PHYSIOLOGICAL AND PSYCHOLOGICAL PARAMETERS OF HUMAN TOUCH

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The purpose of the present study was to investigate a human being's basic responses to being touched by another human being in a nonreactive context and the effects of an illogical rationale on system disorganization. The available literature on touch overwhelmingly suggested that being touched has important effects on people, including consequences for physical and mental health. However, many variables were not controlled for in past research, so the present investigation sought to provide a more sound design. Sixty undergraduate females were randomly divided into three groups: a control (no touch) group; a touch group which received a rationale for being touched which was logical; an a touch group which received a rationale for being touched which was more illogical. Two hypotheses were put forth: 1 - that persons who are touched, for whatever reason, will display greater psychological and physiological reactivity than persons in similar circumstances who are not touched, and 2 - that persons who are touched for a reason that makes sense will display less psychological and physiological variability than persons who are touched for a reason that

makes less sense or, perhaps, is even considered "illogical." Forehead touch was chosen. Positive and negative affect scales were utilized to measure psychological reactivity while skin temperature and heart rate were employed to measure physiological reactivity. These hypotheses were not supported in the present study since the expected group by phase interactions were not obtained. Instead, main effects for phase were found, especially for heart rate scores. Many concerns about the nature of the sample and the manipulation itself are discussed.

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CHAPTER I

INTRODUCTION

While the role of nonverbal behaviors such as eye contact, body language, and facial gestures has been increasingly researched in recent years, one very important nonverbal behavior which is an integral part of human interchange - touch - has largely been ignored (Whitcher & Fisher, 1979). From the time of Aristotle, touch has been identified as one of the five basic senses with which human beings learn about their environment and how to interact with it. It is widely believed that the sense of touch was the first to evolve and led to the emergence of the other senses, which is perhaps why touch has long been referred to as "the mother of the senses" (Montagu, 1986). As Stevens and Green (1978) noted, even Aristotle recognized that touch can have several different attributes, "but before the mid-nineteenth century the belief that the skin might house a variety of sense modalities had won only a handful of converts" (p. 4). For some individuals, such as those with impaired vision, speech, or hearing, touch can become one of the main vehicles for communicating with others (Carterette & Friedman, 1978). Jacob-Rodriguez Pereire (1715-1780) was believed to have been the first person to have successfully

taught deaf-mutes to speak through touch (Montagu, 1986). Perhaps the most well-known deaf-mute, Helen Keller, was a beautiful example of the extraordinary powers of touch. Touch can be used to convey warmth, nurturance, sexual interest, power, and status. As Baldwin (1986) stated, "It (touch) has been used to comfort, console, reassure, show acceptance, and in healing for thousands of years, possibly even from early in our evolutionary process" (p. 45). Montagu (1986) went so far as to state that "although touch is not itself an emotion, its sensory elements induce those neural, glandular, muscular, and mental changes which in combination we call an emotion" (p. 128).

However, in the last two hundred years, certainly up to the 1960's, touch has become almost taboo in certain cultures due to sexual connotations and associations with primitive healing and superstitious customs. Baldwin (1986) believed there to be two reasons why the role of touch has decreased in today's health care. The first reason is related to many individuals' interpretation of touch to be related to sexuality and sexuality to original sin in Christianity. The second reason is linked to the movement away from primitive medicine with its superstitious practices and home healing toward scientific medicine.

However, there are clearly more complex reasons for the drastic decrease in touching. Cultural differences exist today which cannot be explained by the above justifications.

The boundaries of when touching is appropriate, how one should respond to touch, and whom may or may not be touched is often defined by the culture in which one lives (Fisher & Joseph, 1989). In the 1960's, Sidney Jourard pointed out dramatic differences in the rate of touching in different cultures (Jourard & Rubin, 1968). When observing pairs of people in coffee shops and then averaging the rate of touching between couples per hour, he found that touch was virtually nonexistent in some cities (2 times an hour in Gainesville, FL and 0 times in London, England) as compared to other cities where touch seemed to flourish (180 times in San Juan, Puerto Rico and 110 times in Paris, France). Americans tend to touch only during intimate moments and equate such touch with sexual intent (Fisher & Joseph, 1989). Montagu (1971) stated that Anglo-Saxon linguistic groups were less affectionate in general, and higher socioeconomic groups had less ability to express themselves through touch. Another study found that the rates of touching when retrieving or punishing children were similar in Greece, the United States, and the Soviet Union (Thayer, 1988). However, children from the U.S. recieved much less touching in the form of soothing, holding, and play.

In some cultures, touch is believed to play a significant, if not essential, role in maintaining or recovering health. In Mithila, Bihar, India, women massage their babies daily from birth to late toddlerhood to enhance

both physical and spiritual health (Reissland & Burghart, 1987). Shiatsu, or acupressure, and its predecessor, acupuncture, are ancient Japanese and Chinese practices based on the belief that the body has certain trigger points which, when manipulated, can generate physiological changes in other areas of the body (Chapman, 1978). Dossey (1983) noted that the skin is the transducer of information in the science of these practices. These techniques are still widely practiced in the East, but much less in the West, to cure disease and relieve pain. In fact, much of Western medicine has tended to dismiss the ideas that lie at the heart of traditional healing, including the importance of touch.

Definitions and Categories of Touch

It is noteworthy that there is so little known about touch even though the word "touch" has 14 primary definitions as a verb and 15 primary definitions as a noun (Webster's, 1986). Montagu (1986) observed that the importance of touch is evident in the many metaphors and expressions which contain reference to it, such as "keep in touch" and "out of touch with reality," to name just a couple. For purposes of the present research, touch will be defined as tactile stimulation, or "to bring a bodily part in contact with, especially so as to perceive through the tactile sense" (Webster's, 1986, p. 1246).

Five categories of touch based on people's roles and relationships have been proposed (Thayer, 1988). The "functional-professional" touch is observed when the toucher fulfills a special role, such as dentist or barber, and is devoid of personal meaning or messages. The "social-polite" touch is a formal touch, limited to greetings, farewells, and expressions of appreciation. This type of touch is most often seen among strangers, acquaintances, and colleagues. "Friendship-warmth" touches express personal concern and caring and lie somewhere between warmth and deep affection. Close co-workers, friendly neighbors, and extended family members often utilize this category of touch. The "love-intimacy" touch demonstrates affection and caring between closer family members and friends. The last category of touch, "sexual-arousal" touch, occurs in erotic-sexual contexts.

Pratt and Mason (1984) hypothesized ten categories of touch: communicative, diagnostic, incidental, personal care, assisting, accidental, guiding, pleasure-giving, instrumental, and pleasure-receiving. Cashar and Dixon (1967) identified three uses of touch: reality orienting, support, and physical protection. Other researchers have recognized only two main categories of touch - instrumental or procedural touch is the deliberate physical contact for performance of a skill, such as in nursing, and affective

touch which is more spontaneous and not required (Fisher & Joseph, 1989).

The many categories and definitions of touch indicate just how complex and multifaceted this concept is. The research conducted on touch is equally as complex and multifaceted and, at times, difficult to follow.

Research on Touch

Over the past 20 years, research on the beneficial effects of touch has increasingly grown in the health care literature. The research has focused on the importance of touch in nursing care (Tobiason, 1981; Whitcher & Fisher, 1979), in infant development (Montagu, 1986; Ross, 1984; Whitelaw, Heisterkamp, Sleath, Acolet, & Richards, 1988; Widstrom, et al., 1990), with the elderly (DeWeaver, 1977; Fakouri & Jones, 1987), in therapy (Holub & Lee, 1990; Pattison, 1973; Pratt & Mason, 1984; Willison & Masson, 1986), and in student-teacher relationships (Steward & Lupfer, 1987). There exists research on gender patterns in touch (Major, 1981; Major, Schmidlin, & Williams, 1990; Stier & Hall, 1984; Whitcher & Fisher, 1979) and even a large body of literature on therapeutic touch which was popularized recently by Dolores Krieger (1982). While it is beyond the scope of this paper to address all of these areas, the most pertinent areas with regard to the nature and heuristic value of the present study will be covered.

Touch in psychotherapy

It is believed that even though Freud would frequently stroke his client's head or neck and perhaps shake their hand as they entered or left the sessions, he advised his friend Ferenczi to avoid physical contact with clients (Holub & Lee, 1990). In fact, physical contact between analyst and client was prohibited during the early psychoanalytic period due to transference and countertransference issues. Later, the human potential movement encouraged nonerotic physical contact as a means of improving the therapeutic relationship (Levy, 1973). Today, with all the many different therapeutic systems available, the ambiguity of the Ethical Principles of the American Psychological Association with regard to touch in therapy (APA, 1990), and the swarm of malpractice suits being filed, it is no wonder that both clients and counselors are confused about the role of touch in therapy.

In order to help bring clarity to this issue, the role of touch in psychotherapy has been explored to some degree. However, the reported findings have been inconsistent. Some studies have found that counselors who touch clients on the shoulder or hand are not rated significantly differently than counselors who do not touch their clients (Bacorn & Dixon, 1984; Hubble, Noble, & Robinson, 1981; Pattison, 1973; Suiter & Goodyear, 1985). Alagna, Whitcher, Fisher, and Wicas (1979) discovered that counselors who touched

clients were rated more positively by the clients, especially by opposite-sex clients. Suiter and Goodyear (1985) found that counselors were rated as being less trustworthy when they touched their clients in a semi-embrace. One group of researchers contended that touch is perceived as positive if it (a) is appropriate to the situation, (b) does not impose a greater intimacy level than the recipient desires, or (c) does not communicate a negative message (Fisher, Rytting, & Heslin, 1976). Few of these studies address what role gender plays in touch, however, and gender has been researched with regard to touch in other areas.

Gender and Touch

It is widely assumed that touch is more frequently expressed among females than males (Berman & Smith, 1984; Major, 1981; Major, Schmidlin, & Williams, 1990). If asked why they believe this to be true, most persons state that females have been socialized to be more "touchy-feely." The research in this area, when looking at individual studies, conflicts in regard to this hypothesis. Therefore, it will be more helpful to look at meta-analyses which have been conducted.

In a review of the literature on gender patterns in touch, Major, Schmidlin, and Williams (1990) cited meta- and conceptual analyses which conflicted with regard to certain gender differences in touch patterns (Major, 1981; Stier &

Hall, 1984). The only points that these analyses agreed on were that females are more likely to be touched than males and that same-sex touch occurs more frequently among females. This meta-analysis provides some support for the layperson's expectations on gender patterns in touch. Whitcher and Fisher (1979) found that female patients who had been touched by a nurse during preoperative teaching had more positive affective, behavioral, and physiological reactions than female patients who had not been touched. On the other hand, male patients who had been touched had more adverse reactions in these domains than males who had not been touched. However, it should be noted that the researchers in this study purposefully chose a context which was characterized by dependency. Therefore, these authors hypothesized that the males may not have liked being touched because they perceived the touch to suggest dependency (Whitcher & Fisher, 1979). The results of this study point out the complexity involved when investigating gender differences with touch.

Gender differences in touch have also been studied with children and adolescents. Willis and associates (Willis & Hoffman, 1975; Willis & Reeves, 1976) observed the amount of touching by children in a school cafeteria line. They found frequent hand-to-hand touches between girls but none between boys. Berman and Smith (1984) assigned youths from kindergarten through high school to same-sex and same grade

level pairs and then observed the pairs in one of two situations. One condition was a neutral situation and the other was a "male-appropriate" situation which emphasized team spirit for athletic competition. While males and females did not significantly differ in their tendency to touch same-sex peers within each of the situations, there was a significant difference in the amount of touch between situations. Among both females and males, there was little touching in the neutral situation but significantly more touching in the team spirit situation. The subjects' age and sex of experimenter had no significant effect on the amount of touching. It must be pointed out, however, that only Caucasian children were included in this study. These authors concluded that sex differences in touching may be limited to a narrow range of situations. If this is indeed the case, then the conflicting findings which exist in the literature are more understandable, and perhaps meta-analyses which examine situtation-specific sex differences as opposed to sex differences in general may provide a clearer picture and more helpful information.

