPONSES OF REPRESSERS, MIDLINES, AND SENSITIZERS TO AFFECTIVE STIMULUS FILMS

By

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To Mom and Dad

To paraphrase Sholem Aleichem -
if I reach higher than my parents
it's only because I'm standing on
their shoulders.

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Were it not for these people, this dissertation would never have been written.

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CHAPTER I

THE PROBLEM

Introduction

Human behavior, in one form or another, makes up a part of the subject matter for a myriad of academic disciplines ranging from biology to aesthetics. However, traditionally in academia the various sub-specialties have had little to do with each other, as if those who were concerned with the appreciation of beauty had no object of study in common with those who sought to unravel the mystery of the optic nerve. Increasingly, as the arbitrary boundaries have become obscured, the need has been felt for inter-disciplinary study, and hybrid fields have developed; psychophysiology is an example of such a case. Of course, in the case of psychophysiology, both "parental" fields are themselves quite diversified and, predictably, this "inter-marriage" occurred between the most compatible parts--experimental psychology and that part of physiology which deals with intact homo sapiens. However, once the precedent had been set, it was only a matter of time until the "second cousins," such as personality, clinical and counseling psychology, began to view their particular fields

from a physiological perspective. (On the other side of the fence, of course, neurological and endocrine researchers began to look past their dissected specimens, speculating about complex, living humans.) The advantages of this academic intercourse seem obvious--the broadened perspectives can lead to new conceptualizations and fresh strategies in attacking old, persistent problems. The pitfalls, unfortunately, are staggering: there is twice as much basic information to be assimilated, there are "translation" problems from one discipline to the other, and special measurement problems which come from adding apples and oranges.

This study is one that belongs to that second set of "inter-marriages"--specifically between personality psychology, based on clinical assessment, and psychophysiology; it is a piece of research concerned with translation. Physiologists have for years dealt with "orienting reflexes" and "defensive" reactions; psychophysiologists have conceived of various physiological patterns as being geared towards receiving information from the environment or shutting it out. Personality psychologists have classified people as being introverted, extroverted, defensive or open. Psychotherapists spend a great deal of energy in trying to assess when an individual is being defensive. On an intuitive level it would seem that there should be a fair amount of overlap between many of these concepts. If some equivalence could be established and specific patterns identified, this could both help to clarify a part of the relationship between mind and body and be a

helpful indicator to the practising psychotherapist. This study is in the area of interdisciplinary translations. In its broadest sense this study is an examination of the relationship between the psychophysiologist's environmentally-oriented organism and specific defense patterns known to personality theorists.

Need

The general need which this study serves is that of obtaining more data about the relationship of the "mind" to the body. Socrates (Plato, c 390 B.C.) spoke of a body and soul, emphasizing the latter because it is that which gives humans the ability to discern good from evil. Plato was a dualist seeing the soul as an independent entity attached to the body for the extent of the human life. Aristotle (c 340 B.C.), on the other hand, believed that body and psyche were indivisible. Hundreds of years later Descartes (1649) amplified on the concepts of Aristotelian psyche and body, but changed the emphasis so as to separate them. He considered mind and body to be totally separate, picturing mind and body to be entities in two distinct worlds,with the body being subject to natural laws, while the mind was free of such constraints and was alone capable of exercising free will. The immediate problem posed by this dualistic conception of reality was how--if at all--did the two entities interact? Some, such as de Malebranche and Guilincx, denied that there could be any such interaction (Watson, 1968).

Hobbes (1651) took an extreme materialist position, explaining everything in terms of molecular interaction. Spinoza (1677), in contrast, took the view that "the order and connection of ideas is the same as the order and connection of things." He admitted that mind and body correlated with each other, but denied that events in one sphere could cause things to happen in the other. This view was later expounded upon by Fechner (1966) who viewed mind and body as differing aspects of one unity. He sought to quantify the relation of the two in order to show that increases in mental sensation correspond to proportional changes in physical stimuli. Nietzsche took an even more extreme view saying, "Body am I entirely, and nothing more; and soul is only the name of something in the body" (Edwards and Pap, 1965).

The above is not intended to reduce to one paragraph the work of some of the greatest minds in the Western world. It is, however, an attempt to establish the fact that the relation of mind to body has been a matter of major intellectual concern for hundreds of years. This study will proceed from the philosophical position that there is a relationship between mind and body; it is an attempt to specify one part of that relationship.

There is a second, more practical need which this study bears upon. Psychotherapists spend a great deal of energy trying to be aware of, and making their clients aware of, defenses and resistances. Freud (1924) wrote:

> A vehement effort must have been exercised to prevent the mental process in question from penetrating into consciousness and as a result it has remained unconscious; being unconscious it had the power to construct a symptom. The same vehement effort is again at work during analytic treatment, opposing the attempt to bring the unconscious into consciousness. This we perceive in the form of resistances. The pathogenic process which is demonstrated by the resistance we call REPRESSION.

Having thus said that resistance to therapy is a manifestation of a person's defenses (ie. repression), he underscores the importance of resistance.

> Every step of the treatment is accompanied by resistance; every single thought, every mental act of the patient's, must pay toll to the resistance and represents a compromise between the forces moving towards the cure and those gathered to oppose it.

Neo-Freudians such as Reich (1933) have devoted great importance in their therepeutic technique to dealing with these resistances and defenses. If physiological patterns indicative of defensive orientations could be found, it is possible that this pattern could be useful in making both clients and therapists aware of the defensive posture, thereby improving or accelerating therapy.

Archer et al. (1971) wrote:

> 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 interpresonal engagement but to literally permit him to see what his internal responses were as well... 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.

If one accepts this reasoning it seems logical that it could be potentially of even more benefit to the client to have some interpretive help in understanding his physiological "read out."

Purpose

There are two major purposes of this study. The first of these is to test and extend the original psychophysiological work differentiating heart rate and skin conductance patterns in organisms attending to and shutting out the environment. The original work, done primarily by Lacey and his associates, in the case of heart rate, and Edelberg, in the case of electrodermal activity, primarily used psychophysical stimuli such as photic flashes and cold pressor tests; it is unclear to what extent the results can be generalized to vastly more complex interpresonal stimulation; this study will attempt such an extension.

The second reason for doing this study is that it will clarify whether, in this area, the personality psychologist, who talks about "styles of interpersonal coping," and the physiological psychologist, who talks about "externally" and "internally-oriented organisms" are simply speaking two different languages or are really referring to unrelated phenomena.

Hypothesis

It is expected that there will be a moderate positive correlation between physiological patterns indicative of

openness toward the environment and the level of involvement in brief scenes in which actors give a variety of messages to the subject. It is hypothesized that there will be a low positive correlation between scores on the Byrne Repression-Sensitization Scale and physiological response patterns. It is hypothesized that there will be a significant interaction effect in immediate involvement between physiological response patterns and sensitizer-represser classification on the Byrne scale, ie. a sensitizer's physiological responses when involved will differ from the involved physiological responses of a represser.

Theory

This study bears directly on two separate theories--a psychological one concerning defense patterns and a psychophysiological one concerning cardiac and electrical skin conductance response patterns. The theoretical implications from personality theory will be considered first.

According to psychoanalytic theory a neurotic conflict occurs when there is "a tendency striving for discharge and another tendency that tries to prevent this discharge" (Fenichel, 1945). It is to defend the ego from a realization of the abhorrent instincts of the id that defense mechanisms come into play. In that sense all defense mechanisms are restrictive in goal--they seek to keep something from the ego. Fenichel (1945) writes:

> In fainting, the organism, which has been overwhelmed with too intense stimuli, shuts out the influx of further stimuli. The complicated defense mechanisms of the psychoneuroses may be looked upon as partial faintings. In fainting, all perception is blocked; in repression, some selected perceptions are blocked.

He goes on to say:

> Neurotic characters, instead of reacting to their experience adequately, respond more or less rigidly with the same reaction patterns. They are not only fixated to certain levels of instinctual demands but also to certain mechanisms of defense.

Various typologies have been employed to characterize typical response patterns. Horney (1937), for example, speaks of four basic means of protection--securing affection, being submissive, obtaining power, and withdrawing.

Byrne (1964) sees a continuum of defensive behaviors which at one extreme seek to avoid anxiety-producing stimuli (eg. repression, denial) and at the other seek to control and manipulate the stimulus, thereby avoiding the anxiety (eg. intellectualization, obsessive behaviors, and rumination). Behaviorally, the former involve an avoidance of the stimulus, while the later are characterized by an approach which distorts; they are all defense mechanisms in that they seek to reduce the ego's experience of the anxiety.

Other theorists, examining different concepts have described a dichotomy similar to the one postulated by Byrne. Hudson (1966), discussing differences between "convergers" and "divergers" says that the former's "defenses lie in the direction of inhibition," while the latter's "defenses lie in a subtle distortion of true openness."

Byrne (1964) reviews a host of studies which find differential recognition thresholds or differential accuracy scores for a variety of neutral and conflictual stimuli including words, drawings, Blacky pictures, and tape-recorded sentences. In these studies ease of recognition was varied by using different exposure speeds, illumination intensities, loudness of recordings, or by using successive carbons to decrease legibility or by increasing background white noise. A variety of defense indicators were used including readiness to verbalize conflictual material on the TAT and sentence completion tests, ability to recall failures vs. successes in an experiment, recall of Blacky pictures, California F scale scores, ratings of Rorschach and Machover Figure-Drawings, and psychiatric evaluations based on interviews and case histories. The general findings of all these studies were that subjects who perceive threatening stimuli as accurately or more accurately than neutral stimuli respond in other situations with approach behavior, intellectualization, and sensitization. Those who perceive conflictual stimuli less well than neutral stimuli tend to repress and avoid in other situations.

It is important to note that according to Byrne's theory both the repressing and sensitizing ends of the continuum are considered to be pathological. Byrne (1964) writes:

> If each end of the repression-sensitization continuum represents an extreme of the respective defense modes, scores on the R-S scale would be expected to have a

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> curvilinear relationship with various indices of psychological adjustment. Neither over-intellectualization of conflicts nor denial of them should result in optimal adjustment.

In summary, then, the relevant points from personality theory discussed here are: 1) there exists a class of behaviors--defense mechanisms--which block the ego's perception of anxiety-arousing stimuli, 2) people often adopt typical response postures with rigid reliance on a particular set of behaviors being indicative of neurotic adjustment, and 3) one particular way of conceptualizing these behaviors is along a continuum from always controlling, approaching, and distorting the stimulus to another extreme of always avoiding the stimulus.

The second theoretical set of underpinnings this study bears upon is the relationship betweeen emotional and physical events in the human body. The first point in this theory is that there is a relationship. There is ample evidence for such a connection ranging from the subjective feelings such as "butterflies in the stomach," headaches, and physical tenseness reported by individuals in response to stressful situations, to more formal academic findings associating physiological changes with a variety of emotional situations. In his review of the field Oken (1967) cites substantial evidence showing such diverse biological changes as the secretion of 17-hydroxycorticosteroids by the adrenal cortex, aldosterone secretion, catecholamine (ephinephrine and norepinephrine) secretion, and a variety of autonomic responses such as differences in muscle tension, heart rate,

systolic and diastolic blood pressure, respiration, skin conductance, and finger temperature in response to changes in the psychological environment.

Unfortunately, the next step in building this theory--determining the precise relationship between the physiological and psychological variables--is not nearly as clear-cut. Indeed, Dykman et al. (1968) write: "Psychophysiological research by competent investigators is remarkable for results which are inconclusive, contradictory, or paradoxical--thus attesting to the complexity of the data and the difficulty of posing soluble problems." Although philosophers have dealt with this problem at least from the time of Plato, modern psychology only began addressing this problem with the work of William James (1884) who posited that physiological states were evoked directly by affective stimuli and that what the individual experienced as emotion was due to his own processing of bodily states. Cannon (1927) challenged this notion with his demonstration that partially severing the central nervous innervation of the viscera did not eliminate emotional behavior. Cannon hypothesized a chain of communication going from the viscera to the thalamus, to the hypothalamus and, from there, to the cerebral cortex and the viscera. In this system he posited that the cortex would play an inhibitory role over the lower centers. As Lang (1971) traces in his summary of psychophysiological history, the basic "chain of command" hypothesized by Cannon was later expanded by Papez, who showed that the cingulate

gyrus served as the cortical reception center from lower brain impulses, and by MacLean, who suggested that the amygdala is of major importance in the parasympathetic regulatory system and that the hippocampus is of primary importance in sympathetic, emotion activity. Lindsley (1951) suggested that the degree of cortical arousal was responsible for the emotion which was felt. The problem this notion faced was that there was only one dimension--intensity of arousal--along which emotion could vary, and that made it very difficult to explain qualitative differences in emotion. It was as if the theory could account for feeling slightly peeved or very furious, but could not deal with the difference between anger and sadness. Hebb (1955) remedied this theoretical problem by proposing a two-factor model. The first factor is one of arousal--identical to Lindsley's theory; the second factor was what he called a "cue" function which gave the aroused feeling a behavioral direction. For example, an emotion such as fear was thought to be made up of a high arousal component and a cue component picking avoidance as the direction. It is significant that prominence is given in this theory to neurological as opposed to visceral mechanisms. Schacter (1964) modified the two-factor theory somewhat, suggesting that emotions are composed of an undifferentiated autonomic pattern which is characterized by a cognitive state which interprets the emotion according to the context. In one experiment subjects were given epinephrine injections

which resulted in intensifying whatever emotion was appropriate in the social context (ie. those watching comic movies found them funnier, those with a hostile experimental stooge became more hostile, and those with a playful accomplice were more playful) (Schacter & Wheeler, 1962). However, this data can be seen to reflect only part of the picture, for if one examines the work of Ax (1953) one finds a clear differentiation between visceral reactions to experimentally-induced fear and anger. Specifically Ax reported that diastolic blood pressure increases, heart rate decreases and the frequency of skin conductance responses were greater in the case of anger than fear, while the magnitude of skin conductance increases and respiration increases were greater in the case of fear than in the case of anger. In light of this, one must question Schacter's "undifferentiated autonomic pattern."

It is this general arousal theory of emotion with its latter variants which form the springboard from which various other theorists take off, either seeking to confirm or discredit the arousal theory. There are two general strategies employed: one--devising two or more different emotional situations and with sophisticated instrumentation recording a wide range of physiological variables seeking to show differing reactions--is best illustrated by Ax's work (1953) referred to above, while the second is illustrated by the work of Lacey (1959) and involves finding some general characteristic of emotion which accounts for some percentage of

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the physiological variance not accounted for by arousal theory. The particular characteristic Lacey has focused on is the external versus internal orientation of the organism. He reports monitoring heart rate and palmar skin conductance while subjects were engaged in four tasks: visual attention, empathic listening, thinking, and enduring physical pain (Lacey, 1959). In the first two it is necessary to orient one's attention outwardly; in the latter two it is helpful to shut out outside input. His findings were that skin conductance increased across all four tasks; however, heart rate accelerated while the person was thinking of experiencing the physical pain and decelerated while he was attending visually or listening empathically. Support for this idea that the heart rate either increases or decreases depending upon whether the organism is seeking to attend to or reject the external stimulation is most clearly seen in Davis' (1957) work presenting pictures to male subjects. He identified a "P" pattern which consisted of considerable sweat gland activity, peripheral vascoconstriction, and a decreasing heart rate; this pattern was most reliably obtained from male subjects viewing female nudes. However, when the visual stimulus was a starving man the cardiac response was reversed.