The intentionality of touch, the age of the participants, the nature of the relationship between the participants, and the setting or context in which touch occurs are four factors which have not been systematically controlled for or observed in research on gender patterns in touch (Major, Schmidlin, & Williams, 1990). Many of the

studies contain methodological problems (Stier & Hall, 1984). Some problems noted in the present review involved not counterbalancing the sex of experimenter and the sex of research participant, not attending to whether the situations were neutral, or female or male "sex-appropriate", and not accounting for cultural differences. As Smith and Berman (1984) stated, clearly the research has not explored the full range of variables which may be involved in gender differences in touch. Thus, at this point in time, gender patterns of touch are not clear, and studies on touch must be interpreted cautiously since most do not address the role of gender in their results. Instead, most research focuses on the physiological, and to a lesser degree, psychological, consequences of touch.

Physiological Studies on Touch

As noted in the beginning of this paper, in the late 1950's and early 1960's the taboo on touch began to be eased as professionals in the health care field started examining this area. In 1958, Harlow observed that infant monkeys displayed apathy and autistic-like behaviors when deprived of their mothers and would cling to a cloth surrogate mother rather than a wire one when they felt threatened. Young human infants often form strong attachments to blankets or soft toys as a substitute for maternal contact (Ribble, 1965). Hyperactivity, autistic behavior, violence, and aggression can result from deprivation of tactile

stimulation (Prescott, 1975). Children restrained in large casts for medical reasons were observed to become hyperactive, aggressive, and craving of affection or they withdrew and avoided physical contact (Grandin, 1984). Suomi (1982) found that monkeys that were separated from their mothers wrapped their arms around themselves. One research study with human infants found that the mother/infant relationship was positively influenced by the infant's early touch of the mother's areola and nipple during the first four days after birth. The effects on the relationship were measured by the amount of time infants were left in the nursery and the observation that more mothers talked to their infants during feeding when skin to skin contact was made (Widstrom, et al., 1990). Studies have found that light touch appears to have an alerting effect and firm pressure a calming effect (Ayres, 1979; King, 1979). Henderson, Dahlin, Partridge, and Engelsing (1973) described a highly successful therapy used with hyperactive children in which the children were held and soothed until they stopped resisting.

The importance of touch to infants is now well documented. It has long been recognized that infants who do not receive adequate touch will likely suffer irreversible psychomotor retardation and have an increased risk of death (Spitz, 1947). Spitz (1965) described the "institutionalization syndrome" where children in a hospital

for abandoned babies failed to thrive when left alone but grew healthy when touched and held by the nursing staff. This syndrome has also been labeled "nonorganic failure to thrive" or "reactive attachment disorder" (Schanberg & Field, 1987). Grandin (1984) stated that a restricted environment has the effect of making both people and animals more sensitive to stimuli, including touch. On the other hand, research has demonstrated that tactile stimulation can have profoundly beneficial effects on the health of infants, even premature infants (Solkoff, Yaffe, & Weintraub, 1969; White & Labera, 1976). Even the effects of tactile deprivation can sometimes be reversed if caught early enough. One study found that while institutionalized babies had abnormal reactions to being held at two months of age, their reactions became more normal after the amount of tactile stimulation was increased over many months (Provence & Lipton, 1962). Montagu (1986) cited an unpublished study by Weininger which found that infants whose mothers were taught to stroke the infants' backs at ten weeks of age had fewer sniffles, vomiting, colds, and diarrhea at six months of age than infants who had not been stroked. Another study found that infants whose mothers maintained skin-to-skin contact while feeding them cried significantly less at six months of age than infants in a control group who did not experience this skin-to-skin contact (Whitelaw, Heisterkamp, Sleath, Acolet, & Richards, 1988).

Even adults have a need to touch and be touched, but social prohibitions rule against much of this touching. Morris (1976) hypothesized that in order to help meet these touch needs, some adults turn to "licensed touchers," such as hairdressers and masseurs, where touch may not be the primary reason but is a satisfying by-product (Fisher & Joseph, 1989). Huss (1977) believed that due to decreases in sensory modalities which limit experiential capacity, elderly persons may have greater needs for touch. Elderly patients with chronic brain syndrome were found to respond in a positive manner to being touched and increased their appropriate verbal and nonverbal communication (Burnside, 1973). Seriously ill patients found touch to be a source of comfort and a communication of caring (McCorkle, 1974). With nursing home patients, slow stroking and gentle touching, in addition to verbalized support, were found to help relieve depressive symptoms (Powers & McCarron, 1975).

While massage therapists have long proclaimed that massage increases psychological well-being as well as physiological health, recent studies have provided empirical support for this stance. Weinberg, Jackson, and Kolodny (1988) found that massage with university students consistently enhanced positive mood and the sense of well-being while concurrently decreasing levels of tension, confusion, fatigue, anxiety, depression, and anger. Massage has also been found to be effective in alcohol/drug

treatment to produce quicker detoxification, deeper relaxation, greater self-acceptance, and to facilitate the awareness of unresolved emotional issues which have been "stored" as muscle tensions (Adcock, 1988).

Tempereai, Grossman, and Brones (1989) emphasized the importance of touch in conveying information and/or feelings to burn patients, even when these patients have clouded sensorium or are unconscious. These patients and those persons interacting with them are encouraged to learn to talk by touching. The authors stated that, "Touch is a primitive modality that requires less complicated neural processing than does verbal language" (Tempereai, Grossman, & Brones, 1989, p. 466).

The studies cited above strongly suggest beneficial, if not overtly healthful, consequences of touch. Why do backrubs, being massaged or stroked, or being held seem to alleviate suffering and promote a sense of well-being? It surely must be something more than the oils or creams used in giving backrubs or massages. However, the question of what exactly the relationship is between touch and these outcomes has only recently been the subject of investigation. Dossey (1983) noted that "concrete impingements on the skin - what is called 'touching' - generate a cascade of biochemical events whose reverberations in the body are more pervasive and complex than might be imagined" (p. 2). But what are these

biochemical events? It seems necessary not only to observe the effects of touch, as noted in these studies, but also to inspect the sense organ of touch - the skin. As Dossey (1983) recognized, because of the complex interactions the skin has with environments both internal and external to it, it is a very important pathway for communication.

Physiology of the skin. The skin is not only the largest organ in the human body, but it is also one of the fastest growing tissues. The skin forms two new layers of cells approximately every four hours (Montagu, 1986). The cornea, which is the skin of the eyes, can be replaced within 24 hours after removal (Dossey, 1983). These facts are not surprising considering that more than a million skin cells are shed every hour. Pathways from the skin to the central nervous system are operative earlier than other sensory systems (Montagu, 1986). Wolff (1959) reported that tactile stimulation during the first days after birth produces a greater response than auditory or vestibular stimulation. Tactile signals from the skin first pass into the spinal cord and then to the neocortex of the brain, specifically into the somesthetic area, where neurons of the postcentral gyrus are stimulated (Montagu, 1986; Passingham, 1982). Corkin (1978) cited research which indicated that the right hemisphere provides a greater contribution to many aspects of tactual perception than the left hemisphere. It has been estimated that the skin houses approximately 50

receptors per 100 square millimeters and from 7 to 135 tactile points per square centimeter (Montagu, 1986). It is astonishing that the skin of one hand alone contains approximately 17,000 sensory units that are sensitive to nonnoxious mechanical deformation (Vallbo, 1987). The skin also contains receptors that are sensitive to other potential attributes of touch, such as roughness, warmth, cold, pressure, size, location, and weight.

The sensitivity of touch varies significantly depending on the body area examined, partly due to the fact that the skin varies in thickness from 1/10 of a millimeter to 3-4 millimeters. As measured by the von Frey esthesiometer, the absolute threshold for touch sensations is largest on the lower extremities, especially the sole of the foot and the big toe, and smallest on the face, especially on the nose (Kenshalo, 1978). Research cited by Kenshalo (1978) found that females demonstrated a marked increase in touch sensitivity at approximately five years of age while males did not demonstrate this increase until about eleven years of age. Also, females were found to be slightly more sensitive to touch than males at all ages, and the nondominant side was slightly more sensitive than the dominant side.

The epidermal layer of the skin, the most superficial layer, produces a substance which is indistinguishable when observed immunochemically from the hormone thymopoietin

(Montagu, 1986). Thymopoietin is released from the thymus gland and stimulates T-cell differentiation. T-cells are responsible for identifying and attacking antigens. Therefore, it appears that certain substances in the skin may play a role in the maintenance of the immune system. Another observation which is noteworthy concerns acupuncture and acupressure, which have long been utilized in the area of pain and disease management. It has been hypothesized that these techniques trigger complex neuroendocrinological pathways originating in the skin which likely promote the release of endorphins (Dossey, 1983).

Montagu (1986) noted some 20 physical functions of the skin. While the skin has been studied in humans, much of the current knowledge about the function of skin and the importance of touch comes from animal studies.

Animal studies. Animal studies also contribute to the growing evidence that touch produces complex physiological reactions. Schanberg and Field (1987) cited many studies which have provided evidence that rats who are petted and touched, relative to those that are not, exhibit a variety of positive responses, such as the ability to thrive longer under conditions of deprivation, less emotionality in stressful conditions, and superior maze performance. Schanberg, Bartolome, and Kuhn (1988), in a series of studies, discovered that the enzyme ornithine decarboxylase

(ODC) plays an important role in the effects of maternal deprivation in rats directly related to the pups being licked. ODC is necessary for the synthesis of certain substances which help regulate nucleic acid and protein synthesis in organs such as the heart, brain, lungs, and spleen. These researchers found a shutdown in ODC activity in these major organs within 30 minutes of rat pups' separation from their mothers. The licking of the rat pups by the mother rats and stroking of the pups with a wet paintbrush by the researchers, to mimic the mother rat's licking, were both found to restore protein synthesis and weight gain in the rat pups to normal levels (Schanberg, Bartolome, & Kuhn, 1988; Schanberg & Field, 1987). In a well-controlled study comparing tactile, vestibular, and kinesthetic stimulation of maternally deprived rats, Pauk, Kuhn, Field, and Schanberg (1986) found that only tactile stimulation was able to reverse the deprivation effects of decreased ODC and growth hormone and increased corticosterone (a stress hormone). Nerem, Levesque, and Cornhill (1980) discovered that rabbits who had been fed a diet rich in fat and cholesterol had predictably higher rates of the formation of atherosclerotic lesions in their coronary arteries and aortas. However, one subgroup of rabbits had a 60% lower rate of these lesions than the rest. The only difference which could be found to account for this phenomenon was that the subgroup had been removed from their

cages at feeding time and held and touched. Two replications of this study confirmed the results. (Nerem, Levesque, & Cornhill, 1980). Higher internal body temperatures and changes in cerebral spinal fluid nucleotides were found in adult cats that were cuddled (Sakai, Ary, Hymson, & Shapiro, 1979). Nucleotides are the basic structural units for DNA and RNA.

Although these findings have obvious implications for humans, attempts to explore these specific physiological relationships in people have been few and far between. Unfortunately, most studies with humans have been descriptive and correlational in nature and few have been experimental.

Human studies. It is interesting that human infants who receive inappropriate or inadequate stimulation from caregivers develop "psychosocial dwarfism," a condition that is biologically and behaviorally similar to the animal model of maternal deprivation described earlier (Montagu, 1986; Schanberg & Field, 1987). One investigation with elderly nursing home clients found that a 3-minute slow back rub, described as long, slow strokes on both sides of the spinous process from the crown of the head to the sacral areas, decreased heart rate and both systolic and diastolic blood pressure as well as increased skin temperature (Fakouri & Jones, 1987). It appears from this particular research that touching by administering a slow back rub was useful in

promoting a relaxation response in these persons. The production of decreased sympathetic and increased parasympathetic activity attests to the healthful effects of this type of touching with this particular population. Other research has demonstrated that even patients in a coma experience a reduction in blood pressure when touched by another person (Lynch, 1977). Grandin (1984) hypothesized that tactile stimulation will result in increased numbers of endorphins and their respective receptor sites on the synapses via neurotransmitters involved in tactile stimulation, and removal of this stimulation will result in decreased numbers.