Lacey (1959) considers these findings to be devastating to any concept of emotion based solely on arousal because of the difficulty in simultaneously explaining increasing arousal, as evidenced by the increasing skin

conductance (indicative of increased sympathetic activity) and decelerating heart rate (indicative of decreased sympathetic activity, increased parasympathetic activity or both). He goes on to hypothesize that these cardiovascular changes have a direct effect on central nervous system activity. An increase in pulse rate is picked up by pressure-sensitive receptors in the carotid sinus, the aortid arch, and possibly in the heart itself which, by way of Hering's nerve, inhibits cortical electrical activity and spinal motor-neuronal activity (Callaway & Dembo, 1958). Lacey and Lacey (1970) cite evidence that direct stimulation of Hering's nerve or an increase in pressure in the carotid sinus decreases muscle tone in an anesthetized animal. The distension of the carotid sinus causes cortical inhibition as evidenced by the shift from low voltage fast activity to high voltage slow wave activity. As pressure on the carotid sinus increases, response thresholds also increase. (The contention that increased cardiac activity has this inhibitory effect on attention has been questioned by Obrist et al. (1965) who have shown that pharmacologically blocking this pathway does not change performance as expected.)

From a somewhat different perspective Edelberg (1972) joins the attack on the general arousal theory of emotion. He points out that electrodermal activity is considered to be an indication of sympathetic activity which is interpreted to be an equivalent of arousal level. This interpretation is based on what Edelberg terms an "unwarranted" assumption

of a direct relationship between sympathetic activity and behavioral correlates. (Furthermore, as Lang (1971) points out, measures of electrical skin activity provide an atypical picture of sympathetic activity in that the sympathetic synaptic transmitter is typically norepinephrine, while in the case of sweat gland innervation the synaptic transmitter is acetylcholine.) To further complicate the already beclouded physiological picture Davis (1957) writes, "the parasympathetic nervous system would now have to be recognized as capable of producing excitatory states..." Support for this statement can be found in Gellhorn's work (1968, 1969, 1970) which classifies individuals as having a dominant sympathetic or parasympathetic system. The propensity for increased sympathetic activity--called ergotropic tuning, is associated with cortical desynchronization, high muscle tone, and behavioral arousal, while the tendency for increased parasympathetic activity--known as trophotropic tuning--is associated with cortical synchronization, decreased muscle tone and sleep. The important point here, though, is that at extreme levels of either ergotropic or trophotropic tunings one finds reversal phenomena. For example, in an ergotropic system, a novel stimulus evokes an increase in alpha (a trophotropic response) instead of the expected cortical desynchronization.

Other evidence which can be considered damaging to the idea of equating sympathetic activity with psychological arousal is Martin & Edelberg's (1963) demonstration that

electrodermal activity may be diminished when subjects show considerable irritation. Along the same lines, Johnson's and Lublin's (1966) finding that electrodermal activity can be greater during stage four sleep than when the same subject is performing a task in the waking state, points to a more complex phenomena than the simple equation of electrodermal activity and general arousal. Edelberg (1972) concludes that it is inappropriate to speak of increased nervous activity or heightened arousal; he prefers to try to be more specific, speaking of cortical, amygdaloid, hippocampal, or pontine activity and, behaviorally, of defensive arousal, cognitive-activation, and alertness for information. He postulates that electrodermal activity is an index of reticular activation.

Whatever the precise relationship of electrodermal activity to neurological and psychological phenomena, it does have some very clear physical effects. Edelberg (1972) gives the following list of possibilities:

> (a) thermoregulation to compensate for cutaneous vasoconstriction, (b) thermal preparation for a heat load of muscular origin, (c) the adjustment of physical properties to favor manipulative contact, (d) the adjustment of physical properties as a defense against abrasion, (e) the enhancement of tactual acuity either mechanically or neurochemically, or (f) the secretion of a characteristic odoriferous substance that facilitates tracking by other members of the species.

Reading over the list one cannot help but to be impressed by the possibility that electrodermal activity is well-suited to affect the interaction between the organism and the environment. Martin and Edelberg (1963) have explored

this possibility in a limited way by having subjects whose galvanic skin response was being monitored indicate by pressing a key their positive and negative feelings as they were listening to tape recorded readings. They found that when the subjects expressed negative feelings ("irritation") via pressing the key, the galvanic skin response was diminished. They expected, but failed to find, an increase in galvanic skin response activity associated with positive feelings. Thus, this study only partially supports the hypothesis that galvanic skin response is part of a screening mechanism employed by the organism. The authors suggest that this failure to confirm fully the hypothesis might be due to the low valence attached to what they considered positive readings. The implication here about the relationship of galvanic skin response activity to psychological involvement is similar to Lacey's (1959) report of work by Furer and Hardy where after repeated presentation of a painful stimulus, the galvanic skin response habituated, but was made to reappear when the situation varied slightly. When the subject is attending galvanic skin response activity appears to be present.

This whole problem has been approached from a slightly different perspective, primarily by Russian investigators. Berlyne (1966) discusses Pavlov's early work with the orienting reflex (OR). Pavlov's dogs would cease any ongoing activity, turn their heads, and look toward the source of any unusual event. Pavlov classified this as an

unconditioned reflex, which was subject to extinction and disinhibition much like any conditioned reflex. Sokolov (1963) has extended the notion of this response to novel stimuli by positing a generalized response system, known as the orienting response, which through its autonomic feedback loops facilitates peripheral receptor sensitivity. He postulates that a neuronal model of a stimulus is built up in the central nervous system after repeated presentation. The smaller the discrepancy between the neuronal model and the real-life stimulus, the smaller the OR. Opposed to this OR he posits a defensive reflex (DR) which is also a generalized response system with feedback mechanisms, but is distinguishable from the OR in that with repeated stimulation OR's habituate, whereas DR's do not habituate and may even become stronger. Furthermore, OR's are elicited by low intensity stimulation, whereas DR's are elicited by high intensity and/or noxious stimulation. On the basis then of this Pavlovian-Sokolovian theory, it can be predicted that if a person were "open" to external (non-defensive) stimulation they would orient towards a stimulus and electrodermal activity would diminish; conversely, if the subject were closed to such stimulation, electrodermal activity should maintain steadily or increase.

Up until this point research has been cited which suggests that both electrodermal and cardiac activity are in some way related to the organism's attending to the external environment. Darrow (1929) presents evidence which

has to do with the inter-relationship between these two variables, suggesting that a high pulse rate's inhibitory effect on cortical activity can be overcome by the excitatory effect of skin conductance activity. They showed that palmar electrical skin conductance (ESC) increases were associated with alpha blocking, while blood pressure increases were negatively correlated with alpha blocking. They had subjects perform a task which involved attending to lights and found that ESC and heart rate increases were associated with false responses. They concluded that skin conductance activity, which is excitatory, can overcome the inhibitory effects of a high heart rate. However, when heart rate is low, the organism is already in an excitatory state, and skin conductance activity has no additional effect. Dykman et al. (1968), on the basis of work with psychiatric patients and normals describe four basic patterns. When examined for cardiac and electrodermal activity components, the patterns are: 1) alerting - moderate to large skin resistance decreases, moderate heart rate increases, 2) closed - negligible or no skin resistance decreases, moderate heart rate increases, 3) open - moderate galvanic skin response and no difference or decreasing heart rate, and 4) non-responding - no change in either direction.

Thus, whether or not the organism is opened or closed to its environment should account for some percentage of the variance of these measures above and beyond that accounted for by simple arousal. One should keep in mind, however,

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that a major function of these biological systems concerns vegetative bodily processes; therefore, one expects small, but significant amounts of the variance to be associated with these variables.

In summary, then the physiological theory which this study is based on comes from two separate sources: 1) a reaction against the classical arousal theory of emotion and 2) an examination of Pavlovian orienting responses. Logical arguments from both theories predict that cardiac and electrodermal responses should differentiate internally vs. externally oriented postures. The question addressed in this study is whether there is a relationship between the psychophysiological theories summarized here and the personality theory summarized earlier.

Overview

In Chapter II, the literature most releveant to relating psychological defense to physiological responses is reviewed. Methodology, instrumentation, procedures, analysis techniques, and research hypotheses are described in Chapter III. The results of the study, with the appropriate statistical analyses applied are given in Chapter IV. In Chapter V the conclusions and implications of this study are discussed.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter is to review the pertinent findings regarding the two physiological variables most relevant to this study--cardiac and electrodermal activity (EDA)--paying particular attention to how they might relate to psychological defensiveness. These two variables were picked because the literature seems to implicate them, more than any other, vis-a-vis subjects' openness and closedness to environmental stumuli. The best way to proceed is to divide the chapter into two parts--the first reviewing the literature pertaining to the interpretation of heart rate and the second reviewing the literature concerned with electrodermal activity.

Heart Rate

Lacey's (1959) contention that heart rate decelerates when the organism is oriented externally and that it accelerates when the organism is oriented internally has already been presented in Chapter I. The literature is replete with examples which confirm his essential findings, although at times, other conclusions are drawn from the data. In their

review of the literature concerning heart rate, Graham and Clifton (1966) conclude that pulse rate deceleration is a part of the orienting response and that pulse rate acceleration is part of a defense reflex. Porges and Raskin (1969) found that pulse rate decelerates when subjects attend to a light, while when they try to estimate their own heart rates, the pulse accelerates. Hodges and Speilberger (1966) measured heart rate of high and low anxious subjects under two conditions--threat of shock and no threat. They found that heart rate acceleration was greater in the threat condition, supporting the contention that heart rate acceleration is part of a defensive reaction; furthermore, those subjects reporting moderate to high fear of shock two months before the experiment exhibited greater cardiac acceleration than those reporting low fear of shock. In a similar study Hare and Blevings (1975) divided female subjects into two groups, those who were afraid of spiders and those who were not. They found that in the fear-of-spiders group heart rate accelerated when presented with slides of spiders, while in the not-afraid-of-spiders group there was no significant acceleration. Israel (1969), studying the differential cardiac response of "levelers" and "sharperers" (among other characteristics "sharepeners" tend to be very attentive to external detail and focus on differences between object while "levelers" tend to make global judgments, are less attentive to external detail, and tend to focus on similarities between objects) found marked cardiac deceleration

in "sharpeners" when attending to stimuli as compared with "levelers." Elliott et al. (1970) found that heart rate decelerates as the difficulty of an externally oriented task increases, while heart rate does not decelerate in response to shock. Obrist (1963) found a deceleratory heart rate in response to continuous environmental input even though sympathetic tonus (as evidenced by decreasing skin resistance) was increasing. Malmo and Davis (1956) found that as heart rate increased, performance time in a mirror-tracing task decreased. Bull and Lang (1972) found that cardiac response was a function of both the subjects' ability to discriminate stimuli and the physical intensity of the auditory stimuli used.

Lang and Buss (1965), reviewing literature concerning deficits in schizophrenics, cite evidence that schizophrenics, as compared with normals, tend to exhibit an increased level of cardiac activity. If one assumes that schizophrenics tend to shut out a greater proportion of the external environment than normals, this finding is in accordance with Lacey's theory. (One important qualification to remember in modern studies comparing schizophrenics with other groups is that the effect of phenothiazines, the class of medications most commonly prescribed for schizophrenics, is to increase heart rate and decrease heart rate variability and electrical skin conductance (Gruzelier and Venables, 1975). Spohn et al. (1971) report that when schizophrenics are taken off medication, heart rate remains elevated.)

Venables (1966) writes, "the general consensus of opinion is of a diminished responsiveness of the autonomic nervous system in the chronic schizophrenic." The finding that schizophrenics have elevated heart rate levels is consistent with this because of Wilder's Law of Initial Values which states that the response of an autonomic variable decreases as the prestimulus level increases (Wilder, 1967). However, Gray (1975) found that schizophrenics decreased their inhibition of anticipatory responding as signal intensity increased, while controls did the opposite. From this and reports he cites in the literature, he questions the position that schizophrenics exhibit a diminished autonomic responsiveness due to an elevated physiological basal level. Thetford et al. (1974) failed to find heart rate difference in groups of paranoid vs. nonparanoid schizophrenics, acute vs. chronic schizophrenics, or groups of those with good vs. poor pre-morbid adjustments.

Investigating this same matter of the relation between psychological coping ability and physiological reponse, but from a different perspective, Roessler et al. (1963) report a trend that as ego strength (defined as the "capacity to integrate environmental adaptive demands with psychological economy") increases, cardiac acceleration to auditory stimuli increases.

Tan's data (1964), comparing anxious subjects with normals supports this finding in that those with high anxiety had higher resting pulse rates and mean pulse rates in

response to stimulation. Deane (1966) found that the heart rate accelerated during the time the subject anticipated a shock; the acceleration decreased during and after the time the subject acutally received the shock. Schnell and Catania (1975) required subjects to detect the threshold level of a visual stimulus and found that heart rate decelerations during the "warning period" were greater on "hit" trials than on "miss" trials.

Lacey and Lacey (1974) report attempts to study heart rate when tasks involve both internal and external orientation. In one task which involved mental arithmetic (internal orientation) and signal detection (external orientation), heart rates simply increased as would have been expected had there been no externally oriented part to the task. However, in another task, called "Rules of the Game" which also involved both an internal and external orientation (ie. attending to outside stimuli and internally memorized rules), they found that the heart rates could be described as a "vectorial resultant" (or arithmetic average) of the increase one would expect from an internally-oriented task and the decrease one would expect from an externally-oriented task.

In Lacey's (1959) early studies he found that heart rate accelerated when a subject immersed a limb in very cold water (known as the cold pressor test). This appeared to be consistent with the idea that cardiac acceleration was associated with shutting out input from the environment.

However, Obrist et al. (1965) have shown that in a classical conditioning paradigm, heart rate will exhibit a biphasic response with an initial acceleration and subsequent deceleration when a noxious UCS is presented. Furthermore, they found that the initial heart rate increase is a respiratory artifact. However, they conclude that this finding is not necessarily inconsistent with Lacey's hypothesis in that "...deceleration of heart rate is thought to facilitate sensory intake. Therefore, the deceleration observed during conditioning could involve similar processes and have a like function." Thus it would seem that the critical difference between the direction of heart rate change in the cold pressor test and the conditioning experiment is that the latter was a learning situation where it was advantageous for the organism to attend to the environment, while in the former nothing was to be gained from any such attention. Lacey and Lacey (1974) agree with Obrist's position that "attention to unpleasant, aversive, and potentially threatening stimuli may be biologically advantageous." "Unpleasantness," they conclude, "does not preclude the intention to note and detect." In situations where attending to the noxious stimulation accomplishes nothing, heart rate acceleration is found. For example, Gang and Teft (1975), using dental drilling sounds as a stimulus, found greater cardiac acceleration in subjects who rated the stimulus as being more unpleasant.

A further criticism of Lacey's hypothesis is that heart

rate acceleration is an artifact of respiratory activity (Westcott and Huttelocher, 1961). Wood and Obrist (1964) report that with respiration controlled, the acceleratory cardiac component was not found, while the deceleratory activity was unchanged. Germana and Klein (1968) found only a cardiac deceleration to an auditory CS when respiration was controlled. Deane (1964) has presented contradictory evidence to suggest that breathing is not totally responsible for cardiac acceleration. However, even if it is true it does little damage to that portion of Lacey's hypothesis most relveant here; it says nothing about the idea that deceleration is associated with increased external attention. It seems that it is of crucial importance to the physiological question of what system(s) mediate cardiac changes, though it says nothing about the reliability of those differences.

Campos and Johnson (1966) failed to find that an orientation varible was significant in determining heart rate. Instead, they found that the requirement to verbalize produced heart rate increases. This finding is suggestive of the idea that it is the demand characteristics of a potential response and not differential orientation which is responsible for the pattern that Lacey reports. Support for this notion may be found in a study by Obrist et al. (1970) in which subjects are required to perform a reaction-time task while heart rate, electromyelograph bursts recorded from the skin, and eye movements are recorded. Their findings

are that cardiac deceleration is associated with a generalized inhibition of task irrelevant activities; in other words, the deceleratory response is interpreted as being due to the organism's inhibiting functions which are extraneous to the given task rather than because the organism has assumed some orientation posture. Elliott (1972), in reviewing a number of studies designed to test Lacey's hypothesis, finds Obrist's reliance on metabolic requirements to be the superior explanation of the actual phenomenon. Epstein et al. (1975), comparing heart rate and electrical skin conductance, conclude that heart rate is more reliably related to motor output than is electrical skin conductance, whereas electrical skin conductance is more reactive to stimulus input than motor output. Lacey and Lacey (1974) have responded to Obrist's and Elliott's position by agreeing that task-irrelevant motor activity is probably inhibited in preparation for reaction-time trials. However, they do not believe that this is sufficient to account for the cardiac deceleration. They criticize Obrist's sampling of other motor activity (chin muscle and eye movements) as being too small to generalize to overall activity level and suggest that muscles not sampled in the research might have been increasing in tension. Furthermore, they point to one of Obrist's own findings (Obrist et al. 1969) that reports that when subjects were required to continuously tap their fingers while being conditioned to a negative sitmulus, electromyelogram activity increased while

heart rate decreased. In addition, they refer to a study by Chase et al. (1963) similar to the Obrist study except that the reaction-time task was a leg lift rather than a finger tap. This presumably increased the metabolic demand placed on the heart. The finding was that because of the increased metabolic demand there was a cardiac acceleration. However, "superimposed on this response was a statistically significant cardiac deceleration." Lastly, in support of their position, the Lacey's point out that the metabolically relevant variable is cardiac output--not pulse rate. They quote the physiologist, Guyton:

> ...the decreased cardiac output is not proportional to the decrease in heart rate because the degree of filling of the ventricles becomes enhanced during the prolonged diastolic filling periods, which increase the stroke volume, and in this way offsets to a great extent the decrease in output that one might expect.

Lacey et al. (1963) suggest another factor, involvement, which is important in predicting cardiac response. They found that the greater the childhood involvement with scholastic tasks, the greater the cardiac response, as adults, to problem-solving tasks. They concluded that as the motivational relevance of a task increases, so will an individual's cardiac response. The importance of an involvement factor is supported by Lazarus et al. (1963) who found that when a task included a sense of personal involvement heart rate increased even when the subject's attention was externally focused, while when attention was directed externally without a sense of personal involvement, heart rate decreased.

This review of the cardiac literature would give an inaccurate picture if it gave the impression that all the experimental data corresponded with some particular theory of cardiac change. Klorman et al. (1975) divided female subjects into groups of high and low fear with respect to mutilation. Subjects were then presented with slides from three categories: neutral (ie. someone in typical photographic pose), incongruous (eg. bald man with lemon attached to him) and mutilation (ie. burns and accidents). As predicted by Lacey's theory the fearful subjects had cardiac acceleration, while the non-fearful subjects had cardiac deceleration, in response to the mutilation pictures. Both groups exhibited cardiac deceleration to the incongruous stimuli. Surprisingly, they also both showed heart rate increases in response to the neutral pictures. This result is not explicable in terms of any theory reviewed by the present author.

A similar example of seemingly inexplicable experimental findings are those of Uno and Grings (1964) who found cardiac deceleration associated with auditory tones of 60 and 100 decibels, but cardiac acceleration associated with tones of 70, 80, and 90 decibles. Maximal acceleration occurred 4-5 beats after the onset of stimulation, while maximal deceleration occurred 6-7 beats after stimulus onset. Average acceleration was 2.5 beats; average deceleration was 2 beats. No similar findings have been reported.

Electrodermal Activity (EDA)

Before launching into a review of the pertinent EDA literature, it will be useful to clarify some of the terminology used in reporting experiments. In the old literature the terms psychogalvanic reflex (PGR) and galvanic skin response (GSR) are used almost exclusively. Vigoroux (1879) was the first to report electrical variations of the skin. Féré (1888) discovered that if a small current were run between two points on the skin a resistance to that current appeared and that that resistance varied in response to emotional stimuli. This is the classic galvanic skin response; it is usually measured by placing a bridge circuit between the subject and a recording amplifier, thereby making the subject an arm of the bridge while a variable resistor in the other arm is adjusted so as to balance the voltage at some null point, thus allowing resistance fluctuations in the subject to be recorded (Lang, 1971). One should note from this description that the GSR differs from cardiac responses, discussed earlier, in that the cardiac response is generated entirely by the subject, whereas in the case of GSR there are resistance changes generated by the subject in response to an electric current being applied by the experimenter. There does exist a subclass of EDA responses--skin potential responses--which are entirely generated by the subject (largely by sweat gland activity) (Lang, 1971). Because the term GSR came to be

used (incorrectly) to denote almost any sort of EDA, modern writers prefer to use terms which specify exactly what is being measured--electrical skin resistance (ESR) and its reciprocal, electrical skin conductance (ESC). Both of these, in turn, are divided into measures of level--referring to average value of baseline between responses--and measures of response--referring to change of amplitude from base level to peak (Edelberg, 1973). In this review, where possible, the specific terminology will be used. Where the term GSR is used, it was not possible to be more specific about the measure, but in the context of the literature it seemed reasonable to assume that the term was being employed in its original sense, as described by Féré. Often measures of conductance are preferred over those of resistance because they tend to be more normally distributed, and thus more suitable for many parametric tests (Lacey, 1947; Lacey & Siegel, 1949).

The biophysical significance of EDA is yet to be completely explained. Lang (1971) summarizes the following facts regarding possible underlying events. The distribution of sweat glands on the human body and where resistance changes take place overlap to a great degree. He reports correlations ranging from .4 to .9 between the number of active sweat glands and resistance levels. This seems to implicate the sweat glands as the major factor responsible for ESR activity. However, the correlation between sweat and skin resistance is low. Furthermore, skin resistance

changes appear just before sweat can be detected, suggesting that it is the sweat gland activity, rather than the presence of the actual sweat which is important. The fact that atropine, a drug which blocks cholinergic transmission (the mechanism of sweat gland innervation) increases skin resistance supports the importance of sweat gland activity. However, another factor--the permeability of an epidermal layer--has also been shown to be important in affecting ESR.

McCurdy (1950) writes:

> From the earliest period of PGR experimentation it has been asserted that magnitude of galvanometric deflection is intimately associated with the subject's estimate of the intensity of his experience--whether emotionally, affective, conationaly, or otherwise. This clear statement has been beclouded by sundry differences of opinion as to the exact quality of experience usually involved; but so far as the actual evidence goes there has apparently never been an instance in the literature when the central issue has been in doubt.

Although EDA's association with the "intensity" of experience may not have been questioned, the precise nature of the association has been hotly debated.

Raskin (1973) reviewed the general psychological significance ascribed to EDA. The most common position taken is that of Duffy who emphasized the overall level of energy mobilization as a major aspect of emotion and who saw skin conductance levels as indicative of that energy level. Flanagan (1967) cites studies which show a strong relation of GSR to startle, a study showing greater emotional response to be associated with smaller GSR's, and a study showing that adrenalin--secreted in emotional situations--diminishes

GSR, in an attempt to marshal evidence that indicates that GSR is associated with attention and not emotion. He presents evidence from his own work, having subjects rate photographs for their emotional involvement and their attention-getting value and finds support for his contention that attention is the best intervening variable to explain GSR activity. He writes:

> Experienced GSR researchers have repeatedly indicated this conclusion. [that GSR is associated with attention and not emotion!] However, those interested in personality have continued to interpet GSR as an index of emotion of anxiety. One thing GSR cannot indicate is continued strong emotion or anxiety because if adrenalin is involved, the GSR is suppressed!

Johnson and Lubin (1966) found that there was more spontaneous EDA during sleep than when awake. Although caution is urged about generalizing from sleeping to waking states, they conclude that EDA is not an indicator of arousal.

Lazarus and Alfert (1964) found that subjects who were pre-disposed to deny affective disturbance, as judged by the K scale on the MMPI, exhibited high ESC levels of reactivity, in response to films depicting upsetting scenes. Conversely, people who were classified as low deniers, exhibited low ESC levels. Gordon and Glass (1970) classified female subjects as repressers and sensitizers and had them make choices about the color of a pen in two situations--one where their decision was judged as being indicative of their femininity and one where it was not. Their pertinent findings were that when GSR was measured repressers were more active than sensitizers physiologically. Learmonth et al. (1959), using a variety

of Rorschach measures and MMPI scales reported that the increase of palmar potential fluctuations of student nurses during stress is negatively correlated with expressivity. Conversely, the increase of palmar potential fluctuations is positively correlated with restraint and curtailment of unpleasant or prohibited feelings and actions. Raskin et al. (1969) presented varying intensities of white noise to male students and concluded that the magnitude of the positive wave of the skin potential response and its failure to habituate is related to the occurrence of a defensive reflex. Koepke and Pribram (1966) found that the median number of trials for GSR habituation was 5.5 for subjects classified as physiological "stabiles" and 19.0 for those classified as physiological "labiles." If failure to habituate is taken as evidence of a defensive reflex (Sokolov, 1963), then this can be taken as evidence that people who have labile GSR activity are more prone to defensive, as opposed to orienting, reactions.

Carrier and Orton (1964) monitored ESC during complex learning by groups of bright, normal, and retarded children. They found a trend for increasing skin conductance across the sessions for the normal and combined groups and interpret this to mean that ESC will increase as interest and task involvement increases. Kintsch (1965) showed that in a paired-associate learning task GSR's began to habituate after learning was completed. The GSR's were strongest in the intermediate stage of learning. Berlyne (1966) showed that

GSR magnitude with repeated exposure to one or more visual pattern decreases.

In one study which seems to be at variance with those reported until now, a comparison was made of subjects who had the most reactive and least reactive GSR recordings; the results showed that the reactive subjects were dependent, dreamy, idealistic, and suggestible while the non-reactive individuals were cool, evasive, opportunistic, and independent (Block, 1957). Block goes on to discuss GSR lability as an index of anxiety or affect in a given situation. He sees no relationship between directionality of response and GSR. Jones (1950) also classified subjects as having high or low GSR reactivity and then looked for psychological traits they had in common. He described his highly reactive adolescent subjects as less assertive, less animated, less talkative, less attention-seeking, calmer, more deliberate, more good-natured, more cooperative, and more responsible than the low reactors who were more irritable, excitable, and impulsive.

Lader (1967) measured GSR's in five patient groups (anxiety with depression, anxiety, agoraphobia, social phobias, and specific monosymptomatic phobias) and found that those patients with specific phobias had fewer spontaneous fluctuations and habituated more rapidly to auditory stimuli. Assuming that patients with specific phobias have less free-floating anxiety than the others in this study (because it is stimulus bound) this argues for high spontaneous activity and resistance to habituation being considered indicative of

anxiety. Syz and Kinder (1928) found that depressed and catatonic patients had high initial resistance and few GSR responses to a variety of stimuli including words, a car horn, and a pin prick, while paranoid schizophrenics had frequent GSR's, a low initial resistance, a large number of spontaneous fluctuations, and a clear decrease in resistance during the testing session. The pattern obtained for normals was one of low initial resistance, like with paranoid schizophrenics, but with far less change during the experiement. These results suggest that psychopathology is associated with both ends of the GSR reactivity continuum, with adjustment being located in the middle.

Another study suggestive of the notion that adjustment is located between two pathological extremes on a GSR reactivity continuum, compares the conditioning of GSR to electric shock in anxious, chronic schizophrenic, and normal subjects (Howe, 1958). Anxious subjects had a greater response magnitude than the other two groups (no significant difference between the schizophrenic and normal groups was found in this dimension, possibly because of the large error variance in the schizophrenic group), while the chronic schizophrenics were less reactive than the other two groups. It should be noted that if this interpretation of Howe's data is correct, it suggests that different components of EDA (in this case magnitude vs. frequency of response) are correlated with different psychological phenomena. The work of Edelberg and Wright (1964), finding a sweat gland component and an

epidermal component of GSR activity, and the work of Darrow (1964) finding different processes occuring at different levels of arousal, suggest that attaching different significance to the various EDA measures is a legitimate reading of the data. Thayer and Silber (1971) compared schizophrenics who had been taken off phenothiazines for two weeks (not long enough for their systems to be drug free) and normals. If both groups were equated for tonic (ie. long-term) arousal level as measured by skin resistance, no physiological differences between the two emerged. However, they did find that those subjects, regardless of diagnostic category, with high tonic arousal levels evidenced more GSR activity than those with low arousal levels.

In their review of schizophrenic deficits, Lang and Buss (1965) stress that of all the autonomic measures taken, only skin resistance suggests that schizophrenics are underaroused. However, Zahn et al. (1968) found that compared to normals, chronic schizophrenics had higher ESC levels, greater frequency of non-specific GSR's and a slower EDA habituation rate. Bernstein (1970) showed that "confused" psychiatric patients exhibited diminished reactivity to auditory stimulation of low to moderate intensity. Using anxious patients and normal controls, Tan (1964) found that there was a greater decrease in ESR level in the anxious patients than in the controls. However, Katkin and McCubbin (1969) found no relationship between the classification of subjects into high and low groups on the basis of the Taylor Manifest

Anxiety Scale and high and low GSR lability groups. (Fenz and Epstein (1965) have suggested that the Taylor Anxiety Scale confounds two separate anxiety variables--an autonomic and a cognitive one--and suggest that this is a reason why many studies using it fail to find predicted results.) However, they did find that autonomically stabile subjects habituated to low and moderate intensity tones, while labile subjects habituated only to low intensity tones. They interpret this in the light of Sokolov's theory (1963) suggesting that stabile subjects exhibit OR's at both stimulus intensities, while labile subjects exhibit DR's at the higher levels of stimulation.

Van der Valk and Green (1950) reported increased electrical skin resistance in patients with essential hypertension, peripheral vascular disease, ulcers, colitis, and bronchial asthma--all physical diseases with significant psychosomatic components.