Not all research has found beneficial effects of touching, however. Green and Green (1987) conducted a study in which participants who were in a control group had eight specific points on their back touched with one finger by a masseur for 2 minutes, 15 seconds each. The result was a decrease in salivary immunoglobulin A, a protein important to the immune system, as compared with relaxation groups which produced an increase in immunoglobulin A. However, the subjects in the control group stated that they were uncomfortable during the experience, and the authors suggested that the experience was unusual enough to be stressful. This finding implies that the role of touch in health depends not only on the type of touch but also the individual perceptions and personal meanings of touch

espoused by the person being touched. In fact, it has been found that the perceptions of the toucher can indeed be important. Tobiason (1981) found that nursing students who were asked to touch both infants and nursing home residents used the words cuddly, small, warm, soft, and smooth to describe the infants but used wrinkled, loose, flabby, bony, and cold to describe the nursing home population. It would seem feasible that the touchee could perceive the toucher's feelings concerning the touch, which may influence how the touchee reacts to being touched. Such possibilities again point to the complexity of interpreting the results of research with touch as well as the risk involved with generalizations. Some persons may have innate aversions to either touching others or being touched themselves.

Brasic and Fortune (1990) discussed tactile defensiveness, a sensory integrative learning disorder which is most often found in children with emotional disturbances and learning disabilities. This condition is characterized by an aversive reaction to nonnoxious stimuli. Baldwin (1986) noted that many elderly persons also show tactile defensive behaviors as a response to being touched. This defensiveness in the elderly may be the result of fear of injury or pain due to such things as joint inflammation, or perhaps a realistic fear of abuse. Others may be defensive because of personal or social taboos or values against being touched except by close friends or family. DeWeaver (1977)

found that elderly persons in a nursing home had a variety of responses to touch. Many females accepted task-oriented touching, such as help getting dressed, but did not accept affective touching. Other elderly residents disliked being touched by male nurses.

Added to the complexity of people's responses to being touched is the specific site on the body where the touch occurs. As noted earlier, sensitivity to touch varies depending on body site (Kenshalo, 1978). In 1975, Tuan, Heslin, and Nquyen divided the body into eleven areas and had subjects identify which areas would be the least and most comfortable if touched. They found that the hands, forearms, upper arms, shoulders, head, and forehead were the most comfortable sites for touch while the torso, buttocks, pelvic area, legs, and feet were rated as the most uncomfortable. Of course, as pointed out earlier, the perception of why one is being touched, say, on the forehead, would be important. If one believes that the touch is to estimate body temperature, it seems reasonable to think that the level of anxiety would not be unusually high since most people probably had parents or caregivers who assessed fevers by touching their forehead. However, if the reason given for being touched was to communicate feelings, however, the level of anxiety might be elevated due to the more personal nature of this action. In his discussion of mirror time, Mahoney (1990) noted that studies of mirror

time found interesting results. When subjects were instructed to look at themselves in a mirror, physiological responses which would normally be positively correlated were temporarily negatively correlated with each other, and vice versa. For instance, heart rate is normally negatively correlated with skin temperature. However, when nonclinical subjects were instructed to look in a mirror, these two physiological indices were temporarily positively correlated and gradually, over a period of 15 minutes, returned to an inverse relationship, perhaps due to the subjects' organizational efforts. Conceivably because being instructed to look in a mirror is a novel and challenging task, Mahoney (1990) hypothesized that confrontation with such a task could result in momentary disorganization and reduced coherence among physiological and psychological systems. It is plausible, therefore, that the reactions an individual displays to being touched depends greatly on whether the touch challenges their conceptual schema. Ulric Neisser did a superb job of explaining a schema in terms of the mind-body link:

> A schema is that portion of the entire perceptual cycle which is internal to the perceiver, modifiable by experience, and somehow specific to what is being perceived. The schema accepts information as it becomes available at sensory surfaces and is changed by that information;

> it directs movements and exploratory activities that make more information available, by which it is further modified.
>
> From the biological point of view, a schema is part of the nervous system. It is some active array of physiological structures and processes: not a center in the brain, but an entire system that includes receptors and afferents and feed-forward units and efferents. (cited in Johnson, 1987, p. 20)

This view contrasts that of the notion of mind-body split espoused by Descartes, "What we know most intimately is not our bodies but the structure of our minds (i.e., the nature of our rationality) . . . the world consists of physical substances (bodies) and mental substances (minds)" (Johnson, 1987, p. xxvi).

It would be quite interesting to investigate Mahoney's (1990) hypothesis about system disorganization and mirror time with touch. Instead of having individuals look at themselves in a mirror, one could examine the physiological and psychological effects of having an unusual rationale given for being touched. This rationale should challenge the person's schema of what being touched on a particular part of the body is supposed to mean or imply. If the person's schema is indeed challenged, one may expect to find a temporary break in system coherence as the person attempts to cope with this novel stimuli.

It has been established that an individual's perception of events can indeed affect physiological changes. Green and Green (1977) noted that the limbic system is an important link between the emotions and the body. They specifically stated that the perception of events leads to limbic-hypothalamic-glandular responses which inevitably result in physiological changes. Such things as heightened levels of arousal, anticipation, and muscular tension are intimately linked to increased heart rate (Basmajian, 1983; Green & Green, 1977). Also, the temperature of the hands, which is an indication of the blood flow to the hands, is another physiological marker directly involved in the fight-flight response pattern (Basmajian, 1983; Blanchard & Epstein, 1977; Green & Green, 1977; Ray, Raczynkski, Rogers, & Kimball, 1979). Skin temperature reflects a general state of sympathetic arousal (Gaardner & Montgomery, 1977). Changes in skin temperature are well known to be correlated with changes in affective states, with a decrease in temperature occurring in reaction to stress and fear (Sedlacek, 1983). Sedlacek (1983) also noted that there is a wide variation within individuals in changes of skin temperature in reaction to different stressors.

If such indices as these were utilized to track system disorganization and sympathetic arousal, then one could investigate both the basic human responses to touch and the effects of unusual reasons given for touch.

Rationale and Hypotheses for the Study

It seems incredible that the most basic research of how does an individual respond, physiologically and psychologically, to being touched by another human being has somehow been overlooked. The research has instead started with the complex interactions and implications of touch which involve many confounding variables. For instance, many of the cited studies with animals and human infants did not control for such variables as temperature change and vestibular stimulation which are invariably present when an infant or animal is picked up and held. Reviewers of the literature could also become confused by comparisons of studies utilizing different forms of touch or handling which involve more confounding variables such as pressure and location. Most of the research which investigated the physiological effects of tactile stimulation, or the lack of it, has been conducted with animals, preterm neonates, infants, and elderly adults. More research of this nature with younger adults is clearly needed. Whitcher and Fisher (1979) also noted that very few studies have been done in a nonreactive context. This observation is important since touch has strong socialization-related restrictions. The history of the research on touch does not appear to have a logical progression, for instance, from basic physiology to complex social interactions. Instead, there are pockets of research in different areas that are difficult to tie

together. It seems necessary to go back to step one to lay the foundations for more complex research.

Although the literature abounds with conflicting explanations, there does seem to be evidence that touch has some effect on individuals. However, each individual may have different reactions. The extant research is not consistent about what direction these effects may take. It appears obvious from a review of the existing literature that more research with fewer confounding variables is needed in nonreactive settings with adults. The present study attempted to create a neutral setting in which basic physiological and psychological responses to touch could be observed and measured.

The available research also hints at the importance of each individual's perceptions of touch and the meanings they assign to it may influence their reactivity. This project also, therefore, attempted to manipulate the meanings assigned to touch. This was accomplished by offering two different rationales or explanations for identical forms of tactile stimulation. One explanation was intended to be familiar and the other not familiar. This manipulation afforded information on the question, "Does an individual react differently to touch which challenges her conceptual schema than to touch which fits in with her conceptual schema?"

A rating scale which contains items on both positive and negative affect was employed to measure psychological effects (Watson, Clark, & Tellegen, 1988). To measure physiological effects, heart rate and skin temperature were employed as appropriate indices of sympathetic arousal and, as Mahoney (1990) has noted, system disorganization.

The present study contrasted individuals who were not touched at all with individuals who were touched for a "logical" reason with individuals who were touched for an "illogical" reason. Forehead touch was used since it was discovered to be more comfortable for subjects than many other places on the body (Tuan, Heslin, & Nquyen, 1975) and since both rational and irrational explanations for being touched on the forehead could be readily offered. Since the role of gender in touch is not clear, only female participants and female researchers were utilized. It is recognized that while these conditions may limit the generalizability of the results, the major purpose for this study was to provide more basic, sound information about the effects of touch, and that this goal would be attained if the study had fewer confounds.

Two experimental hypotheses were proposed:

Hypothesis 1: Persons who are touched, for whatever reason, will display greater psychological and physiological reactivity than persons in similar circumstances who are not touched. Reactivity was defined as individual differences

between phases in the experiment as measured by change scores within each variable measured.

Hypothesis 2: Persons who are touched for a reason that makes sense will display less psychological and physiological variability than persons who are touched for a reason that makes less sense or, perhaps, is even considered "illogical."

CHAPTER II

METHOD

Subjects

The participants in this study consisted of 60 right-handed female volunteers recruited from undergraduate psychology courses at the University of North Texas. Other than gender and hand dominance, no restrictions as to age, race, or other variables were placed on potential participants. The mean age was 21 with a range from 16 to 44. Forty-five of the participants were Caucasian, 7 were African American, 5 were Asian, and 3 were Hispanic. The educational levels of the participants were fairly evenly distributed throughout the range with 20 participants classified as freshman, 13 as sophomores, 11 as juniors, 14 as seniors, and 2 as non-degree seeking students. Those individuals who participated in this study incurred no psychological or physiological risks as a result of this study. The confidentiality of all persons was maintained by having their files number-coded and their release forms kept in a separate file.

Materials

Positive and Negative Affect Schedule. The Positive and Negative Affect Schedule (PANAS) (Watson, Clark, &

Tellegen, 1988) is a 20-item inventory which is comprised of a 10-item positive affect (PA) scale and a 10-item negative affect (NA) scale (see Appendix A). The PANAS is a four-point, Likert-type scale in which participants rate the extent that each adjective represents how they feel in the present moment with 1 representing "not at all" and 4 representing "very much." The scales have been shown to have high alpha internal consistency (α = .86 to .90 for PA and .84 to .87 for NA) and to be largely uncorrelated with each other (r = -.12 to -.23) (Watson, Clark, & Tellegen, 1988). When utilized with short-term time frames, these scales have been found to be sensitive to changing internal or external circumstances (Watson, Clark, & Tellegen, 1988). For the present study, item 8 was reversed with item 15 and item 11 with item 12 in order to maintain a balanced alteration of positive and negative items.

Skin Temperature. A Harvard Differential Temperature Monitor, Model 1704, was utilized to obtain information about each participant's skin temperature. This instrument has a temperature range of 70-100° Fahrenheit direct readout with an accuracy of ±1.0° Fahrenheit, which is considered sufficient (Peek, 1987). Input is from a thermistor skin-temperature probe secured to the skin with lightweight "paper" adhesive tape to reduce local sweating. Feedback is visual, using an integral analog panel meter. Gaardner and Montgomery (1977) noted that analog meter output is

preferable to digital LED readouts because trends and small changes are more easily followed with the analog output. The sensor was attached to the middle finger of the nondominant hand because temperature changes are the most pronounced in the extremities, such as the fingers and toes, where "vascular diameter changes are pronounced and where the relatively small amount of surrounding tissue warms and cools fairly rapidly in response to changes in blood supply" (Peek, 1987, p. 75).

Pulse. Each participant's pulse was monitored by a CIC Heart Speedometer, Model 8719 (Computer Instruments Corporation, 1987). A pulse sensor clipped to the earlobe transmitted the heart rate in beats per minute through a sensor cord to a digital display microcomputer which also displayed continuous time in minutes and seconds. The pulse readout was also continuous, changing as the heart rate changed.

Procedure

This research project included one control and two experimental groups (each with 20 participants). The participants volunteered to take part in the current study by signing their names on a flyer advertising the project (see Appendix B), which was posted on a research bulletin board on the second floor of the psychology building. One undergraduate female research assistant was utilized to help run participants in all three groups. Each participant was

assigned to one of the three groups upon arrival for their session based on a table of random numbers (Winer, 1971). Once a group was filled, numbers for that group were rejected.