Attempting to investigate this problem from a positive rather than a negative perspective, Roessler et al. (1963) investigated the relationship between ego strength, as measured by the Barron ego-strength scale, and skin resistance responses to auditory stimuli. They found "...the high Es [ego strength] group will show the greatest response, the low Es the least response, and the middle Es group an intermediate response. The greatest differences among Es groups will be evident at threshold intensity of stimulation and the least difference at maximum intensity."

Stennett (1957) found that an inverted U relationship existed between palmar conductance and performance level on an auditory tracking task, suggesting that the organism is most open to the environment at moderate ESC levels.

Edelberg (1970) measured EDA recovery rate and found that subjects with a fast recovery rate during a task exhibited slower EDA habituation; he interprets this to be adaptive for goal-directed behavior. Subsequently, he interpreted similar findings to suggest that "enhanced electrodermal activity with retarded recovery may signal a defensive reaction" (Edelberg, 1972). The same study suggested a relationship between recovery time and skin conductance level. However, Crider and Augenbraun (1975) showed that those subjects who exhibited slow habituation of electrodermal responses perceived signals more accurately than those with fast habituation. On the basis of an analysis of the errors, they suggest that this was due to a difference in the response criterion employed by the two groups (with slow habituators being less cautious about reporting an event as a signal) rather than group differences in attention.

Kaplan (1963) measured GSR activity during interaction in a three person female group and found that reactivity increased when what was being said had a negative tone and that, for the two patients in the group, GSR increased as did their participation. He concluded that GSR activity is a measure of defensiveness. However, this result has not been found uniformly. Martin and Edelberg (1963) failed to find

an increase in interest associated with an increase in GSR; they did, however, report that GSR activity decreased as subject's reported irritation increased. Furthermore, they found a trend relating the change in the slope of EDA to interest.

Edelberg (1972) examined EDA in four conditions--resting with the eyes open, cold pressor test, mirror-tracing, and threat of shock. He found that the recovery limb time constant decreased as performance and task complexity increased. EDA recovery time increased with activation except in the case of the cold pressor test. A decrease in the recovery rate followed the threat of shock. He concluded that goal-orientation is the primary determinant of the acceleration of recovery. He hypothesizes that when activation is for defense, an inhibition of the re-absorption process causes a protective flooding of the skin. However, when activation is for manipulative purposes, sweat secretion and re-absorption are balanced, which then manifests itself as an accelerated recovery rate. Orne-Johnson (1973) found that the GSR habituation rate to auditory tones was faster for meditators than for controls. Furthermore, meditators had fewer spontaneous GSR's than did controls. If one accepts the claim that meditators are better able to respond to the present situation than are non-meditators, this supports Edelberg's contention that goal-orientation is of primary importance in determining EDA recovery rate.

Johnson (1963), using helicopter pilots as subjects,

showed that those subjects who had a large amount of spontaneous GSR activity, had increased reactivity to an initial stimulus and adapted less to repetitive stimuli.

Gordon et al. (1959) hypnotized female subjects and instructed them to recall a conflict with their parents. They used three different conditions--a repression situation in which the subjects were told not to think about the conflcit, a suppression condition in which they were told to think about, but not to discuss, the conflict, and a verbalization condition in which they were told to discuss the conflict. Under all conditions skin conductance increased throughout the session; however, the slope of the increase for suppressers was significantly steeper than for those who were allowed to verbalize.

Panek and Martin (1959) found that skin resistance dips were associated with "speech disturbances" (ie. pauses and repetitions) during therapy.

Sternbach and Tursky (1965) compared skin potential responses of housewives from different ethnic groups to electric shock. They relied on Zboroski's characterization of "old Americans" as having a "phlegmatic, matter-of-fact, doctor-helping orientation," Jews as being concerned about what the cause of the pain is and as distrusting palliatives, and Italians as simply desiring relief from the pain. After twenty-nine shocks, they found that Italians had the highest palmar skin potentials, Yankees had the lowest, and Jews and Irish were in the middle. They explain the Yankee's skin

potential adaptation in terms of their matter-of-fact attitude and the Italians' large reaction in view of their significant concern about immediate pain.

In view of the foregoing, there seems to be a solid case for concluding that both heart rate and EDA are intimately involved in the intake or rejection of external stimuli. The next question is how do they interact. Lacey et al. (1963) state that when attending to visual and auditory stimuli, heart rate decreases and ESC increases. However, they point out that skin conductance changes tend to be smaller than differences in heart rate. Darrow's et al.'s (1942) research showed that palmar conductance increases were excitatory in that they were positively associated with alpha blocking and that increases in blood pressure were "homeostatic" (ie. had an inhibitory effect on cortical excitation) since they were negatively correlated with alpha blocking. Lacey and his associates hypothesized that a high heart rate would be inhibitory for sensorimotor impulsivity and that a low heart rate would be facilitory for sensorimotor impulsivity. Using a key-tapping task they found this to be true with the qualification that an ESC increase--which is excitatory--could overcome the inhibitory effect of a high heart rate. However, the reverse is not true; when heart rate is low--which is already an excitatory state--there is no detectable effect with an increase in skin conductance. Both the above hypotheses and results--coming from Lacey's laboratory--are strange at first glance. What he is saying

is that subjects were more likely to respond to irrelevant stimuli, inspite of instructions to the contrary, when their heart rates were low, rather than when they were high. If one reasons that a decelerating pulse is indicative of increased attending, and assumes that increased attention should be associated with a decrease in false responses, one would predict the wrong result. A careful analysis of the data can resolve this apparent dilemma; there are two sorts of errors that can be made--a false response and a failure to respond. Associated with cardiac deceleration is an increase in responding--including incorrect responding. Thus one may qualify Lacey's contention that attending is associated with cardiac deceleration. It is attending in the sense of a generally heightened responsivity to the external environment and not attending in any sort of discriminative sense.

Lacey et al. (1963) present what is some of the most confusing findings in the published literature. They played tape recordings dealing with three different subject areas--aggression to peers, aggression to mothers, and sexual conflict, recording heart rate and ESC. They also had subjects identify line drawings of figures, engaged in some activity relevant to the conflict areas. They only found significant results in the aggression tapes; no satisfactory explanation is offered about why sexual conflict did not yield the predicted results. Furthermore, during the warning period before the aggression to peer tape, the correlation between

heart rate and ESC was .66. Both measures were positively related to tachistoscopic recognition times, contrary to the prediction. However, with the aggression-to-mother tape, the two physiological measures were uncorrelated with each other. ESC had a negative correlation with perceptual threshold, whereas heart rate had a positive, but statistically insignificant correlation. These results are in the predicted direction with decreasing ESC or increasing heart rate indicative of defensiveness. One can speculate about the different stimulus values of the two tapes (eg. perhaps aggression toward mother was much more threatening for these young men than aggression towards peers), but no hard evidence has yet been presented to explain these results.

Lacey (1959) presents a great deal of evidence to make the point that some people respond only in one particular physiological modality. In two studies he reports that with the cold-pressor test 10.6% of the subjects and 11.2% evidenced a cardiac increase with no skin conductance response. At the same time another 14.9% and 10.1% of the subjects had a conductance response with cardiac response. In other words, between 21% and 25% of the subjects only reacted in one sphere. These findings underline the importance of not relying on just one physiological variable in evaluating openness and closedness to the envirnoment.

Summary and Conclusions

The literature reviewed concerning cardiac activity gives substantial support to the idea that cardiac deceleration is associated with increased responsivity to the external environment. This phenomenon is most reliably found in response to psychophysical stimuli such as photic and auditory stimuli. Other factors, most notably vegetative requirements of the organism, definitely determine pulse rate changes, but a strong case can be made--based on physiological differences between amount of cardiac output and pulse rate and mathematical comparison of tasks with differing metabolic requirements--for the contention that an internal vs. external attentiveness factor accounts for an otherwise unexplained part of the variance.

The research reviewed here concerning EDA suggests that an organism which is externally oriented may have a large initial conductance response followed by a reduction in conductance activity as manifested by fewer responses and a decreasing EDA level. Continued EDA activity or failure to habituate is indicative of a defensive reaction.

Evidence was also presented suggesting that because some people respond only in one physiological domain or the other that evidence of these response patterns would be sufficient evidence to suggest environmental orientation. Some studies were cited suggesting that interest level is related to both cardiac and EDA responses.

Evidence was reviewed which suggests that people who tend to deny and/or repress also tend to be more reactive physiologically than those who tend to approach and manipulate stress-producing stimuli. In addition, some examples of empirical findings which appear to be inexplicable as far as any theory reviewed here were given.

No consistent evidence however, was found specifically linking the particular patterns of increasing vs. decreasing activity of heart and skin conductance, which is predicted by the physiological research, and the degree of involvement in interpersonal situations. Some ambiguous findings of Lacey's et al. (1963) are cited dealing with this. Other studies which touched on the problem dealt only with the quantity rather than the directionality of response. In addition, often there was a reliance on just one physiological measure. It is therefore concluded that a study relating directionality of both heart rate and ESC to involvement in interpersonal situations is needed.

CHAPTER III

METHODOLOGY

Physiological Measures

Three measures were used to describe heart rate activity. The first cardiac measure was the mean heart rate during each vignette and during a five minute rest period prior to stimulation. This measure was chosen, while others such as heart rate variability measures were excluded, on the basis of the cluster analysis done by Speisman *et al*. (1961) which showed that the other variables included in their analysis were too highly correlated with mean heart rate for them to add sufficient information to warrant their use. One measure not included in their analysis, however, is the autonomic lability score (Lacey, 1956). This measure attempts to take into account the Law of Intitial Values (Wilder, 1967) by looking at the level which the individual is at before a response is made. Lacey explains his measure in terms of a regression analysis, but Benjamin (1963) has shown that the procedure is similar to an analysis of covariance with the initial level being the covariate. According to this then, a heart beating 80 beats per minute which increases to 87 beats per minute has,

in view of its base level, made a larger response than a heart beating at 65 beats per minute which increases to 72 beats per minute. The formula Lacey gives to compute a lability score is:

$$\text{Autonomic lability score} = 50 + 10\left(\frac{y_z - x_z r_{xy}}{(1 - r_{xy}^2)^{\frac{1}{2}}}\right)$$

where x_z = individual's pre-stimulus level, expressed in standard score units

y_z = individual's stimulus level, expressed in standard score units

r_{xy} = correlation for sample between initial level and stress level.

The correlation for the sample was computed independently for each cell defined by personality group and level of involvement (eg. correlations for involved sensitizers, uninvolved sensitizers, involved repressers). The correlations ranged from .75 to .80; there were no significant differences between the correlations at the .1 alpha level. Therefore, it seemed reasonable to pool the r_{xy}'s in computing the lability scores.

The final cardiac score which was used was the heart rate change score. This was computed by subtracting the mean heart rate level during the last eight seconds of a vignette from the mean cardiac level during the first eight seconds of a vignette.

Four measures were used to evaluate ESC. ESC was recorded in micromhos with the sensitivity set so that one

micromho equals one centimeter. Again, relying on the cluster analysis done by Speisman et al. (1961) two measures were selected so as to maximize the amount of information being taken from this variable. They were the mean skin conductance level for vignettes and for the five minute rest period before stimulation and the standardized standard deviation of the ESC over the same time periods.

There is a debate in the literature about the applicability of Lacey's autonomic lability scores to ESC, since ESC has no counterbalancing parasympathetic component as does heart rate. Hord et al. (1964) have concluded that for the skin conductance response the opposite of the Law of Initial Values seems to hold true. Edelberg (1967) has shown that with a small skin conductance response the change in conductance equals the change in the resistance divided by the resistance level squared. In other words, conductance units automatically adjust for resistance levels. In accordance with the work of Wenger et al. (1961) and Haggard (1949), it was decided to compute the change in log conductance for each vignette. The reason for using the log transformation here was to increase the approximation to the normal distribution. However, as will be shown in the following chapter, the log transformation decreased the approximation to the normal distribution; therefore, simple mean conducatance values, in micromhos, were used.

The final ESC measure, known as the ESC change score, which was used was the difference in number of responses,

or bumps (defined as any deflection of at least one quarter micromho) between the first eight seconds of the stimulus vignette and the last eight seconds of the vignette.

Psychological Measures

Another measure which was taken on a vignette by vignette basis for all subjects was a rating of the subjects' involvement with each stimulus vignette. This involvement rating is based on the work done by Kagan and Millhouse (1975) in which judges rated a subject's involvement with each vignette on a scale of 1 (high involvement) to 5 (low involvement) after listening to a tape recording of an IPR recall procedure. Kagan and Millhouse (1975) state that their scale is based solely on "face validity." In their study they failed to find statistically significant differences on the measures of involvement with the vignettes between pre and post differences for a group which had undergone IPR training and a control group. They had two judges rate each of the vignettes and inter-rater reliabilities ranged from .09 to .79. Thinking of the pre and post series of vignettes as separate scales, they found a Kuder-Richardson reliability coefficient of .75 for the pre-test and .64 for the post test. If one examines the scale, one finds that the criteria for judgment vary in that some require considerable inference on the part of the judge (eg. the category of "unconscious involvement" which is to be inferred by "slips, defense mechanisms, distortions etc.)

while other categories rely more heavily on the subject's own verbalizations (eg. the category of uninhibited involvement where the subject says something such as "I was really scared...angry...frightened...etc.") Using this scale as a basis, those categories of involvement that relied most heavily on inference were excluded. This leaves the scale with four clear categories--uninhibited involvement, inhibited involvement, uninvolvement (called "detached, distancing" on the original scale) and a "cannot be scored" category. The specifiic criteria for each category are given in Appendix A.

The judges used in this study were two female graduate students--one completing her doctorate in counseling at Michigan State University and the other completing her Masters in recreational therapy who had been thoroughly trained in Interpersonal Process Recall. Before rating the experimental data, the judges were trained using tape recordings of recall sessions. An inter-judge reliability coefficient of .87 was obtained on a practice tape immediately after training. The inter-judge reliability coefficient for the tapes acutally used in this study was .80.

Decreasing the amount of subjective judgment required of the raters was intended to increase the reliability of the instrument, but this did not help the problem of having to rely solely on face validity. To deal with this, two validity measures were taken. The logic behind the first validity measure was that sensitizers ought to be involved more

frequently than repressers with the vignettes. Therefore, if the measure of involvement here was a valid one it ought to reflect this. This was tested by using a repeated measures design by groups with involvement as the dependent variable. The results of this test and the analysis of varance table are given in Table 3.1.

Table 3.1 Mean Involvement Ratings and Analysis of Variance

Group	Mean			
Repressers	1.62			
Midlines	1.83			
Sensitizers	2.28			
Source	DF	Sum of Squares	Mean Square	F Ratio
Groups	2	40.84	20.42	30.42*
Subjects x Groups	42	28.20	.67	
Vignettes	11	1.99	.18	.25
Vignettes x Groups	22	2.77	.13	.17
Vignettes x Subjects x Groups	462	335.07	.73	

*sig. at less than .01.

The difference reported for the groups is in the expected direction; this is taken to support the validity of the involvement scale.

(One should also note from this ANOVA table that even using the liberal degrees of freedom one fails to find a vignette effect or a vignette by groups interaction. This has no bearing on the validity of the involvement scale,

but is an important justification for treating the various vignettes as equivalent; the significance of this is discussed below.)

The second validity measure was a correlation between the number of vignettes a subject was rated as being involved with and the score she received on a simple memory test (reproduced in Appendix B) in which she was asked to recall visual details about a vignette (eg. what color blouse was the woman wearing?) after being reminded of the verbal content of that vignette.

The memory test was constructed by administering four items for each of the twelve vignettes to a pilot group of ten people. Two items were chosen per vignette for the final test such that one item had been missed by 10-20% of the pilot group and the other had been missed by 60-70% of the same group.

Contrary to expectations a correlation of -.58 was found between recall of cognitive details and involvement scores. The original thinking here was that people should be able to recall vignettes with which they are involved better than vignettes with which they are not involved. However, a search of the literature on this point not only failed to turn up any evidence to substantiate this line of thinking, but actually suggests the exact opposite. Kleinsmith and Kaplan (1963) report that if GSR is used as the measure of arousal the low arousal group performs better than the high arousal group if recall is tested immediately

after a paired-associate learning task. Walker (1958) found that his low arousal group recalled things better immediately after presentation than did his high arousal group. Easterbrook (1959) concludes, "...emotional arousal acts consistently to reduce the range of cues that an organism uses..." Callaway and Dembo (1958) report that high arousal states such as anxiety, pain, and sexual excitation and chemical agents such as amphetamines and carbon dioxide serve to reduce people's attention. Bahrick (1954) found that when he instructed high and low incentive groups to learn geometric shapes and then tested them on color recognition the high incentive group performed worse than the low incentive group.

On the basis of the above-cited studies and because of the dearth of published material which would support the original hypothesis it seems reasonable to consider the correlation of -.58 between involvement ratings and scores on the memory test as support for the validity of the involvement ratings. It further suggests that involvement, as tapped by the involvement scale, is correlated with emotional arousal.

The final psychological measure which was used in this study was Byrne's Revised Repression-Sensitization Scale (R-S Scale) (Byrne, et al., 1963). As previously mentioned Byrne conceptualized defensive behaviors along a continuum which at one extreme avoided anxiety-producing stimuli and at the other extreme approached the stimuli in an attempt to

control and manipulate them. From this theoretical vantage point he proceeded to develop a questionnaire to differentiate people who characteristically defend against anxiety in these two ways (Byrne, 1963). He based his scale on previous work done by Altrocchi et al. (1960) where a sensitization score based on the depression, psychasthenia, and Welsh anxiety MMPI sub-scales is computed, a repression score based on the L and K validity scales and the Hysteria denial sub-scale of the MMPI is computed and then computed a final index by subtracting the total score based on the last group of the scales from the total score based on the first group of scales. Because of sub-scale overlap, individual items sometimes received double or conflicting weights so Byrne (1961) revised the scale so as to eliminate these inconsistencies and disproportionate weightings. He further refined his Repression-Sensitization scale by eliminating all individual items which failed to yield correlations with the total R-S scale significant at at least the .001 level in two independent samples (Byrne, Barry & Nelson, 1963).

Byrne (1964) reviews a variety of different types of evidence in an attempt to establish construct validity for his instrument. The first set of evidence he marshals in support of his instrument is the high correlation between clinician's judgments and the R-S scale. When clinicians were asked to fill out a questionnaire as they believed a represser would, there was a 90% overlap between their

judgments and the R-S scale. In a second area--selective forgetting--he cites the work of Gossett to show that repressers fail to remember threatening material as well as sensitizers. A third area he finds support for the construct validity of the R-S Scale is the area of perceptual defense. An example of such a study is the work of Tempone who found repressers had a higher recognition threshold for threat words originally encountered in a failure experience (the failure being the inability to solve an anagram) than did sensitizers. Cohen (1967) replicated this finding. A fourth supporting area is the individual's subjective awareness of anxiety. Here the work of Pomeranz is cited showing that in response to movies sensitizers indicated more emotional arousal than repressers. Merbaum and Kazaoka (1967) found, as expected, that sensitizers were quicker to admit negative affect than were repressers. Byrne and Scheffield (1965) found that sensitizers were more anxious than repressers when they were being read sexual material; they found no difference in anxiety levels when subjects were exposed to neutral stimuli. Feder (1968) found that repressers report a smaller discrepancy between their ideal selves and real selves than do sensitizers. A fifth area mentioned by Byrne as corroborating the validity of the R-S scale concerns the appreciation of humor. According to Freudian theory, normals (ie. those with intermediate scores on the R-S scale) should have the highest appreciation of humor, sensitizers should be next, and repressers should

have the least appreciation. He reports that when subjects were divided into groups according to degree of appreciation of humor, the low appreciation group was the most repressing. A sixth category mentioned by Byrne--and the one that is most releveant to this thesis--is the area of physiological response to threat. Davison (1963) showed a subincision film to male subjects while their heart rates and ESC were being recorded. He found that sensitizers were the least responsive to the film, the group that was in the intermediate range on the R-S scale was most responsive physiologically, and the repressers exhibited an intermediate range of physiological responsivity. Simal and Herr (1970) reviewing the previous physiological literature in relation to the Byrne scale writes:

> Physiological studies seem to agree that repressers show more physiological arousal to stress or anxiety-producing situations than do sensitizers. This phenomenon was initially observed by Davison (1963) and later confirmed by Lazarus and Alfert (1964). These studies suggest that a repression-sensitization dimension such as is defined by Byrne's scale does in fact exist.

However, it should be noted that using sexually arousing pictures, Simal and Herr failed to find GSR differences between repressers and sensitizers. (This is reminiscent of Lacey's previously mentioned failure to find expected differences with sexually arousing stimuli, although Lacey did find differences with aggressive stimuli; this suggests that there may be something about sexually arousing stimuli which uniquely alters EDA and cardiac activity.)

In spite of the substantial support much of the

literature seems to give to the construct validity of the R-S scale, it would be inaccurate to give the impression that this support is universal. Wiener et al. (1956) using judges' ratings, failed to find any support for the notion that there is some consistency to individual's defensive behavior in terms of an approach/avoidance continuum. More damaging to the R-S scale is Hoffman's (1970) study, failing to find support for the hypothesis that as stress increases repressers will increase avoidance and senstizers will increase vigilance. Lefcourt (1966) made the observation that the strongest evidence supporting the validity of the R-S scale comes from self-report measures lacking in behavioral correlates. In an attempt specifically designed to find a behavioral correlate Thelen (1969) compared the R-S scores of students seeking psychotherapy with those who were not. The findings indicate that "therapy-seekers" were more likely to be sensitizers than repressers. Furthermore, males who remained in therapy more than four sessions were more likely to be sensitizers. Thelen concludes, "As evidenced by the behavior of seeking therapy, this study suggests that the R-S scale does have the behavioral referrants, such as avoidance and sensitization, which have been questioned by Lefcourt."

Another attack on the validity of the R-S scale comes from studies claiming that the R-S scale measures anxiety because of the high inter-correlation between scores on the Taylor Manifest Anxiety Scale and the R-S scale. Golin et al.

(1967) concluded the results of the two tests were practically interchangeable, with scores being determined by two factors--emotionality and defensiveness. There is, however, evidence to suggest that this high correlation is not due to a mis-labelling of the R-S scale. Kaplan (1966), writing about a study which used the Taylor Manifest Anxiety scale in order to classify subjects, says:

> Despite their low scores on the anxiety scales, the low anxiety subjects in this study did not appear to be individuals who are free from the threat of experiencing significant amounts of anxiety (also Truax, 1957). Rather, on the whole, they appear to be individuals who attempt to ward off the threat of anxiety and other distressing affects by heavy reliance on the defenses of repression and/or denial. The high anxiety subjects, on the other hand, appeared to be individuals who deal with anxiety by thinking and talking about it. That is, their style of defense permits conscious awareness of anxiety-arousing ideas (also Spielberger, DeNike, and Stein, 1965).

Dublin (1968) has suggested that sensitization may be a "measure of defensive failure resulting in a response characterized by lack of ego adaptiveness which takes the form of anxiety...and which has concomitant observable behaviors indicating ineptness, hesitancy and indecisiveness" because when put in an ambiguous situation sensitizers, as compared with repressors, were "taken aback." However, this interpretation is clearly not consistent with the data provided by Petzel and Gynther (1968) who found that repressers solved fewer anagrams when they received "ego-oriented" instructions than when they received task-oriented instructions, while sensitizers exhibited the opposite pattern. They concluded, "Sensitizers...characteristically 'face up to' even

small stresses of everyday life and thus may be more likely than repressers to deal effectively with the more severely stressful situation."

It will be remembered from the earlier theoretical discussion that Byrne considers there to be a curvilinear relationship between his scale and psychological adjustment. Some of the above validity studies are indicative of that in that depending upon the group or behavior being studied, varying negative characteristics are found at either end of the continuum.

Evidence against the curvilinear hypothesis, and in favor of a linear relationship between psychological adjustment and repression-sensitization (indicating that repressers are the healthier people) is found in the work of Byrne et al. (1968) (surprisingly!) who found that students who were sensitizers had a greater frequency and severity of physical illness as measured by a health survey. In addition, male sensitizers made more frequent visits to the health center than male repressers. Along the same lines, Feder (1967) compared psychiatric patients with medical-surgical patients and found a higher frequency of sensitizers in the maladjusted population and a higher frequency of repressers in the normal population. Tempone and Lambi (1967) confirm this observation in a separate study finding more repressers in their "adjusted" (non-patient) group and more sensitizers in the "maladjusted" (psychiatric patient) group.

In support of the curvilinear relationship Byrne cites

the work done by Ullmann, using his Facilitation-Inhibition Scale. (Byrne [1964] considers the Facilitation-Inhibition scale to be virtually "interchangeable" with his R-S scale, citing correlations of .76 and .88 between the two scales in student populations and a correlation of .94 in a neuro-psychiatric population. Furthermore, he points out that approximately half the items on the F-I scale are included in the revised R-S scale.) Ullmann (1962) compared male neuropsychiatric VA patients' F-I scores with those of male students. Presumably there should be a higher incidence of pathologic defense in the patient population than in the student population. As expected the patient population had a significantly higher standard deviation than the students. (Student standard deviation = 6.50 compared with patient standard deviations of 11.22 and 11.44.)

Other evidence mustered to support the curvilinear relationship between adjustment and R-S scores can be found in comparing a number of studies. Byrne (1964) discusses Megargee and Mendelsohn's cross-validating an MMPI scale designed to discriminate "extremely assaultive offenders from other criminals and from normals" with the R-S scale. They found that "extreme repressers are seen to fit into the pattern of chronic overcontrol which includes rigidity, conventionality, moralistic views, and (at least in the criminal group) a greater probability of psychosis." On the other side of the continuum Byrne (1964) cites the work of Ullmann and McReynolds, reporting a significant correlation

of -.50 between F-I scores and anxiety ratings in psychiatric patients, Joy's and Endler's work correlating MMPI scales and R-S scale scores suggesting that in comparison with repressers, sensitizers tend to be depressed, anxious, introverted, discouraged, and tend to respond to the test as would members of the opposite sex, and Byrne, Golightly and Sheffield's correlation between the California Psychological Inventory and the R-S scale which indicated that sensitizers were less well adjusted than repressers. Looking over this sample of studies one can see that severe maladjustment is associated with both extremes, with repressers having a higher likelihood of acting out aggressively and sensitizers being more prone to anxiety, depression, and neuroticism. This argues for psychological adjustment to be found in the middle of the R-S continuum.

Merbaum and Badia (1967) found partial support for the interpretation that maladjustment is equally associated with the two extremes of the R-S scale. They exposed male and female subjects to varying intensities of shock and measured their approach or avoidance of the stimulus. They found a curvilinear trend for their female subjects in which those who scored in the middle two quartiles on the R-S distribution withstood higher shock intensities than those at the two extreme quartiles. They concluded, "If, however, one interprets low-shock tolerance within an adjustment frame of reference, Byrne's (1964) proposition...could be held tenable at least for female subjects."

Due to the far greater number of studies which find greater amounts of psychopathology at the sensitizing end of the continuum than at the repressing end, Byrne (1964) reluctantly concludes that greater psychopathology is found at the sensitizing end of the scale. However, the present author does not believe that this necessarily reflects a serious flaw in the theoretical base for the R-S scale. First, there is the possibility that the pathological consequences of repression are most clearly seen in extreme groups such as the aggressive convicts in the Megargee and Mendelsohn study (most other studies used less extreme populations such as groups of students). More important, however, is the fact that the plethora of studies cited finding repressers to be healthier than sensitizers relies on self-report measures to determine psychological adjustment. By the very "nature of the beast" one would expect sensitizers to admit with much greater frequency than repressers, items which would detract from one's adjustment rating. Therefore, though the quantity of research clearly suggests a linear relationship between adjustment and R-S scores, the evidence is not compelling.

Stimulus Films

The procedure of using films to stimulate physiological reactions is widely used in the past research (eg. Lazarus & Alfert, 1964 and Davison, 1963). Typically these films are pictures taken of some particular event such as

sub-incision rites or motor vehicle accidents which the experimenter believes will be anxiety-producing for the subjects. Kagan and Schauble (1969), however, describe the production of a somewhat different sort of filmed stimulus:

> In order to create the simulated emotional situations with which to confront the clients, professional actors were trained to portray the four basic types of affect with varying degrees of intensity, but to avoid use of words which indicate a specific situation or 'story.' Each actor was instructed to direct the emotion (rejection, affection, hostility, etc.) at an imaginary individual directly behind the camera lens so that the viewer would see the resultant image as if the actor were talking directly to him.

Thus, because of their deliberate vagueness and because they treat the viewer as a participant, they require the subject to participate actively in imagining him/herself in the situation.

These films have been used as stimuli in one study done by Kagan and Millhouse (1975), a study done by Smith (1975), and in a series of pilot studies done by the present author.

Sample

Subjects for this study were drawn from the female students taking the Interpersonal Process Recall (IPR) classes (Ed. 484) during the Winter Term, 1976 at Michigan State University. Members of the class ranged in age from 18 to 35 with the modal ages being 20 and 21. Because of the various degree requirements, the class was largely made up of pre-teaching and pre-nursing students and others

preparing to enter a variety of "helping professions" such as social work, counseling, and music and recreational therapy.

All members of the classes were required to take Byrne's Repression-Sensitization Scale. The distribution for the female class members on the Byrne R-S scale conformed very closely to the one reported by Byrne et al. (1963), having a mean of 46.32 and a standard deviation of 21.47. Keeping within the limits used by Byrne all individuals scoring 69 or above were designated as sensitizers; those scoring between 42 and 52 were considered midlines, and those scoring 22 or below were designated as repressers. Only those persons whose scores fell into one of these three grouping were retained as subjects; all the data from the other students were discarded.

One hundred three students from five classes went through the entire experimental procedure. Five were eliminated as possible experimental subjects because they were taking medication known possibly to affect heart rate. One was eliminated because of poor mechanical recording and one was eliminated because she was pregnant. One was eliminated because she became so emotionally upset watching the first two vignettes that the experimenter decided it was not in her best interests to continue. This left ninety-five potential subjects. Forty-five (fifteen per personality sub-group) were selected because they met the criteria for inclusion in one of Byrne's sub-groups and allowed the groups

to be of equal sizes.