The participants for the control group (Experimental Group A) were asked to set up an appointment for a 30-minute session in the psychology building. A video camera was placed in a position where it recorded the instrument panels and meters of the equipment as well as the right hand of the participants. Upon arriving for their appointment, each participant was greeted by the senior researcher and instructed to sign an informed consent form reflecting their awareness and willing participation (see Appendix C), to fill out a demographic information form (see Appendix D), to sit in a recliner, to allow the researcher to attach one non-invasive skin sensor to the middle finger of their left hand and another sensor to their right earlobe for purposes of physiological monitoring, to not speak during the session unless absolutely necessary, and to listen to audiotaped instructions, paying particular attention to the reason for the study (at which point the primary researcher blindfolded the participant to minimize extraneous interference, turned on the video camera and tape recorder, and left the room). These instructions stated that "the purpose of this experiment is to administer a mood rating scale to

university students under relaxed conditions" and requested them to do the following:

a) to relax for 90 seconds (Phase I - to obtain baseline experimental measures) after which time they were to respond to audiotaped requests for mood ratings (at the rate of one response per fifteen seconds); that is, the tape-recorded message asked the participant to rate the extent to which they were currently experiencing a given mood (e.g., "nervous") on the 4-point scale (the entire PANAS was administered once in this fashion in each phase of the experiment); the participants were asked to register their self-report by raising a corresponding number of fingers on their right hand (in order to reduce physiological interference as much as possible);

b) to continue to relax while a female research assistant entered and stayed in the room (seated to the left of the participant's head, with her body positioned in the opposite direction as the participant's) during the next phase (Phase II) of the experiment for purposes of "monitoring the experiment";

c) to again relax for 90 seconds before responding to audiotaped requests for mood ratings, after which time the research assistant left the room;

d) to again relax for 90 seconds (Phase III - to obtain post-experiment measures) and to again respond to audiotaped requests for mood ratings.

At this time, the primary researcher arrived and removed the sensors and allowed the participant to ask questions about or offer comments on the experience. The primary researcher also questioned the participant about whether they remembered the purpose of the study. This process was employed as a manipulation check.

For the two experimental groups, additions to the above procedures included signing a different consent form (see Appendix E) and allowing the research assistant to gently place her hand (palm down, thumb near hairline) across the participant's forehead after Phase I and leave it there during Phase II of the session. Also, the audiotaped instructions for Experimental Group B included the statement that "the purpose of this experiment is to evaluate a person's ability to accurately estimate another person's body temperature by feeling their forehead." Experimental Group C was told that "the purpose of this experiment is to evaluate a person's ability to accurately estimate another person's mood by feeling their forehead." The research assistant was told the same justifications for Groups B and C and was, in fact, asked to write her estimate of each participant's body temperature (in degrees Fahrenheit) or mood strength (1 to 4 on PANAS) (see Appendix F) at each of

the 20 15-second intervals during Phase II. She was told that the purpose of Group A was to gather evidence about university students' physiological and psychological profiles. Upon conclusion of the experiment, the true nature of the study was revealed to the research assistant.

All participants were offered a summary of the results of the study when they were available (they were given a request form to fill out for later mailing of a results summary - see Appendix G) and were given a card certifying that they earned one point of extra credit per half hour of participation.

The video tape was transcribed to data forms (see Appendix H) by the primary researcher with heart rate and skin temperature being recorded five seconds after each PANAS item was asked. Both data forms and consent forms were then number-coded and placed in separate locked files to ensure confidentiality.

Statistical Analysis

Psychological - For each phase, a Positive Affect (PA) score was obtained by summing the ratings of the positive items, and a Negative Affect (NA) score was obtained by summing the ratings of the negative items. Two additional scores were obtained for both PA and NA by finding the differences in ratings on each individual item from Phase I to Phase II and from Phase II to Phase III and then summing

the absolute values of these differences to yield PA and NA change scores.

Physiological - One mean heart rate (HR) index and one mean skin temperature (TEMP) index was obtained for each phase of the experiment by summing the respective scores and dividing by the number of ratings obtained during the phase. Two additional scores were obtained for each physiological measure by finding the differences between corresponding ratings from Phase I to Phase II and from Phase II to Phase III and then summing the absolute values of these differences to yield mean heart rate and mean skin temperature index change scores.

CHAPTER III

RESULTS

Descriptive statistics were obtained and graphed for Positive Affect (PA) scores, Negative Affect (NA) scores, skin temperature (TEMP) ratings, and heart rate (HR) ratings by phase and group, as were their respective change scores (PACS1 - change score from Phase I to Phase II, PACS2 - change score from Phase II to Phase III, NACS1, NACS2, TEMPCS1, TEMPCS2, HRCS1, HRCS2) (see Figures 1 through 8 and Tables 1 through 8). The control group was designated as Group A, the "logical" or physiological rationale touch group was designated as Group B, and the "illogical" or psychological rationale group was designated as Group C.

Preliminary t-tests confirmed that there were no mean differences between the groups on the above named dependant variables during Phase I. Exploration of the manipulation check (that is, did the participants remember what the purpose of the study was at the end of the session) discovered that while the majority of Group A did not remember what the purpose of the study was, the majority of Groups B and C did, in fact, remember accurately (see Figure 9). However, upon being subjected to statistical analysis, this difference between Group A and Groups B and C was not significant. The sample was divided into those who did remember and those who

did not, and then the subgroup of persons who did remember was analyzed in the manner to be described below. The results obtained with this subgroup did not differ from those obtained when the entire sample was utilized, so only the entire sample analyses will be presented.

The rest of the analyses will be presented in five major sections. The first and second sections will discuss analyses of Positive and Negative Affect scores and their change scores, respectively. Section three will examine skin temperature ratings and change scores. The fourth section will deal with heart rate ratings and change scores. The last section will examine the relationships among the different measures. For PA, NA, TEMP, and HR scores, 3 X 3 (group by phase) analyses of variance (ANOVAs) with repeated measures on the second factor were utilized. For change scores 3 X 2 (group by phase) ANOVAs with repeated measures on the second factor were employed.

PANAS Positive Affect

As can be seen from Table 1, while the mean PA scores for Group A remained relatively constant across phases, Groups B and C had mean PA scores which decreased each phase. When analyzed with a 3 X 3 (group by phase) repeated measures ANOVA, while the set value of .05 for statistical significance was not reached for a group by phase interaction, the obtained level did approach significance, $F(4,114) = 2.04$, $p = .094$. On the other hand, a significant main effect for phase was

discovered, $F(2,114) = 5.56$, $p < .01$ (see Table 9). Follow up planned comparisons revealed that, overall, PA1 and PA2 were significantly higher than PA3 ($t = 2.59$, $p < .05$, and $t = 3.31$, $p < .01$, respectively) (see Table 10). Further investigation with the Student Newman Keuls post hoc procedure revealed that Group A had significantly higher PA scores than Group C during Phases II and III ($t = 2.48$, $p < .05$, $t = 2.86$, $p < .01$, respectively). T-tests for each group also revealed that Group A had higher PA scores during Phase II than Phase III ($t = 2.18$, $p < .05$) (see Table 11), and Group C had higher PA scores during Phases I and II than during Phase III ($t = 2.87$, $p < .05$, $t = 3.57$, $p < .01$, respectively) (see Table 13). For the two PA change scores, a 3 X 2 (group by phase) repeated measures ANOVA again demonstrated a strong main effect for phase, $F(1,57) = 20.34$, $p < .001$, but no significant group by phase interaction (see Table 9). PACS1 was significantly greater than PACS2 overall, $t = 3.57$, $p < .01$ (see Table 10) and also for both Groups A and C ($t = 2.51$, $p < .05$, $t = 2.90$, $p < .01$, respectively) (see Tables 11 and 13).

To specifically investigate the first hypothesis, that persons who are touched, for whatever reason, will display greater psychological and physiological reactivity than persons in similar circumstances who are not touched, the two touch groups, B and C, were combined and compared with the control Group A. No significant group by phase interactions

were obtained (see Table 14). However, main effects for phase on both PA scores and PA change scores did reach significance, $F(2,114) = 3.60$, $p < .05$, and $F(1,57) = 21.57$, $p < .001$, respectively. These effect were in the same direction as described above.

The second hypothesis, that persons who are touched for a reason that makes sense will display less psychological and physiological variability than persons who are touched for a reason that makes less sense or, perhaps, is even considered "illogical", was investigated by comparing the two touch groups, B and C with t-tests. No significant differences on the PANAS Positive or Negative Affect scores or change scores, mean skin temperature ratings or change socres, or mean heart rate ratings or change scores were found (see Table 15).

PANAS Negative Affect

As with the PA scores, overall, a significant main effect for phase was found, $F(2,114) = 5.39$, $p < .01$, with both NA1 and NA2 being higher than NA3, $t = 2.65$, $p < .05$, $t = 3.56$, $p < .01$, respectively (see Tables 9 and 10). However, a significant group by phase interaction was not demonstrated. Group A had higher scores on both NA1 and NA2 than NA3, $t = 2.22$, $p < .05$, $t = 2.39$, $p < .05$, respectively (see Table 11) and Group B had higher NA2 scores than NA3, $t = 2.30$, $p < .05$ (see Table 12).

With the NA change scores, while the anticipated significant group by phase interaction was not found, a main

effect for phase was discovered, $F(1,57) = 6.54$, $p < .05$. NACS1 was larger than NACS2, $t = 2.57$, $p < .05$, overall, but not for the individual groups (see Tables 10 through 13).

No significance was found for a group by phase interaction when Groups B and C were combined (see Table 14). However, significant main effects for phase were found with both NA, $F(2,114) = 6.01$, $p < .01$, and NA change scores, $F(1,57) = 5.50$, $p < .05$, in the same direction as found when all groups were compared. No significant differences were obtained when Group B was compared with Group C.

Temperature Ratings

Ocular analysis of Table 5 will reveal that the mean temperature ratings of the groups had little variation between the groups or the phases. This observation was borne out in statistical analyses where no significance was found for either the mean temperature ratings or the TEMP change scores (see Table 9) or when Groups B and C were combined and compared with Group A (see Table 14) or when Group B was compared with Group C. No further statistical investigation was conducted since significance was not found using repeated measures ANOVAs.

Heart Rate Ratings

Mean heart rate scores varied significantly across phases, $F(2,114) = 19.40$, $p < .001$, with HR1 being greater than HR2 and HR3 overall, $t = 4.63$, $p < .001$, $t = 4.88$, $p < .001$, respectively, and HR2 greater than HR3, $t = 2.04$, $p <$

.05. Within Group A, HR1 was significantly larger than both HR2 and HR3, and HR2 was larger than HR3 (see Table 11). Group B had higher HR1 scores than both HR2 and HR3 (see Table 12). Group C only had a significantly larger HR1 than HR3 (see Table 13). The group by phase interaction for heart rate scores, while not reaching an acceptable level, did approach statistical significance, $F(4,114) = 2.00$, $p = .099$. When compared across groups within phases, Group A had a significantly higher HR2 score than did Group B, $t = 2.32$, $p < .05$.

The heart rate change scores were also found to be significantly different across phases only, $F(1,57) = 4.53$, $p < .05$ (see Table 9) with HRCS1 being larger than HRCS2, $t = 2.14$, $p < .05$. This significant difference was not found within the individual groups across phases (see Tables 11 through 13).

When Groups B and C were combined and compared with Group A, a significant group by phase effect was found for heart rate ratings, $F = 3.53$, $p < .05$. Group A had higher mean heart rate scores than the touch groups especially during Phase II, $t = 2.04$, $p < .05$. However, the two touch groups had more variability in their scores than did the control group, providing partial support for the first hypothesis. When Groups B and C were compared, no significant differences were found to support the second hypothesis.

Relationships Among the Measures

Statistical investigation into the relationships among the measures was conducted by computing Pearson correlation coefficients. As with the previous analyses, the entire was analyzed before breaking it down into the three groups. With this overall analysis, the following significant correlations were found: PA1 with TEMP1, $r = .27$, $p < .05$; NA1 with TEMP1, $r = .31$, $p < .05$; NA2 with TEMP2, $r = .30$, $p < .05$; PA3 with TEMP3, $r = .26$, $p < .05$; PACS1 with TEMPCS1, $r = -.35$, $p < .01$; NACS1 with PACS1, $r = .46$, $p < .001$; and NACS2 with PACS2, $r = .34$, $p < .01$.

When the sample was split into their respective groups and analyzed, Group A had a significant correlation only between PACS2 and NACS2, $r = .82$, $p < .001$. Group B had significant correlations between PACS1 and TEMPCS1, $r = -.48$, $p < .05$, and PACS1 and NACS1, $r = .49$, $p < .05$. Of the three groups, Group C had the most significant correlations among the measures: PA1 with TEMP1, $r = .56$, $p < .05$; PA2 with TEMP2, $r = .65$, $p < .01$; PA2 with NA2, $r = .44$, $p < .05$; PA3 with TEMP3, $r = .64$, $p < .01$; and PACS1 with NACS1, $r = .58$, $p < .01$.

CHAPTER IV

DISCUSSION

This dissertation explored the effects of being touched versus not being touched on positive and negative emotional responses, skin temperature, and heart rate. The literature overwhelmingly suggested that human touch does indeed have an influence on human beings. However, while the literature indicated that there are many different effects of touch, many different confounding variables, such as setting, sex of toucher and touchee, location and pressure of the touch, have not been controlled. The literature on touch appears to have leaped into the running stage without first going through the crawling and walking stages. The present research attempted to investigate the basic foundations of a person's responses to being touched. To minimize confounding influences, only female participants and female researchers were utilized, time of day was counterbalanced in all groups, instructions were audiotaped, room temperature and lighting were controlled for, responses were videotaped, and the research assistant was blind to the true nature of the study. Unfortunately, in spite of this degree of control, the major findings of this study did not support the hypotheses.

Hypothesis One

The first hypothesis, that persons who are touched, for whatever reason, will display greater psychological and physiological reactivity than persons in similar circumstances who are not touched, was not fully supported. Reactivity was defined as individual differences (change scores) in psychological and physiological parameters (Positive and Negative Affect Schedule - PANAS - ratings, skin temperature, and heart rate) from phase to phase. While no significance for group by phase interactions were found when all three groups were compared in repeated measures ANOVAs, when Groups B and C were combined and compared with Group A, significance was found for heart rate ratings. The heart rate of the persons in the two touch groups had more variability than the persons in the no-touch control group. It is not surprising that of all the measures, heart rate would be the first to become significantly different between the groups.

Part of this lack of surprise is because the two psychological measures, Positive Affect (PA) and Negative Affect (NA), were obtained from self-report measures which were not anonymous at the time of report. It is widely known that self-report measures are notoriously subject to deception by the informant. Since the participants knew that a researcher would be in the room with them at some point, it is not unlikely that some form of deceptive self-

presentation would have been present. In contrast, heart rate, as with skin temperature, is more difficult for the participant to manipulate.

Also, skin temperature change occurs relatively slowly, perhaps too slowly to be noticeable in the 15 seconds between PANAS descriptors. However, limited budget and equipment restricted the choice of physiological measures available, and the literature suggested that skin temperature was an acceptable measure (Basmajian, 1983; Blanchard & Epstein, 1977; Gaardner & Montgomery, 1977; Green & Green, 1977; Sedlacek, 1983). Since the experimental room was constantly kept at a temperature of 75 degrees while the rest of the building hovered around 65 degrees, and the fact that many participants came directly into the room from outdoors, it is possible that the time it took for the participants' skin temperature to adjust and stabilize confounded the measurements taken during the session.

On the other hand, heart rate responds relatively quickly to stimuli. When all the groups were combined, even though the heart rates of the participants significantly decreased across phases, perhaps due to the relaxing nature of reclining in a comfortable chair, fluctuations can still be seen in each person's heart rate in response to certain PANAS descriptors. Differences were more apparent when the groups were compared. As a natural adaptation response, it

would be expected that heart rate would slow down throughout the session, and, with most variables held constant, this process should be altered only by the experimental manipulation. In Group A, heart rate significantly decreased steadily across all phases, while Group B did not have a significant decrease from Phase II to III and Group C did not have significant decreases from Phase I to III or from Phase II to III. It is certainly noteworthy that the participants who were touched, for whatever reason, had less of a decrease across phases than participants who were not touched. It is likely that the more intrusive act of being touched kept the heart rates of Groups B and C participants from continuing to decrease as steadily from Phase II to Phase III as those in Group A. Further, Group C, whose members were given an "illogical" reason for being touched, had the least amount of decrease from Phase I to III. These findings provide some support for the literature which suggests that touch affects a person's physiological processes.

Hypothesis Two

The second hypothesis, that persons who are touched for a reason that makes sense will display less psychological and physiological variability than persons who are touched for a reason that makes less sense or, perhaps, is even considered "illogical," was not statistically supported in

the present study. Possible explanations for the lack of expected results will be discussed later.

Other Findings

While the major hypotheses were not fully supported in the present investigation, other results were found which are worth noting and may provide indirect support for the hypotheses. A significant main effect for phase was obtained for every dependent measure, except for skin temperature, when the three groups were compared. One trend which was significant was for both PA and NA scores to decrease across phases. It may be that the experience was relaxing enough for the participants that they felt less emotionality in general. The fact that approximately one-third of the participants fell asleep for a few seconds during the session would lend support to this notion. When all three groups were combined and subjected to t-tests, significance was discovered between each phase to phase measurement except for Phase I and Phase II PA and NA scores. In this case, Phase III PA and NA scores were significantly less than Phases I and II. Also, when the differences within groups on these measurements were explored, each group had significant differences, with Group A having the most differences. Perhaps Group A, the control group, felt less defensive and responded more honestly since they were told they were simply being administered a mood questionnaire.

Of all the results, why were there main effects for phase but only one significant group by phase interaction? These main effects for phase provide strong indications that something was happening to the participants throughout the session and are likely attributable to a difference in what they were experiencing in each phase of the session. Perhaps a larger sample size or elimination of the possible methodological problems which will be discussed below may have resulted in larger differences between groups so that the desired group by phase interactions would have been observed.

Positive Affect and Negative Affect change scores (PACS, NACS) were strongly correlated with each other. When the groups were combined, the change scores from Phase I to II were significantly larger for both Positive and Negative Affect than from Phase II to III. It is possible that the experimental manipulation of having a research assistant enter the room, regardless of whether she touched the participant or not, was enough of an ambiguous stimulus that the participant was emotionally affected by it. Further, once the ambiguity was cleared and the participant was no longer challenged by an unknown, the emotional state stabilized. However, it is interesting that when the groups were analyzed separately, both the touch groups had significant correlations between PACS1 and NACS1 while the control group had a significant correlation between PACS2

and NACS2. It is possible that the this difference could be due to the manipulation. Both touch groups anticipated the experience of being touched and perhaps had their greatest and most similar emotional changes between PA and NA from Phase I to Phase II. On the other hand, the control group had more similar patterns of change between PA and NA from Phase II to Phase III.

Other more complicated findings are the correlations between PA and temperature (TEMP) and NA and TEMP in each phase. It would be expected that PA would be positively correlated with skin temperature since increased finger skin temperature indicates a more relaxed state of being (Sedlacek, 1983). Therefore, as skin temperature increased, this was reflected by an increase in the strength of positive affect felt. However, the positive correlations, when all the groups were combined, between NA and TEMP during the first two phases are surprising. While not significantly different, it was observed that NA was highest in Group A, less in Group B, and least in Group C. The same observation was made for skin temperature. While this perhaps could account for the significant positive correlations, it is unlikely to be clinically significant. It is unfortunate that the differences between groups and phases were not large enough to be detected as significant group by phase interactions. It is possible that these findings are simply artifacts. A logical explanation for

these results cannot be found. Further investigation with larger sample sizes could shed light on this and either confirm or disprove this current observation.

Possible Methodological Problems

One factor which may help account for the lack of expected results could be the manipulation itself. Clearly half of the participants could not accurately remember the rationale given for the study at the end of the session even though they were explicitly told at the beginning of the session, by the primary researcher, to pay particular attention to the rationale given at the beginning of the tape. It is possible that the taped instructions were too monotonous and boring to hold a participant's attention fully. It is also likely that listening and responding to a taped message demands less energy and motivational investment than does person-to-person interaction. In fact, one-third of the sample commented on how relaxing the tape was and how they would drift off to sleep periodically. Indeed, the primary researcher noted many participants, at different times of the day, occasionally falling to sleep for a few seconds at a time. It would be difficult to find a substitute for the tape since the tape was employed to help control for differences in the researcher's voice inflection, speed, volume, tone, etc., from participant to participant. Also, the PANAS descriptors were deliberately administered in a monotone voice in order to prevent

influencing or altering the participants' moods. Perhaps having the descriptors displayed one at a time on a visual field for the participants to read would improve this problem.

It may also be the case that the "mood estimation" rationale given to Group C was simply not believable by the sample of college students. Most of the sample were psychology students, and all participants had been in several experiments prior to volunteering for the present study. Some degree of sophistication or knowledge about experimental deception would be expected. It is also possible that the "illogical" reason may not have been enough of a challenge to activate a high degree of sympathetic arousal and, consequently, to affect skin temperature.

Another part of the manipulation, the touch, may also have been too weak. The forehead was chosen as the site of touch precisely because the literature (Kenshalo, 1978; Tuan, Heslin, & Nquyen, 1975) indicated that it was one of the most comfortable areas of the body to be touched. In attempting to create an atmosphere of comfort for the participants, it is likely that the strength of the manipulation was lessened to the point of ineffectiveness if being touched on the forehead was so comfortable that it did not evoke noticeable emotional or physiological responses.

Two other factors which may help account for the lack of desired results are the nature of the sample itself and the timing of the experiment. Purely for the sake of convenience, undergraduate college women were utilized as volunteers. In order to recruit volunteers, extra credit was given for participation. Every volunteer who participated in this study had recently participated in several other experiments as well in order to obtain as much extra credit as possible for their classes. It was observed by this author that the majority of the participants appeared tired, rushed, and were motivated to take part in the present study only for extra credit. Only two participants asked what the study was truly investigating after the session ended. It seems logical that if the study had been conducted with persons who were more motivated to participate for heuristic or altruistic reasons, different results may have been obtained.

Summary

It was posited that touch would cause variability in a person's psychological and physiological processes. While the hypotheses were not supported, evidence was provided which indicated that they likely would be supported under more ideal circumstances. It is also possible that the results which were obtained are valid and represent the true nature of a female's responses to being touched on the forehead. If forehead touch is indeed comfortable and non-

threatening, perhaps there would be no unusual psychological or physiological responses. If this is the case, then one plausible next step would be to explore the effects of gender on forehead touch, males touching males, females touching males, and males touching females. Another next step could be to explore different areas of touch on the body, for instance, the hands or the stomach. However, in light of the concerns about methodological problems, such a conclusion that the results are valid should be arrived at extremely cautiously.

Since the present study was planned to be the first in a series of studies on touch, it was of great heuristic value. Future investigations will explore different body areas to be touched, strengthen the manipulation by requiring more effort and attention from the participants, and utilize persons other than college students. It is still of great interest to this researcher to investigate system disorganization in the context of touch and the rationale given for touch. Perhaps researchers and/or settings with a mystical or spiritual appearance could be arranged and a rationale involving psychic healing or communicative abilities would be one possible way to study system disorganization. Many different possibilities can be invented. Of course, more sophisticated measures than skin temperature would be employed. It would be ideal to utilize

brain-mapping techniques and track neuronal firing patterns in a study of touch and system disorganization.

While the current research did not support the hypotheses set forth, it did confirm the complex and vulnerable nature of research with touch. The problems noted with the present study lends support to the notion that all research with touch must be interpreted cautiously since so many variables can confound the results. It may be the case that designing a context which is nonreactive in which to study touch is not possible since touch may be too intimate an event and which will always be interpreted in light of some context. Further research in this area will shed light on these possibilities.

APPENDIX A

PANAS SCALE

APPENDIX A

Please circle the number to the right of each term that best reflects the extent to which you feel that way <u>at this moment</u>.

		Not at All			Very Much
1.	Active	1	2	3	4
2.	Afraid	1	2	3	4
3.	Alert	1	2	3	4
4.	Ashamed	1	2	3	4
5.	Attentive	1	2	3	4
6.	Distressed	1	2	3	4
7.	Determined	1	2	3	4
8.	Enthusiastic	1	2	3	4
9.	Excited	1	2	3	4
10.	Guilty	1	2	3	4
11.	Hostile	1	2	3	4
12.	Inspired	1	2	3	4
13.	Interested	1	2	3	4
14.	Irritable	1	2	3	4
15.	Jittery	1	2	3	4
16.	Nervous	1	2	3	4
17.	Proud	1	2	3	4
18.	Scared	1	2	3	4
19.	Strong	1	2	3	4
20.	Upset	1	2	3	4

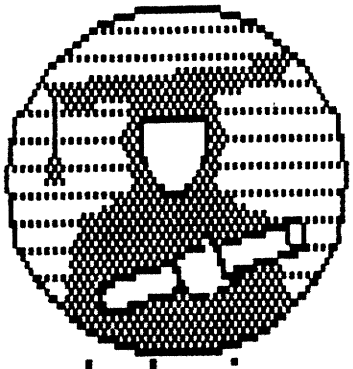
APPENDIX B

SIGN UP SHEET

APPENDIX B

FEMALES!!!