Procedure

During their regularly scheduled IPR classes the procedure of the experiment was explained. It was pointed out that the personality test and physiological feedback might be useful to individuals seeking to know themselves better. All questions concerning the purpose of the experiment were deferred until after all the data had been gathered; a group discussion about the experiment was scheduled for the end of the term. It was also pointed out that though going through the procedure was mandatory to get credit for the class, inclusion of any data in the experimental analysis was optional. If anyone had any objection to being included, they were instructed to inform the experimenter after their experimental session and their data would not be included; no one exercised this option.

During the preparatory session a schedule was passed around for class members to sign-up for one two-hour block during the next six weeks. Because progesterone changes occuring during the luteal phase of the menstrual cycle are known to decrease electrical skin activity (Mackinnon and Harrison, 1961) the women were asked to sign-up between five and ten days after the end of their menstrual period.

For convenience in attaching the electrodes the students were asked to wear a short-sleeve or sleeveless blouse and not to wear panty hose, tights, or stockings.

At the end of the preparatory session all the students were asked to fill out a Byrne R-S questionnaire. The purpose of the questionnaire was left ambiguous, but a complete interpretation was promised later in the term.

When the subject arrived she was asked to wash her hands thoroughly with Ivory soap and water. While she was washing her hands the experimenter made sure that only two fluorescent lights were on in the experimental room and that the temperature was between 72° and 74° F. When the subject returned to the room she was asked to fill out a background information sheet (Appendix C). Next, two disposable silver/silver chloride electrodes (manufactured by American Hospital Supply, No. 65375-030) were attached to the outer surface of either arm, approximately four inches below the shoulder, after the area was rubbed by a swab of dry cotton. The electrodes were connected to an EKG tachograph, Grass Model 7P4D. The electrical signal was amplified by a Grass Model 7DAE DE amplifier and recorded by one pen on a four-channel Grass, Model 7WC8PA strip chart recorder at a speed of 100 mm per second.

After the cardiac electrodes were attached two more disposable silver/silver chloride electrodes were attached, one to the hypothenar eminence of the left hand after it was rubbed lightly with a dry cotton swab, and the other to the volar surface of the left forearm, after it was rubbed vigorously with a dry cotton swab. The electrodes were then connected to a Hagfors bridge (a constant voltage bridge)

which in turn was connected to a Grass, Model 7P1b, low level DC pre-amplifier. Finally, the signal was amplified by a Grass DC amplifier, Model 7DAE, and recorded on one channel of a four channel Grass strip chart recorder, Model 7WC8PA, at a paper speed of 100 mm.

In addition to these two sets of electrodes one 3/8 inch, silver/silver chloride electrode was attached, using Unibase paste (produced by Parke-Davis) mixed with 50% by volume with Normal saline, to the left leg of the subject after the leg was rubbed with alcohol and connected to a ground.

As each electrode was attached to the subject, its purpose was explained. It was explained to the subject that after the recorder was calibrated, a record of her base resting level would be made. Therefore, she was instructed to relax with her eyes open for the next several minutes and to acclimate herself to the surroundings. Before the start of the rest period the subject was told over an office intercom system: "You will now have five minutes to relax. After that the films will appear on the screen in front of you. Make an attempt to imagine yourself alone with the person on the screen. If it helps to fantasize a specific situation in which to place that person go ahead and do so. But above all, do your best to react to that person as if he or she were speaking to you personally." The vignettes were then played with variable lengths of blank leader between the filmed segments. (The typescript is included

in Appendix D). The start and finish of each vignette and of the rest period was marked on the physiological record by the experimenter. The projector which was used was a 16mm Bell and Howell Autoload. It was located in the instrumentation room and projected on a translucent screen approximately four feet in front of the subject. The vignettes depicted hostility, manipulation, sexual advance, rejection, and acceptance. As the films were being shown the subject was video-recorded on one-half inch Ampex equipment, so that the recording was a record of the film sound track, any verbalizations the subject made, and the face of the subject. (Exact procedures for running the polygraph may be found in Appendix E.)

After the subject viewed all the vignettes the electrodes were removed and she was given a chance to clean up. She was then read a questionnaire asking specific questions about cognitive details of the films. After this the videotape of the subject watching the vignettes was played for her. She was encouraged to stop the tape and verbalize what she recalled experiencing, according to the recall process as described by Kagan et al. (1969). In the final stage of the session, she was shown her printout of her physiological responses and they were discussed with her in view of her reported experience.

Design

This study is a predictive piece of research in that the essential question being asked is does knowledge of a subject's physiological pattern and the subject's classification on the Byrne R-S Scale, enable one to predict involvement or non-involvement with the vignettes? The design, diagrammed in Figure 3.1, is a group by vignette by subject by measure design.

	Baseline			V_1							$V_2 \cdot \cdot \cdot V_{12}$
	M_1	M_2	M_3	M_1	M_2	M_3	M_4	M_5	M_6	M_7	
Group 1 (Repressers)	S_1										
	.										
	S_{15}										
Group 2 (Midlines)	S_{16}										
	.										
	S_{30}										
Group 3 (Sensitizers)	S_{31}										
	.										
	S_{45}										

Where: S = Subject
V = Vignette
M_1 = Mean heart rate
M_2 = Mean Electrical skin conductance
M_3 = Standardized electrical skin conductance standard deviation
M_4 = autonomic lability score
M_5 = cardiac change score
M_6 = electrical skin conductance change score
M_7 = Judges' rating as to involvement

Figure 3.1 Design Diagram for MANOVA

It should be noted that the judges' involvement rating (M_7) is dependent on the subject's response and as such cannot be controlled by the experimenter. Therefore, in order to make an analysis possible with this measure two vignettes were chosen from each category--involved and uninvolved. The number two was chosen so as to allow the analysis to retain as much data as possible per subject while maximizing the number of subjects retained in the analysis. The statistical justification for treating the vignettes as equivalent is that no difference in involvement for any of the vignettes were found; neither was there a vignette by personality group interaction (see Table 3.1).

Experimental Hypotheses

I. The groups of sensitizers (G_1), Repressers (G_3) and midlines (G_2) will differ in cardiac and ESC activity during the base period.

A. Mean heart rates for the groups will not be the same.

B. Mean ESC levels for the groups will not be the same.

C. Mean standardized ESC standard deviations for the groups will not be the same.

II. The groups of sensitizers (G_1), repressers (G_3) and midlines (G_2) will differ in cardiac and ESC activity while viewing the film.

A. Mean heart rates for the three groups will not be

the same.

B. Mean autonomic lability scores for the three groups will not be the same.

C. Mean cardiac change scores for the three groups will not be the same.

D. Mean ESC levels for the three groups will not be the same.

E. ESC standardized standard deviations for the three groups will not be the same.

F. Mean ESC change scores for the three groups will not be the same.

III. The physiological variables will differ on those vignettes with which the subject is rated as being involved from those vignettes on which the subject is rated as being uninvolved.

A. Mean heart rates for involved and uninvolved vignettes will not be the same.

B. Mean autonomic lability scores for involved and uninvolved vignettes will not be the same.

C. Mean cardiac change scores for involved and uninvolved vignettes will not be the same.

D. Mean ESC levels for involved and uninvolved vignettes will not be the same.

E. ESC standardized standard deviations for involved and uninvolved vignettes will not be the same.

F. Mean ESC change scores for the involved and uninvolved vignettes will not be the same.

IV. There will be an interaction between personality types and involvement ratings.

A. Repressers will have their highest scores on all physiological variables when they are uninvolved with vignettes. Their lowest physiological scores will be when they are involved with vignettes. Sensitizers will have their highest scores on all physiological variables when they are involved with the vignettes; their lowest physiological scores will be when they are uninvolved with the vignettes.

V. Physiological pattern, as defined by cardiac and ESC change scores, and the Byrne Scale will together predict a subject's involvement with the vignettes.

A. Subjects with high R-S scores and high cardiac and ESC change scores should receive higher involvement ratings. Subjects with low R-S scores and low cardiac and ESC change scores will receive lower involvement ratings.

Analysis

The four moments about the mean were initially computed in order to determine the applicability of parametric test statistics.

Hypotheses I, II, III, IV were tested using a multivariate F test. When significant differences were found univariate and step down F tests were also performed. In addition, when significant differences were found in the groups effect Tukey post-hoc comparisons were carried out.

The repeated measure design employed allows for testing a group's effect, an involvement-non-involvement effect, and a groups by involvement interaction.

Hypothesis V was tested with a step-wise multiple regression analysis using the model:

$$y = B_0 + B_1X_1 + B_2X_2 + B_3X_3$$

where y = level of involvement
X_1 = R-S score
X_2 = ESC change score
X_3 = cardiac change score

It should be noted that the data on which this last analysis is based are different from the data used in testing the first four hypothesis. Here, instead of using two involved and two non-involved vignettes for each subject (which would result in an equal involvement level for everyone) six vignettes for which the physiological records were clear for all subjects were chosen and the involvement and physiological variables were averaged across the six vignettes. Thus, this analysis relies on scores for each subject, as opposed to scores for each vignette.

Summary

Forty-five female students from Interpersonal Process Recall classes were chosen as subjects on the basis of their scores on the Byrne Repression-Sensitization (R-S) Scale. They were videotaped and had their heart rates and electrical skin conductance levels recorded as they watched twelve vignettes geared to provoke some emotional reaction. The videotape of them watching the

films was then played back for them and they were encouraged to describe their recollection of what they were experiencing as they watched the tape. This was in turn tape-recorded and the tape was rated by two judges. A multivariate repeated measures design was used to test for a group effect, during the baseline, a group effect while watching the films, an involvement effect while watching the films and a group by involvement interaction. In addition, a multiple regression was used to predict level of involvement on the basis of the R-S Scale score, change in heart rate, and change in skin conductance. The rationales for the validities of the Byrne Scale and the involvement scale were also discussed.

CHAPTER IV

ANALYSIS

In this chapter the results of the study with the appropriate statistical analyses are presented. The general outline is to present first the descriptive statistics which were used to summarize the data and to determine whether parametric or non-parametric tests would be most appropriate. Next the results of the repeated measures multivariate analysis of variance are presented, followed where appropriate, by the results of post-hoc Tukey comparisons. Lastly, a regression analysis is presented in which involvement levels are predicted from personality test scores and electrical skin conductance change scores.

Table 4.1 lists the means, the variances, the skewnesses, and the kurtoses of all the physiological variables. Means and variances were calculated according to standard formulas. Skewnesses and kurtoses were calculated such that a normal distribution would have a score of zero.

It will be noted that the only variables which seriously depart from a normal distribution are the log transformations of the electrical skin conductance levels. Since the only purpose of carrying out the log transformations was to

Table 4.1 Descriptive Statistics for Physiological Variables

Variable	Mean	Variance	Skewness	Kurtosis
Base Mean Heart Rate	86.556	72.071	.420	-.036
Base Mean Skin Conductance	20.418	67.651	.027	-.217
Base Log Mean Skin Conductance	1.262	.056	-1.682	3.661
Base ESC Standard Deviation	12.531	60.024	.621	-.262
Involved Mean Heart Rate	88.356	92.109	-.270	.544
Involved Mean Skin Conductance	21.568	54.533	-.294	-.180
Involved Log Mean Skin Conductance	1.293	.043	-2.086	6.108
Involved ESC Standard Deviation	11.531	57.993	.534	-.566
Involved Heart Rate Lability	51.167	43.943	.116	.002
Involved Heart Rate Change	2.289	15.221	-.736	.313
Involved ESC Change	.244	1.393	.051	-.440
Uninvolved Mean Heart Rate	90.822	137.240	1.018	.342
Uninvolved Mean Skin Conductance	19.046	38.432	-.135	.872
Uninvolved Log Mean Skin Conductance	1.238	.035	-1.764	4.114
Uninvolved ESC Standard Deviation	11.162	41.423	.610	.004
Uninvolved Heart Rate Lability	49.032	65.223	.074	.127
Uninvolved Heart Change	3.333	19.614	-.510	.017
Uninvolved ESC Change	-.111	1.385	.344	.016

increase the approximation to the normal distribution a decision was made to replace the log transformations with the original skin conductance levels. Making this substitution, it is then clear that nowhere is the assumption of normality too badly violated and therefore a parametric statistical analysis is appropriate.

A multivariate analysis of variance is carried out next. Four questions are asked: 1) is there a difference between groups on base levels of the physiological variables, 2) is there a groups effect during stimulation on the physiological variables, 3) is there an involvement effect during stimulation on the physiological variables, and 4) is there a group by involvement interaction? The individual cell values are presented in Table 4.2. The MANOVA tables are presented in Tables 4.3, 4.4, 4.5 and 4.6. When appropriate univariate add step down F ratios are included, along with Tukey post-hoc comparisons.

Because the four hypotheses mentioned above are being tested, in order to keep the overall probability of making a Type I error at or below .05 it is necessary to set individual critical values at .0125. Furthermore, the overall alpha level for a given hypothesis (.0125) must be divided by the number of variables that contribute to the mean vector (three in the first case--mean heart rate, mean skin conductance and standardized standard deviation-- and six in the others--mean heart rate, mean skin conductance, ESC standardized standard deviation, heart rate lability, heart rate

Table 4.2 Individual Cell Values

Variable	Total	Repressers	Midlines	Sensitizers
BHR	86.5556	88.333	86.0667	85.2667
BMSC	20.4178	25.0067	17.4133	18.8333
STBES	.0004	.8700	-.2513	-.6173
IMHR	88.3556	89.3333	86.7333	89.0000
UMHR	90.8222	92.8333	89.3667	90.2667
IMSC	21.5678	26.1800	20.3600	18.1633
UMSC	19.0456	21.9667	18.4800	16.6900
ISTSC	-.0000	.8467	-.3360	-.5107
USTSC	.0004	.8313	-.5693	-.2607
IHRL	49.999	56.4826	48.3429	45.1736
UHRL	50.0644	52.879	48.2309	49.0832
IHRC	2.2889	1.2333	2.6000	3.0333
UHRC	3.3333	3.7333	2.4333	3.8333
IESCC	.2444	.8333	-.1000	0
UESCC	-.1111	-.5667	.1000	.1333

Key: BHR = Base Heart Rate, BMSC = Base Mean Skin Conductance, STBES = standardized base electrical skin conductance standard deviation, IMHR = involved mean heart rate, UMHR = uninvolved mean heart rate, IMSC = involved mean skin conductance, UMHR = uninvolved mean skin conductance, ISTSC = involved standardized skin conductance standard deviation, USTSC = uninvolved standardized skin conductance standard deviation, IHRL = involved heart rate lability, UHRL = uninvolved heart rate lability, IHRC = involved heart rate change, UMHRC = uninvolved heart rate change, IESCC = involved electrical skin conductance change, UESCC = uninvolved electrical skin conductance change

lability, heart rate change and ESC change scores) leaving a critical value of .0041 or .0021. Finally, the reader is cautioned in interpreting step down F ratios, that these ratios provide residual tests of significance so that when statistical significance is reached in the case of one variable one may not validly continue to test successive variables. The reader is also cautioned that Tukey post-hoc comparisons were performed at the .05 level of significance, considerably above the overall alpha level described above. They are included here as a data-snooping technique to suggest hypotheses for future research and are not intended as formal tests of these hypotheses.