I need your help to graduate. I am conducting a research study with



psycho and physio measures involved. 1 - 2 points extra credit given. Must be right handed, any age or race. Sign up below.

APPENDIX C

CONSENT FORM - CONTROL GROUP

APPENDIX C

Code Number _____

Informed Consent

I, _____, agree to participate in a study investigating physiological and psychological factors at the University of North Texas. I understand that my participation will involve: a 30-minute session in Terrill Hall; sitting in a reclined position in a quiet, comfortable room; and having one non-invasive skin electrode attached to the middle finger on my left hand and another attached to my right earlobe for approximately 20 minutes, during which time audiotaped questions about my mood will be asked.

I have been informed that any information obtained in this study will be recorded with a code number that will allow the researchers to protect my confidentiality. I understand that there is no personal risk or discomfort directly involved with this research and that I am free to withdraw my consent and discontinue my participation at any time without prejudice or penalty. The benefits I can expect involve the common reactions to rest and relaxation, as well as one point extra credit per half hour of participation. I will be given a summary of the results of this study, upon request, when they are available.

If I have any questions or problems that arise in connection with my participation in this study, I should contact Rita A. Kohl, the primary researcher, or Dr. Michael J. Mahoney, the project chair, at (817)565-3289 or office 343, Terrill Hall.

_____ _____

Participant Date

_____ _____

Investigator Date

APPENDIX D

DEMOGRAPHIC FORM

APPENDIX D

Demographic Form

Date _____ Code Number _____

1. Age _____
2. Race _____
3. Freshman ___ Sophomore ___ Junior ___ Senior ___
4. Major _____
5. Did you grow up in urban or rural area? _____
6. Do you now live in an urban or rural area? _____
7. Marital status _____
8. Number of children _____
9. Type of employment _____
10. Do you currently have any illnesses which affect your physiological condition? _____
11. Do you currently have any illnesses which affect your psychological condition? _____

APPENDIX E

CONSENT FORM - EXPERIMENTAL GROUPS

APPENDIX E

Code Number _____

Informed Consent

I, _____, agree to participate in a study investigating physiological and psychological factors at the University of North Texas. I understand that my participation will involve: a 30-minute session in Terrill Hall; sitting in a reclined position in a quiet, comfortable room; having one non-invasive skin electrode attached to the middle finger on my left hand and another attached to my right earlobe for a period of approximately 20 minutes during which time audiotaped questions about my mood will be asked; and having a female research assistant place her palm on my forehead for 10 of the 20 minutes.

I have been informed that any information obtained in this study will be recorded with a code number that will allow the researchers to protect my confidentiality. I understand that there is no personal risk or discomfort directly involved with this research and that I am free to withdraw my consent and discontinue my participation at any time without prejudice or penalty. The benefits I can expect involve the common reactions to rest and relaxation, as well as one point extra credit per half hour of

participation. I will be given a summary of the results of this study, upon request, when they are available.

If I have any questions or problems that arise in connection with my participation in this study, I should contact Rita A. Kohl, the primary researcher, or Dr. Michael J. Mahoney, the project chair, at (817)565-3289 or office 343, Terrill Hall.

_____ _____

Participant Date

_____ _____

Investigator Date

APPENDIX F

DATA FORM - RESEARCH ASSISTANT

APPENDIX F

Data Form

Date _____ Time _____ Code Number _____

	PANAS rating	Skin Temp
1. Active	_____	_____
2. Afraid	_____	_____
3. Alert	_____	_____
4. Ashamed	_____	_____
5. Attentive	_____	_____
6. Distressed	_____	_____
7. Determined	_____	_____
8. Jittery	_____	_____
9. Excited	_____	_____
10. Guilty	_____	_____
11. Inspired	_____	_____
12. Hostile	_____	_____
13. Interested	_____	_____
14. Irritable	_____	_____
15. Enthusiastic	_____	_____
16. Nervous	_____	_____
17. Proud	_____	_____
18. Scared	_____	_____
19. Strong	_____	_____
20. Upset	_____	_____

APPENDIX G

REQUEST FOR RESULTS OF STUDY

APPENDIX G

Request for Results of Study

I would like to have the results of this study, when available, mailed to me at the following address (please print):

_____

Name

_____

Address

_____

City, State, Zip Code

_____ _____

Signature of Participant Date

APPENDIX H

DATA FORM - PRIMARY RESEARCHER

APPENDIX H

Data Form

Date _____ Time _____ Code Number _____

	PANAS rating	Skin Temp	Heart Rate
1. Active			
2. Afraid			
3. Alert			
4. Ashamed			
5. Attentive			
6. Distressed			
7. Determined			
8. Jittery			
9. Excited			
10. Guilty			
11. Inspired			
12. Hostile			
13. Interested			
14. Irritable			
15. Enthusiastic			
16. Nervous			
17. Proud			
18. Scared			
19. Strong			
20. Upset			

APPENDIX I

TABLES AND GRAPHS

Figure 1
Descriptive Information for PANAS Positive Affect (PA) Scores by Group and Phase

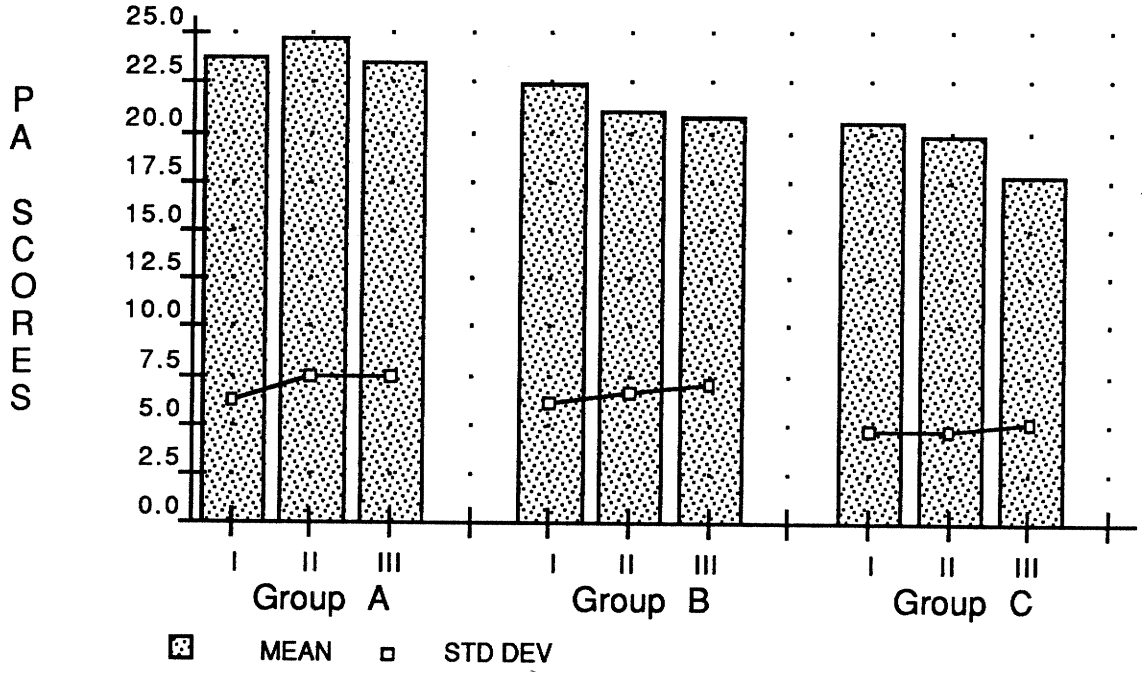


Table 1
Descriptive Information for PANAS Positive Affect Scores

	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Phase						
I	23.55	6.28	22.25	6.18	20.45	4.70
II	24.60	7.46	20.95	6.65	19.70	4.77
III	23.40	7.47	20.70	7.05	17.60	5.12

Figure 2
Descriptive Information for PANAS Positive Affect (PA) Change Scores by Group and Phase

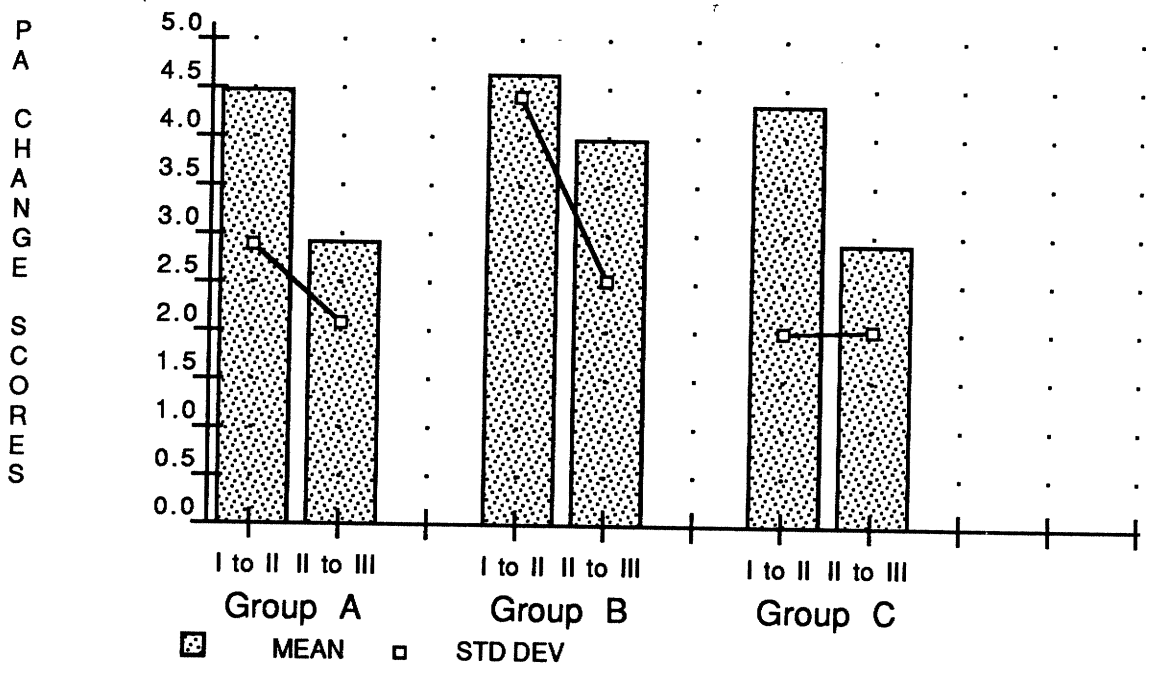


Table 2
Descriptive Information for PANAS Positive Affect Change Scores

	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Phase						
I to II	4.45	2.89	4.60	4.42	4.30	2.00
II to III	2.90	2.08	3.95	2.54	2.90	2.02

Figure 3
Descriptive Information for PANAS Negative Affect (NA) Scores by Group and Phase