Hypothesis 1: Repressers, midlines, and sensitizers differ on physiological measures mean heart rate, mean skin conductance level, and standardized electrical skin conductance standard deviations during the base period.

Table 4.3 Multivariate and Univariate F Tests H_0:1

F Ratio for Multivariate Test = 5.3537 D.F. = 6, 80
P less than .0002

Variable	Hypothesis Mean Square	Univariate F	P less than	Step Down F	P less than
Bas HR	37.9556	.5150	.6013	.5150	.6013
Base ESC	244.4629	4.1272	.0231	3.6380	.0352
Standardized Standard Dev.	9.0088	14.5475	.0001	12.6551	.0001

Tukey (.05 level) Standardized Standard Deviations	Sensitizers	Midlines
	-.6173	-.2513
	Repressers	
	.8700	

The results in Table 4.3 indicate that personality groups do differ in their physiological base rates. Both the univariate and step down F ratios indicate that the standardized base ESC is a specific physiological variable which differentiates between groups. The Tukey comparison suggests that repressers have a higher ESC standardized standard deviation than sensitizers or midlines.

Hypothesis 2: Repressers, midlines, and sensitizers differ on physiological measures mean heart rate, mean skin conductance, standardized electrical skin conductance standard deviation, heart rate lability, heart rate change, and electrical skin conductance change during stimulation.

Table 4.4 Multivariate and Univariate F Tests H_0:2

F Ratio for Multivariate Test = 3.8515 D.F. = 12, 74
P less than .0002

Variable	Hypothesis Mean Square	Univariate F	P less than	Step Down F	P less than
Mean HR	138.1056	.3395	.7141	.3395	.7141
Mean ESC	698.0507	4.9063	.0122	4.6270	.0155
ESC Stand. Standard Deviation	31.7270	12.9838	.0001	11.6389	.0002
HR Lability	270.7167	2.0047	.1346	1.3181	.2791
HR Change	17.4389	.6509	.5268	4.1761	.0230
ESC Change	.2667	.1080	.8979	.5277	.5944

Tukey .05 level	Midlines	Sensitizers
ESC Standardized Standard Deviation	-.452	-.385

Repressers
1.6780

The multivariate F ratio given here indicates that personality groups did differ while watching the films. Both the univatiate and step down F's indicate that standardized electrical skin conductance is a particular variable which registered this difference. The Tukey intervals suggest that repressers have a higher standardized standard deviation than the other two groups.

Hypothesis 3: There are differences on the physiological variables mean heart rate, mean skin conductance, standardized electrical skin conductance standard devitaion, heart rate lability, heart rate change, and electrical skin conductance change between those vignettes with which the subjects were rated as being involved and those vignettes with which the subject was rated as being uninvolved.

Table 4.5 Multivariate and Univariate F Tests H_0:3
F ratio for Multivariate Test = 3.3683 D.F. = 6, 37
P less than .0095

Variable	Hypothesis Mean Square	Univariate F	P less than	Step Down F	P less than
Mean HR	273.8000	4.1333	.0484	4.1333	.0484
Mean ESC	286.2722	16.1707	.0003	11.1645	.0018
Stand. ESC Standard Deviation	.0000	.0000	.9947	.2607	.6125
HR Lability	14.4500	.1502	.7003	2.8771	.0979
HR Change	49.0889	1.1140	.2973	.1361	.7143
ESC Change	5.6889	2.0645	.1582	.7421	.3946

The F ratio in Table 4.5 indicates that there is a significant difference between involved and uninvolved vignettes. The step down and univariate F's indicate that mean skin conductance is particularly sensitive to this difference. It is unnecessary to perform Tukey post-hoc comparisions because there are only two groups--involved and uninvolved--being compared here. The actual cell values for the one significant variable--mean skin conductance, are involved mean skin conductance = 21.5678 micromhos and uninvolved mean skin conductance = 19.0456 micromhos.

Hypothesis 4: There is no significant interaction between involvement ratings and personality types.

Table 4.6 Multivariate Test H_0:4
F Ratio for Multivariate Test = 1.9631 D.F. = 12.74
P less than .0401
(No further statisitcs are given for this hypothesis because the null hypothesis is not rejected.)

Judging by the F ratio in Table 4.6 the null hypothesis cannot be rejected; therefore, one cannot conclude that there is a significant interaction between personality groups and involvement.

Next, the question "does a knowledge of a subject's R-S score, cardiac change score, and ESC change score allow a predicition to be made regarding the subject's involvement with the vignettes" is asked. Table 4.7 contains the cell values computed from the six vignettes used for the regression analysis.

Table 4.7 Cell Values Used for Testing H_0:5

	Repressers	Midlines	Sensitizers
Involvement Rating	.3467	.5780	.6593
Heart Rate Change	2.1000	1.9733	2.0867
ESC Change	1.6400	1.7800	1.6400

Hypothesis 5: The cardiac and ESC change scores and the R-S scores will predict a subject's level of involvement.

Table 4.8 Multiple Regression Analysis

Variable	F Ratio	Signifi-cance	Multiple R	R^2	R^2 Change	Simple R
RS	12.630	.001	.476	.227	.227	.476
ESCC	8.185	.007	.594	.353	.126	.380
HRC	.865	.358	.605	.366	.013	.173

From this analysis one may set up the following regression equation, using RS scores and ESC change scores to predict involvement level:

$$y = .2408 + .0045\ (RS) + .0293\ (ESCC)$$

where y = involvement level, RS = Byrne Scale score, ESCC = electrical skin conductance change score

Table 4.9 95% Confidence Intervals for Beta Weights

Constant	.0964	$< \beta <$	.3852
RS	.0020	$< \beta <$	.0070
ESCC	.0072	$< \beta <$	.0513

If one treats R^2 as an indicator of the percentage of the variance accounted for by a variable, one will note that by itself R-S scores account for over 22% of the involvement variance; taken together with ESCC the two variables account for over 35% of the involvement variance. HRC is dropped because it does not appreciably add to the prediction of involvement.

If one examines the individual ESCC values for the different personality groups (Table 4.2) one notes that there is a much bigger difference between the involved and uninvolved scores for repressers than for the other two groups. Because of this observation, it was decided to compute the regression for the various sub-groups, although this was not originally planned. Because HRC did not contribute significantly to the predicition of involvement and the values in Table 4.2 gave no reason to think that HRC varied across R-S groups, it was dropped from the computation.

Table 4.10 Simple Regression of Involvement on ESCC by Group

Group	F Ratio	Significance	R	R^2	Beta
Repressers	41.206	.000	.872	.760	.0849
Midlines	.927	.353	.258	.066	.0191
Sensitizers	.180	.679	.117	.014	.0064

The R^2 values indicate that for repressers ESCC accounts for 76% of the involvement variance; for midlines ESCC accounts

for over 6% of the variance; for sensitizers ESCC accounts for over 1% of the variance.

Summary

The results of the tests of five research hypotheses were presented in this chapter. The first hypothesis was that personality groups would differ in physiological base rates. The multivariate test at the .0002 level indicated that this was so. Step down F ratios indicated that the standardized electrical skin conductance standard deviation contributed most of any variable tested to this effect. The second hypothesis tested was that personality groups would differ in physiological response to the vignettes. A multivariate test at the .0002 level indicated that this was so. Step down F ratios indicated that standardized electrical skin conductance standard deviations contributed most heavily to this effect. Tukey post-hoc comparisons at the .05 level suggested that repressers have a greater standard deviation than the other two groups. The third hypothesis tested was that there would be a difference in physiological response between vignettes with which the subject was rated as being involved and those with which she was rated as being uninvolved. The multivariate test at the .0095 level indicated that this was so. Step down F ratios showed that mean skin conductance in the involved vignettes was significantly higher than mean skin conductance in the uninvolved vignettes. The fourth hypothesis tested

was that there was an interaction between personality groups and involvement with the vignettes. This was not confirmed by the data. The fifth hypothesis tested was that a linear multiple regression equation could be written which would predict involvement from Repression-Sensitization scores, electrical skin conductance (ESC) change scores, and heart rate change scores. An equation was written accounting for approximately one third of the involvement variance using RS scores and ESC change scores.

CHAPTER V

SUMMARY, CONCLUSION, DISCUSSION AND IMPLICATIONS

Summary

Personality theorists have paid much attention to psychological defensiveness. One conceptualization of defensiveness which was reviewed in detail here is Byrne's (1961) notion that defensiveness may be viewed as a behavioral continuum ranging from repressing and ignoring behaviors on the one hand, to sensitizing and distorting behaviors on the other. Psychophysiologists have devoted a great deal of attention to the correlates of an organism's accepting and/or rejecting stimulus input. This study was an attempt to investigate the relationship between Byrne's conceptualization of defensiveness and hypothesized psychophysiological correlates of defensiveness. Two specific physiological measures--heart rate and electrical skin conductance (ESC)--were analyzed. According to the work of Lacey (1956), heart rate tends to increase when an organism shuts out stimuli; conversely, when the organism attends to stimuli heart rate tends to decrease. Therefore, it was hypothesized that when a subject becomes involved with a filmed vignette she is attending to the vignette, and therefore

her heart rate should decrease. When she is uninvolved with a vignette she is likely not to be attending to it, and her heart rate should increase.

The work of Edelberg (1970, 1972) provided the background for making predictions about ESC activity. According to this work when subjects are defensive and shut out incoming stimulation ESC activity maintains or increases its rate. When a subject accepts environmental input ESC activity decreases. Therefore, it was hypothesized that when a subject is involved with stimulus vignettes her ESC activity should decrease; when she is uninvolved, ESC activity should remain the same or increase.

The literature (Davison, 1963; Simal & Herr, 1970) suggested that repressers should show more physiological arousal than sensitizers. In an attempt to replicate this finding, differences between personality groups as defined by the Repression-Sensitization (R-S) Scale were hypothesized.

Forty-five female subjects from Education 484 classes were picked, on the basis of their scores on the R-S Scale, such that fifteen could be considered repressers, fifteen midlines, and fifteen sensitizers. Each subject was shown twelve stimulus vignettes while her heart rate and ESC were being recorded; simultaneously, she was video recorded. After watching the vignettes and taking a memory test about them, she watched the videotape of herself viewing the film. She was asked to stop the tape and describe her experiences while the tape was being made, according to the recall

procedures described by Kagan et al. (1969). A tape recording of this recall was then rated by two judges. From their ratings, two vignettes per subject were designated as "involved"--meaning that the subject had verbalized an emotional reaction to them--and two were designated as "uninvolved"--meaning that the subject had failed to verbalize any reaction to the vignettes. A multivariate analysis of variance was carried out on this data. The results indicated that repressers were more variable than other groups--ie. they had larger standardized standard deviations than sensitizers or midlines--during the base rate and while watching the films. The results also indicated that subjects had a lower mean skin conductance level when uninvolved than they did when they were involved. No statistically significant interaction was detected in this analysis.

A multiple regression analysis based on the same six vignettes for all subjects was performed attempting to predict overall involvement ratings from R-S scores, ESC change scores and heart rate change scores. For all subjects approximately one-third of the involvement variance could be accounted for by R-S scores and ESC change scores. However, when separate analyses were run on the different personality groups ESC change scores could account for approximately 76% of the involvement variance for repressers, 6% of the involvement variance for midlines, and 1% of the invlovement variance for sensitizers.

Conclusions

1. A significant difference exists between R-S groups on the physiological measures tested during their base rates. Variability of ESC, as measured by the standardized standard deviations, reflects this difference best. Repressers seem to be more variable than the other groups.
2. A significant difference exists between R-S groups on the physiological measures tested while they were watching the films. Variability of ESC, as measured by the standardized standard deviation, reflects this difference best. Repressers seem to be more variable than other groups.
3. A significant difference exists in physiological response between those vignettes with which the subject was rated as being involved and those vignettes with which the subject was rated as being uninvolved. In particular, mean skin conductance was significantly lower when the subjects were uninvolved than when they were involved with the vignettes.
4. No significant interaction between involvement and R-S groups was found in the data based on the two involved and the two uninvolved vignettes per subject.
5. R-S scores and ESC change scores account for 35% of the involvement variance. Heart rate change scores do not account for an appreciable percentage of the variance.
6. The data collected from the same six vignettes per subject suggests that ESC change scores are an extremely potent predictor of involvement for repressers--accounting for 76%

of the involvement variance--while it is a poor predictor of involvement for midlines and sensitizers--accounting for approxiamtely 6% and 1% respectively.

Discussion

It seems clear on the basis of the findings reported above that none of the hypotheses concerning heart rate were supported. There can be two explanations for this. The first possibility is that increasing or decreasing heart rate is not a correlate of psychological involvement in this case because of some idiosynchracy of this study. Perhaps this is true because of the relatively low level of stimulation (compared with real life situations or movies of gruesome accidents) used in this research. Perhaps it is true because the subjects were females or because of some other demographic characteristic of the sample (one is reminded that Lacey's most impressive findings were based on male subjects [Lacey et al., 1963]). Perhaps this is true because of the varied subject matter of the vignettes. (The reader will recall that in one study Lacey obtained different physiological responses depending on the nature of the topic--sexual or aggressive--being dealt with [Lacey et al., 1963]). Perhaps this is true because the measurement procedures used here were not sensitive enough to pick up the small cardiac changes Lacey does. The second possibility is that the hypothesis that increasing heart rate is associated with rejection of the environment

is simply wrong. Perhaps Obrist et al.'s (1970) explanation of cardiac rate in terms of metabolic requirements or Westcott and Huttelocher's (1961) explanation in terms of respiratory artifact or some as yet unformulated theory has greater validity. This research however, sheds no light on the probabilities of these possibilities. All that can be said is that the results cannot be taken to support Lacey's hypothesis; however, there are sufficient differences in the characteristics of the experiments so as not to be damaging to his hypothesis either.

Results of this study are considerably more positive with regard to ESC. ESC variability does appear to be greater for repressers than for other members of the population. This confirms the results of Davison (1963), and Lazarus and Alfert (1964). This great variability in conductance response on the part of repressers in at least suggestive of the Freudian notion that it takes a great deal of psychic energy to defend against something coming into consciousness. Clearly, however, this hypothesis requires further study.

Surprisingly, mean ESC level was greater during vignettes when subjects were involved with the material than when they were uninvolved. The original thinking here suspected the opposite--that when subjects were involved there would be a decreasing ESC level, manifesting itself as a lower ESC mean. In fact, looking at the data shows that that did happen. However, involved vignette scores also reached a higher maximal

level at the start of a vignette than did uninvolved vignette scores, thus yielding the reported results. This suggests that perhaps ESC slope might have been a superior, more direct measure for the present purposes. This also suggests a possible explanation for some apparent discrepancies in the literature. For some groups ESC activity as measured by mean level may be decreasing while ESC activity as measured by responses (bumps) may be increasing.