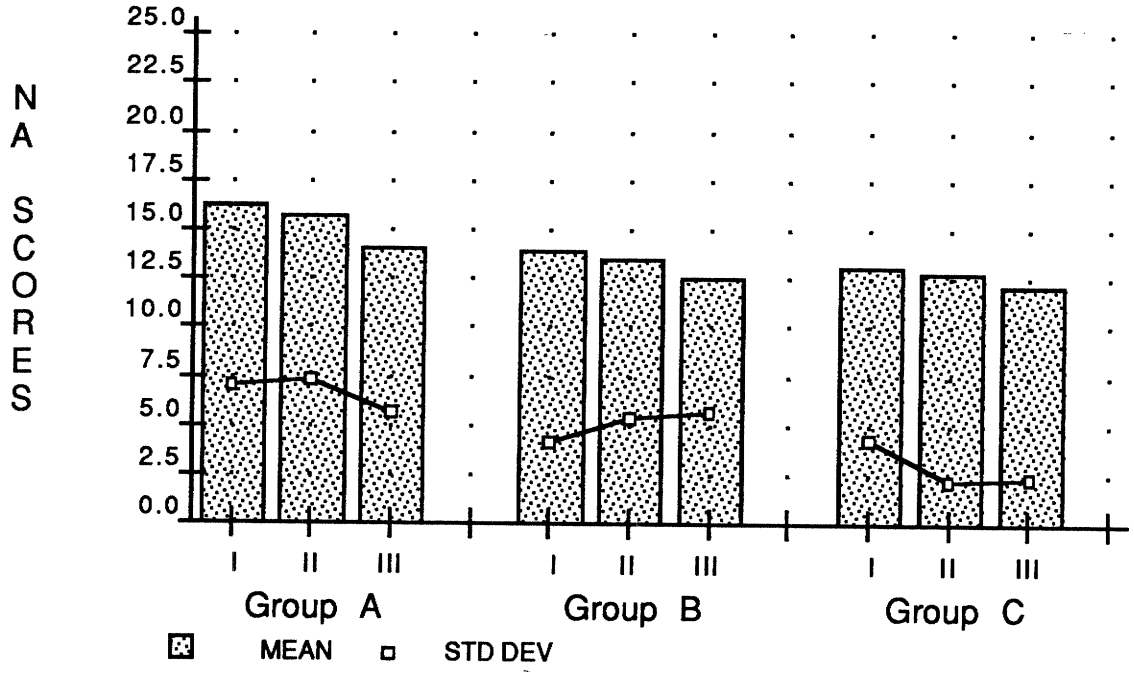


Table 3
Descriptive Information for PANAS Negative Affect Scores

	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Phase						
I	16.05	7.08	13.80	4.23	12.95	4.31
II	15.60	7.31	13.35	5.37	12.65	2.28
III	13.90	5.74	12.40	5.75	11.95	2.42

Figure 4
Descriptive Information for PANAS Negative Affect (NA) Change Scores by Group and Phase

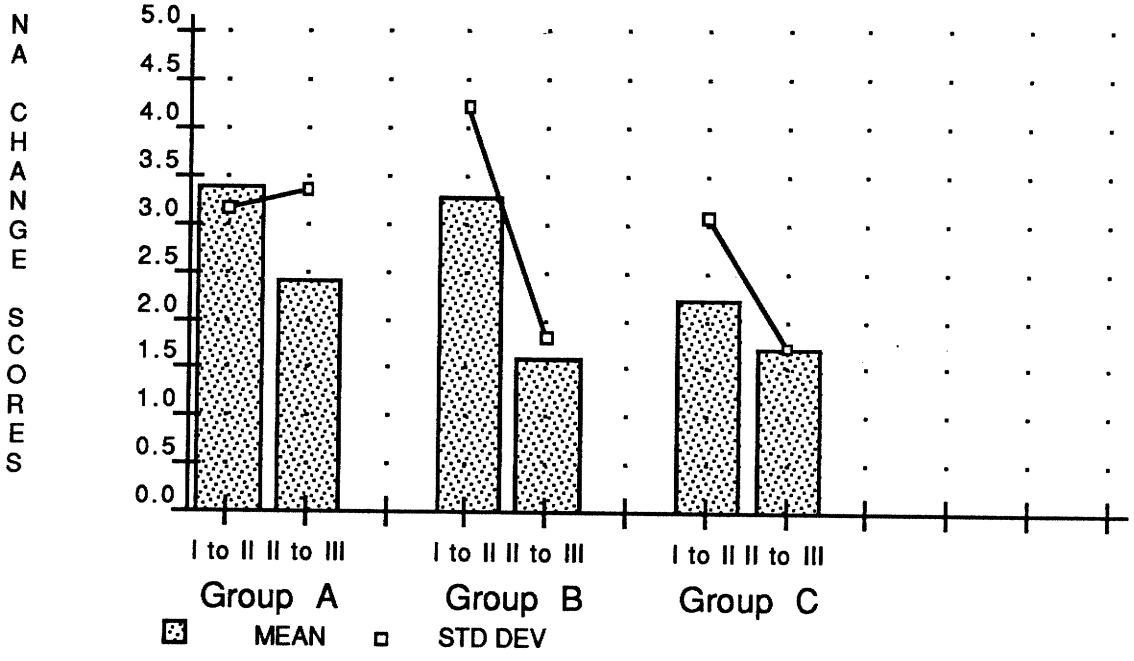


Table 4
Descriptive Information for PANAS Negative Affect Change Scores

	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Phase						
I to II	3.35	3.17	3.25	4.22	2.20	3.09
II to III	2.40	3.36	1.55	1.82	1.70	1.72

Figure 5
Descriptive Information for Temperature Ratings by Group and Phase

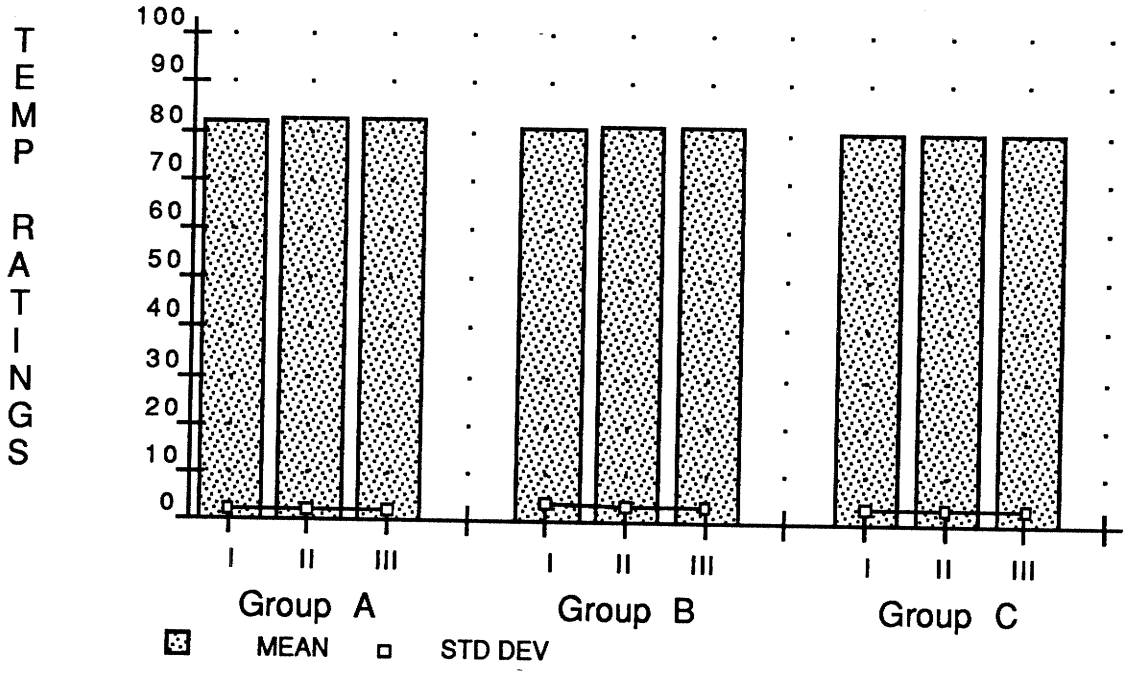


Table 5
Descriptive Information for Temperature Ratings

	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Phase						
I	81.86	2.19	80.70	3.67	79.98	3.44
II	82.01	2.23	80.94	3.26	80.11	3.40
III	81.96	2.26	80.85	3.35	80.16	3.41

Figure 6
Descriptive Information for Temperature Rating Change Scores by Group and Phase

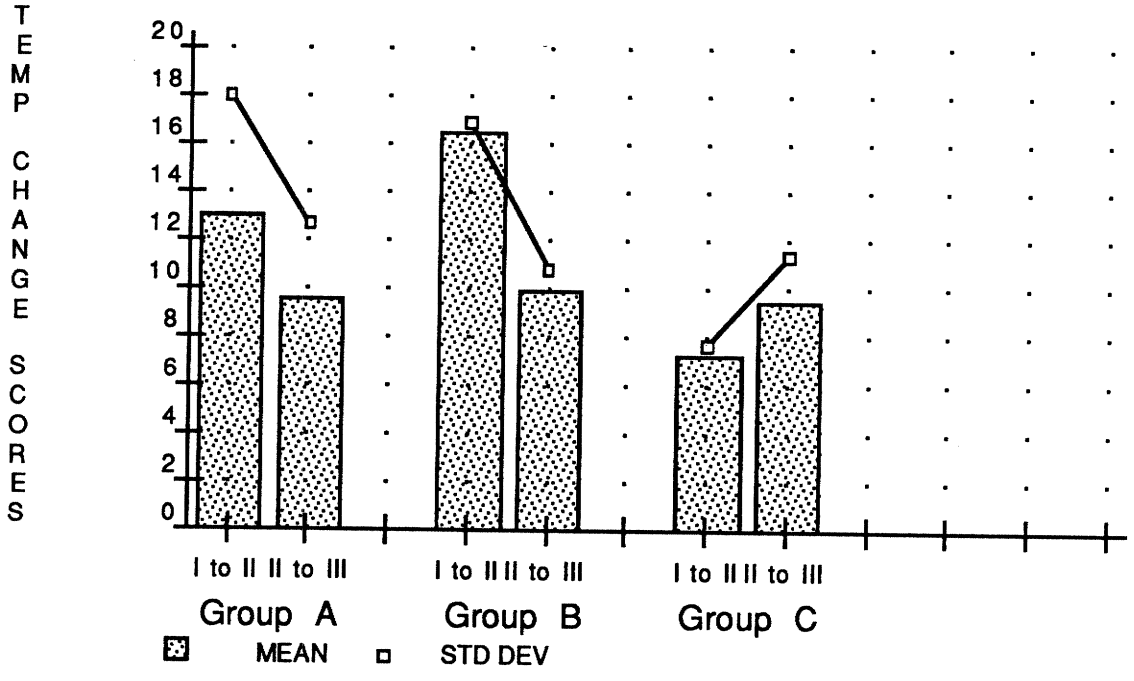


Table 6
Descriptive Information for Temperature Rating Change Scores

	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Phase						
I to II	12.85	17.97	16.35	16.91	7.15	7.71
II to III	9.45	12.65	9.75	10.77	9.30	11.31

Figure 7
Descriptive Information for Heart Rate Ratings by Group and Phase

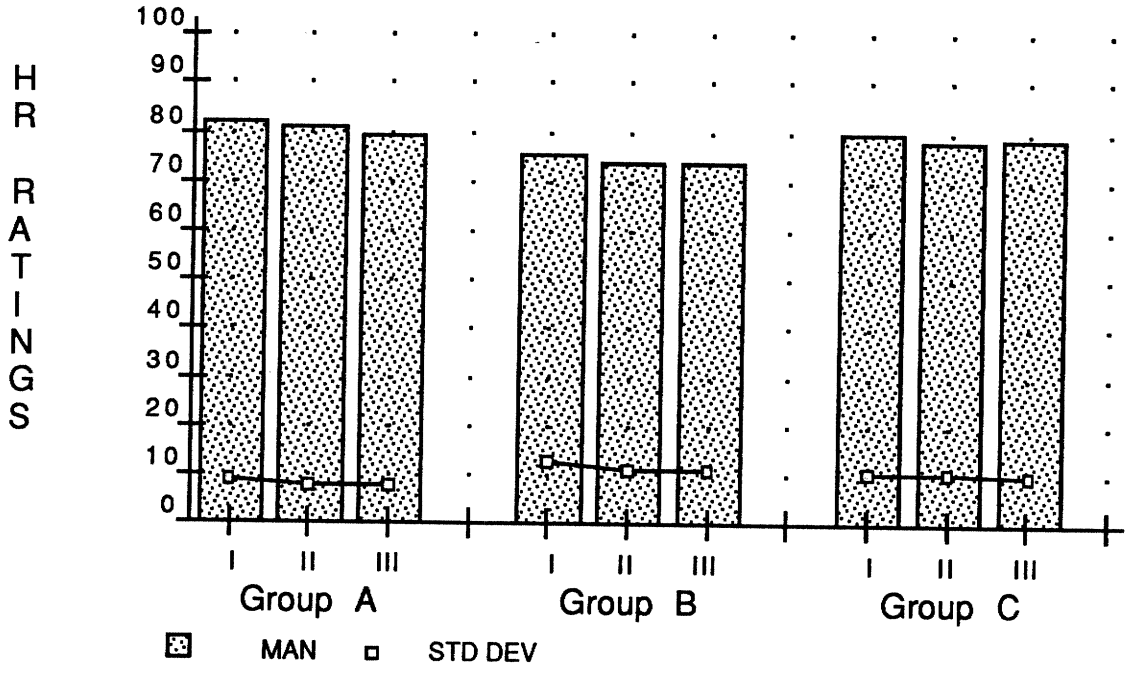


Table 7
Descriptive Information for Heart Rate Ratings

	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Phase						
I	81.85	8.89	74.97	12.69	79.34	10.80
II	80.67	7.86	73.59	11.13	77.72	10.55
III	78.99	7.56	73.23	10.97	78.13	9.82