When ESC change scores are examined in the multiple regression analysis Edelberg's (1972) hypothesis receives its strongest support. Taken alone, ESC change scores account for over 14% of the variance for all subjects. Taken together with RS scores they account for over 35% of the variance. However, if one just looks at repressers, ESC change accounts for a whopping 76% of the variance.

This poses some interesting questions. The first of these is why is there such a clear interaction between RS and ESC change scores in the regression analysis, but not in the MANOVA? The reader is reminded that rejection of the null hypothesis was much more difficult in the MANOVA because more hypotheses and more variables were being tested, resulting in lower critical values. Secondly, the reader is reminded that the two analyses were performed on different sets of data. In the case of the MANOVA two involved and two uninvolved vignettes were arbitrarily selected for subject. In the case of the regression the same six vignettes were selected for each subject. This means that some

vignettes, such as ones with which the subject became only reluctantly involved, were included in the regression analysis although they were excluded from the previous analysis. This difference concerning the interaction suggests some considerations which will be discussed under "Implications for Future Research." However, because the regression analysis here provides the more powerful test and because the direction of differences between the groups on ESC change scores is the same in both sets of data, it is assumed that an interaction does in fact exist.

The second question posed by the large difference in percentage of involvement variance accounted for by ESC change scores within the separate groups is why this is so. One hypothesis is that the answer lies in the differential meaning of involvement for repressers and sensitizers. A represser who indicated she was involved was not likely to have been defensive while watching the vignette. (Repressive defenses would tend towards denying involvement.) A sensitizer who indicated she was involved may or may not have been defensive. (Sensitizing defenses might manifest themselves as over-involvement--perhaps not truly felt by the subject, but nonetheless, rated as true involvement on the rating scale employed.) The involvement scale does not allow one to differentiate between true involvement and defensive involvement. Therefore, when a represser is rated as being involved, one can equate the work "involved" with "non-defensive"; when a sensitizer is rated as being involved,

one cannot make such an inference.

If the data is seen in this light, it strongly supports Edelberg's (1972) contention that "enhanced electrodermal activity with retarded recovery may signal a defensive reaction." When there is a clear indication of psychological defense, ESC change scores behave as Edelberg would predict--larger ESC change scores for involved than uninvolved vignettes. To test fully this hypothesis one would want to show that when sensitizers and midlines are defensive their ESC change scores behave similarly. The problem in this study is that for those two groups there is no clear measure of when they are being defensive. Again, the reader is reminded that this interpretation is not supported in that there was no significant interaction in the MANOVA. Therefore even the extremely low critical alpha levels, the relatively small number of subjects, and the fact that the results are in the same direction as in the regression analysis all suggest that this is a valid result, caution is advised.

If this finding is correct, it also suggests a possible explanation for discrepant results in the literature. Most studies do not report the characteristics of their samples in regard to openness to stimulation. It is possible that subjects in studies coming to differing conclusions differ in psychological defensiveness.

Subjective Observations

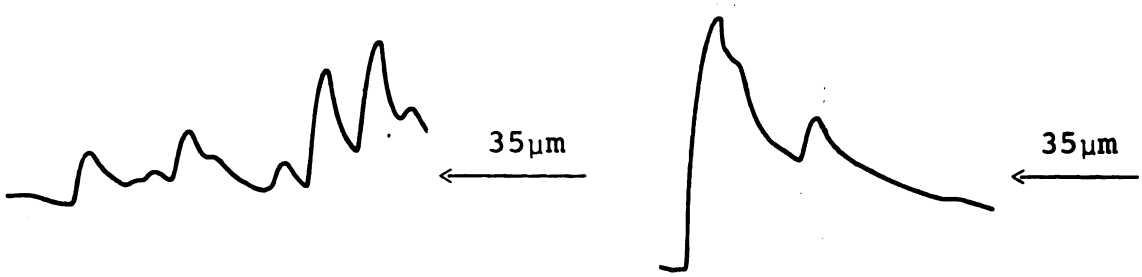
The subjective observations of the experimenter fall into three broad categories: remarks about the subjects, comments about the procedure, and impressions of the data.

Sensitizers tended to be almost hysterical, somewhat flighty, and highly enthusiastic. More often than not they seemed to be nervous about the procedure and often asked questions to confirm that they really were not going to be given "shots" or to ascertain whether or not the movies were "gross." Repressers, on the other hand, rarely verbalized any of these concerns. Interestingly, however,of the five people who missed their original appointments and needed to be re-scheduled, four were repressers. The fifth, although not a represser, as defined by the strict criteria in this study, tended toward the repressing end of the R-S score class distribution.

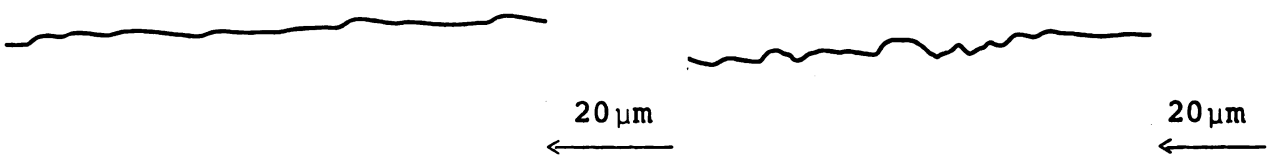
There are some important costs and benefits associated with using the procedure employed in this study. Its biggest drawback is its length and cumbersomeness. It requires approximately two hours of time per subject and a substantial initial financial outlay for the equipment. Furthermore, it lacks highly discrete stimuli and relies on the skill of a clinical "inquirer" (the person asking questions of the subject) which is difficult to keep constant across subjects. However, it is precisely some of these "drawbacks" which are simultaneously the greatest assets of the method. For example,

the lack of highly discrete stimuli is a function of its relatively high approximation to the real world (as compared with a photic flash). Its reliance on a skilled inquirer allows the subject to deal with what was on her mind. The importance of this can be illustrated by the following anecdote: one vignette was of a black male threatening, with obscene language, the viewer. Most viewers saw this as an aggressive theme and, if they reacted, reacted with fear, anger, or some defensive posture. Two viewers focused on the fact--until then completely unnoticed by the experimenter--that the man in the film had a gap between his two front teeth. As both these subjects had similar characteristics their reactions were ones of sympathy for the "poor, ostracized" individual. In all likelihood more clean-cut, precise experimental procedures would have missed these sorts of nuances.

Finally, the records themselves deserve some comment. As suggested by the findings already presented, clear visual differences in ESC are found between the involved and uninvolved represser vignettes. Visual inspection also differentiates repressers from sensitizers. Examples, taken from actual records are given in Figure 5.1. These examples suggest that useful data may be obtained by using two additional measures of ESC activity: slope and a measure which would differentiate between large and small responses (the reader is reminded that in this study all "bumps" of ¼ micromho or greater were lumped together.



Uninvolved Represser Involved Represser



Uninvolved Sensitizer Involved Sensitizer

Records of An Involved and Uninvolved Vignette for a Represser and a Sensitizer

Figure 5.1

Visual inspection of the data also suggests ESC mean levels differentiate between personality groups; they also suggest that ESC mean level is sensitive to an interaction between involvement and personality groups. The figures in Table 4.2 tend to support this, although this is not supported by the statistical tests reported in the previous chapter. One reason for this may be a large error variance with respect to ESC mean level. This big error variance suggests that perhaps the personality categories used in this study can be further refined so as to reduce the amount of individual variation within the groups.

Implications for Future Research

One need for further research is the need to confirm or reject the specualtion that the large interaction suggested in the multiple regression between ESC change scores and R-S Scale scores is valid. This study should be replicated using fewer physiological variables--perhaps only ESC change scores and ESC standardized standard deviations.

A theoretical question is raised about whether ESC change scores correlate with psychological defense generally or only with repression. Specifically, some measure of sensitizing defense--which differentiates between true involvement and defensive involvement--needs to be taken and then correlated with ESC change scores. It would be ideal if the rating of "non-involvement" could differentiate between a non-defensive lack of involvement, due perhaps to disinterest

and a defensive non-involvement.

A second theoretical question about whether the greater variability of represser's ESC levels correlates with Freud's notion of the expenditure of psychological energy to maintain psychological defense deserves consideration. Measuring ESC levels in a variety of situations in which one would expect to find differential psychological energy expenditures would be helpful.

Another question which is raised by this study is whether further refinement of the personality categories will yield stronger correlations between physiological measures and psychological constructs. In addition, just as psychological categories can be further refined, so can the physiological measures. Discriminating amount of ESC response and looking at slope of ESC appear to be two such possible refinements.

A variety of questions concerning heart rate and environmental screening remain. Would positive results have been obtained with male subjects? Would dividing vignettes according to theme yield different results? Is some other translation of Lacey's "acceptance and rejection of environmental stimuli" such as "approach and "avoidance" of stimuli, rather than involvement or non-involvement with the stimuli, more accurate?

Finally, it would be interesting to learn if the ESC change score patterns associated with represser's openess and defensiveness have any practical use. Using a represser

as a client, a future study might provide on-going feedback about ESC activity to the therapist, the client, and/or both, seeking to see if such feedback affects the outcome or rate of therapy.

APPENDICES

APPENDIX A

Instructions for Rating Scale

Rate as involved if the person says he felt a particular feeling or wanted to do a particular behavior. The only exception to this is if the only behavior the person can identify is laughter or if the only feeling is that it (the vignette) was humorous.

Rate as "hesitantly involved" any vignette where the person labels a reaction cautiously--ie. I would have felt scared--I kind of wanted to help him etc. Rate as uninvolved any vignette where the person says "I was bored," I didn't get into it, etc. or where the only reaction is laughter or humor. Also rate as uninvolved any vignette the person can't recall or labels no reaction. Any vignette not rateable in one of the above three categories rate as "can't be rated."

APPENDIX B

Memory Test

RECALL THE VIGNETTE WHERE A WOMAN ASKS WHETHER ANYONE HAS EVER SAID ANYTHING ABOUT YOUR SHAPE.

What is the length of her hair?

What is the color of her blouse?

RECALL THE VIGNETTE WHERE A WOMAN CRIES, SAYING SHE THOUGHT YOU LIKED HER.

What is her approximate age?

Describe her hair style.

RECALL THE VIGNETTE WHERE A MAN APOLOGIZES AND SAYS HE FEELS BAD AND CRIES.

Describe any facial hair that he had.

What was he wearing?

RECALL THE VIGNETTE WHERE A MAN SAYS THAT HE'S NOT SCARED OF YOU.

What was the color of his top _____(word that person used in question before).

Was he wearing any jewelry?

RECALL THE VIGNETTE WHERE A COUPLE WAS LAUGHING.

Who is sitting on your right, the man or the woman?

Which one, if any, are wearing glasses?

RECALL THE VIGNETTE WHERE A WOMAN SAYS YOU DON'T WANT ME AROUND HERE ANY MORE.

What was the color of her blouse?

Describe any jewelry she may have been wearing.

RECALL THE VIGNETTE WHERE A WOMAN SAYS YOU HAVE A GREAT DEAL OF POTENTIAL.

How did her blouse close? eg. zippered?

How much of her could you see?

RECALL THE VIGNETTE WHERE A MAN SAYS HE REALLY LIKES BEING WITH YOU.

Describe any facial hair he had.

What color was his shirt?

RECALL THE VIGNETTE WHERE A MAN SAYS HE WANTS TO FEEL YOU.

How long is his hair?

How did his shirt close?

RECALL THE VIGNETTE WHERE A MAN SAYS HE THOUGHT YOU REALLY CARED.

Is he wearing a ring?

During part of the vignette he looks at you and during part of the vignette he looks down. Which comes first?

RECALL THE VIGNETTE WHERE A WOMAN SAYS THAT NO ONE HAS EVER BEEN SO NICE TO HER.

How long were her sleeves?

What was the color of her dress?

RECALL THE VIGNETTE WHERE A MAN SAYS HE'S GOING TO KICK YOUR ASS.

Describe any facial hair he may have had.

Describe the pattern on his shirt.

APPENDIX C

Background Sheet

Name _____

Age _____

Marital Status _____

Are you taking any medication _____
If so, what? _____

When was the last time you ate _____

When was the last time you had coffee or tea _____

When was the last time you smoked a cigarette _____

APPENDIX D

Vignette Typescript

Female (middle-aged): Anyone ever said anything to you about your shape? Well, its different. Not that that's not fine, but it is different.

Female (young): I thought you liked me. I really thought you liked me. I guess I know what you're thinking. I ah I thought that you really liked me and I uh oh wow...

Male (young, red sweater): I feel pretty bad. I can't. I mean uh. I tried. I tried and I just uh can't do it. I mean I'm sorry. I mean I'm sorry I just uh my stomach is getting all uh. I'm, all I'm just getting all up tight and I couldn't do it. I'm sorry. I'm sorry.

Male (young, red sweater): So what are you looking at. I'm not scared of you. You can't do anything to me. You piece of shit.

Black male and female: Laughing at you.

Female (old, green blouse): I know you don't want me around here. I know you just don't want me here anymore. You don't need me. Alright. You don't want me here, I'll leave.

Female (young): You did pretty well, uh. I think you have a great deal of potential. Um. I think if you keep working at it. And keep trying. Um. You'll get much better.

Male (young, with moustache): You know what. I really like being with you. You really make the day special you know. I just really think you're neat. You really are.

Male (young, with moustache): I want you. I want to feel you. I want to lie next to you. I want to touch you. And I want you to touch me.

Male (young, with moustache): I thought we had something. I thought that you really cared. I thought you felt the way I did. Why did you let me make a fool of myself?

Female (young, low cut blouse): This is really hard for me to say. You've been very nice to me. No one ever has been that nice to me. I just wanted to say I appreciate it.

Male (black): I tell you man I can't take much more. Get the fuck off my back. I'm going to have to kick you ass. I'm going to have to kick your fucking ass.

APPENDIX E

Procedures for Operating the Polygraph

1. Turn main power switch on at least one-half hour before machine will be used.

2. Turn to "stand-by" the power switches of the two amplifier units to be used at least one half-hour before machine will be used.

3. After leads have been attached to the subject turn power switch on cardiac amplifier to "on."

4. Adjust driver sensitivity and base position if necessary. Base line should be at the mid-line and sensitivity should be such that -100 mv will move the needle 2 cm.

5. Turn polarity switch to "use" (up).

6. Tachograph scale should be set at 60-180.

7. Turn tackograph to calibrate - center, +2 cm., -2 cm, and mark on the record.

8. Turn tackograph to AC low. Adjust threshold so that the record is clear. If this cannot be done turn tackograph to AC Fast. Re-adjust threshold.

9. Turn amplifier on.

10. Adjust driver sensitivity and base position if necessary. Base line should be at the mid-line and sensitivity should be such that -100 mv will move the needle 2 cm.

5. Turn polarity switch to "use" (down).

6. Turn sensitivity to .01 mv/cm.

7. Bring needle back to midline using "zero adjust" on the skin conductance bridge.

8. Turn sensitivity down to 1 mv/cm.

9. Switch subject in on skin conductance bridge.

10. Bring needle to approximately midline position by balancing micromhos on the skin conductance bridge. Record the number of micromhos needed to balance on the record.

11. Turn timer on.

12. Run the machine at speed of 100 mm/minute.

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