Figure 8
Descriptive Information for Heart Rate Change Scores by Group and Phase

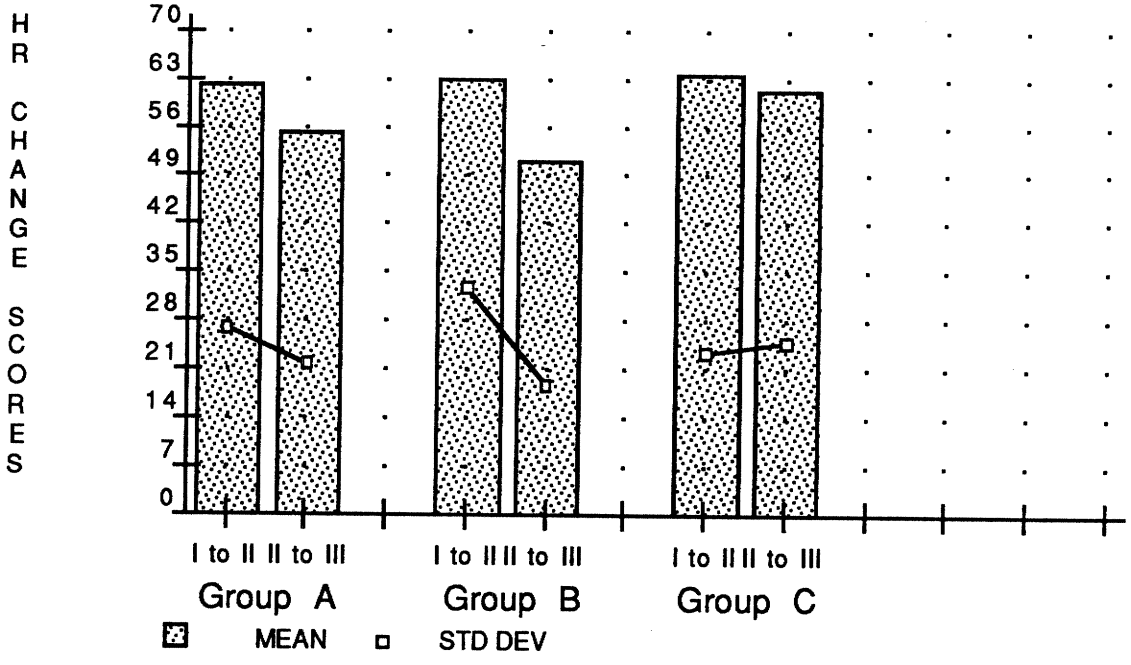


Table 8
Descriptive Information for Heart Rate Change Scores

	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Phase						
I to II	61.80	26.84	62.75	32.57	63.40	23.52
II to III	54.95	21.91	50.70	18.84	61.05	24.84

Figure 9
Comparison of Groups A, B, and C on Post-Session Recollection of the Purpose of the Study

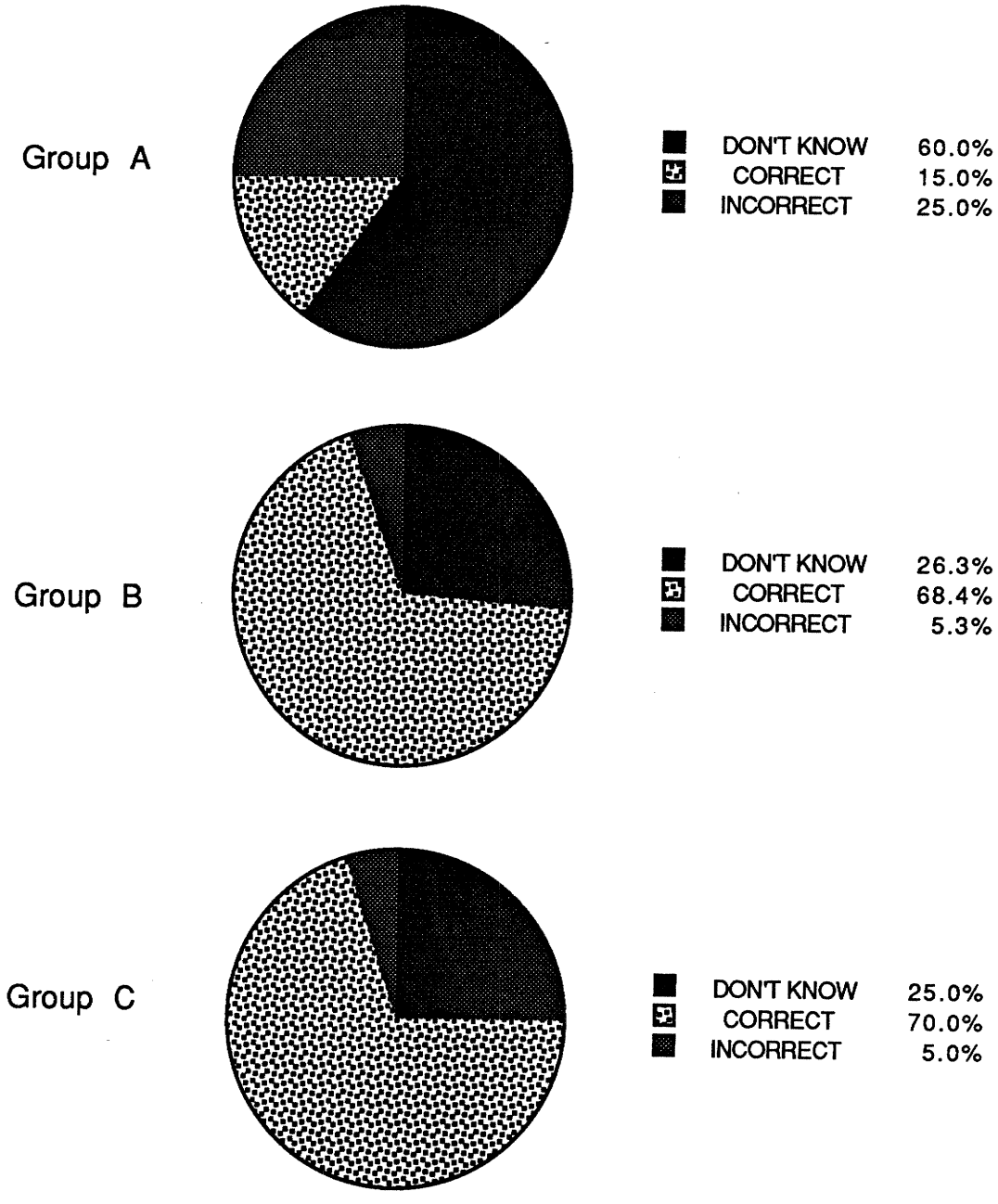


Table 9
Group (A, B, C) by Phase (I, II, III) ANOVAs with Repeated Measures on Phase

	Phase		Group by Phase	
	F	Sig of F	F	Sig of F
PA Scores	5.56	.005**	2.04	.094
PA Change Scores	20.34	.000**	.89	.415
NA Scores	5.39	.006**	.30	.877
NA Change Scores	6.54	.013*	.73	.488
Temperature Ratings	1.12	.330	.08	.989
Temp Change Scores	1.93	.170	1.84	.167
Heart Rate Ratings	19.40	.000**	2.00	.099
Heart Rate Change Scores	4.53	.038*	.71	.496

$N_1 = 20$ $N_2 = 20$ $N_3 = 20$ *$p < .05$ *$p < .01$

Table 10
T-Tests on Positive and Negative Affect Scores (PA1, PA2, PA3, NA1, NA2 NA3), Heart Rate Ratings (HR1, HR2, HR3), and Change Scores (PACS1, PACS2, NACS1, NACS2, HRCS1, HRCS2) without Group Division

	X	t	p
PA1 PA2	22.08 21.75	.68	.498
PA1 PA3	22.08 20.57	2.59	.012*
PA2 PA3	21.75 20.57	3.31	.002*
PACS1 PACS2	4.45 3.25	3.57	.001**
NA1 NA2	14.27 13.87	.81	.423
NA1 NA3	14.27 12.75	2.65	.010**
NA2 NA3	13.87 12.75	3.56	.001**
NACS1 NACS2	2.93 1.88	2.57	.013*
HR1 HR2	78.72 77.33	4.63	.000**
HR1 HR3	78.72 76.78	4.88	.000**
HR2 HR3	77.33 76.78	2.04	.046*
HRCS1 HRCS2	62.65 55.57	2.14	.037*

N = 60 *p < .05 *p < .01

Table 11
T-Tests on Positive and Negative Affect Scores, Heart Rate Ratings, and Change Scores on Group A

	X	t	p
PA1	23.55	-1.24	.229
PA2	24.60		
PA1	23.55	.15	.880
PA3	23.40		
PA2	24.60	2.18	.042*
PA3	23.40		
PACS1	4.45	2.51	.021*
PACS2	2.90		
NA1	16.05	.69	.500
NA2	15.60		
NA1	16.05	2.22	.039*
NA3	13.90		
NA2	15.60	2.39	.027*
NA3	13.90		
NACS1	3.35	1.59	.127
NACS2	2.40		
HR1	81.85	2.25	.036*
HR2	80.67		
HR1	81.85	4.44	.000**
HR3	78.99		
HR2	80.67	4.93	.000**
HR3	78.99		
HRCS1	61.80	1.25	.225
HRCS2	54.95		

N = 20 *p < .05 *p < .01

Table 12
T-Tests on Positive and Negative Affect Scores, Heart Rate Ratings, and Change Scores on Group B

	X	t	p
PA1 PA2	22.25 20.95	1.46	.160
PA1 PA3	22.25 20.70	1.51	.149
PA2 PA3	20.95 20.70	.37	.714
PACS1 PACS2	4.60 3.95	1.01	.324
NA1 NA2	13.80 13.35	.41	.685
NA1 NA3	13.80 12.40	1.12	.278
NA2 NA3	13.35 12.40	2.30	.033*
NACS1 NACS2	3.25 1.55	1.88	.075
HR1 HR2	74.97 73.59	2.42	.025*
HR1 HR3	74.97 73.23	2.41	.026*
HR2 HR3	73.59 73.23	.91	.374
HRCS1 HRCS2	62.75 50.70	2.01	.059

N = 20 *p < .05 *p < .01

Table 13
T-Tests on Positive and Negative Affect Scores, Heart Rate Ratings, and Change Scores on Group C

	X	t	p
PA1 PA2	20.45 19.70	1.00	.330
PA1 PA3	20.45 17.60	2.87	.010*
PA2 PA3	19.70 17.60	3.57	.002**
PACS1 PACS2	4.30 2.90	2.90	.009
NA1 NA2	12.95 12.65	.37	.717
NA1 NA3	12.95 11.95	1.41	.176
NA2 NA3	12.65 11.95	1.52	.144
NACS1 NACS2	2.20 1.70	.85	.405
HR1 HR2	79.34 77.72	3.30	.004**
HR1 HR3	79.34 78.13	1.79	.089
HR2 HR3	77.72 78.13	-.78	.444
HRCS1 HRCS2	63.40 61.05	.41	.690

N = 20 *p < .05 *p < .01

Table 14
Group (A, B+C) by Phase (I, II, III) ANOVAs with Repeated Measures on Phase and Groups B and C Combined

	Phase		Group by Phase	
	F	Sig of F	F	Sig of F
PA Scores	3.60	.030*	2.74	.069
PA Change Scores	21.57	.000**	1.27	.265
NA Scores	6.01	.003**	.55	.578
NA Change Scores	5.50	.022*	.03	.864
Temperature Ratings	.90	.408	.04	.962
Temp Change Scores	1.90	.173	.08	.774
Heart Rate Ratings	20.80	.000**	3.53	.033*
Heart Rate Change Scores	3.94	.052	.00	.961

$N_1 = 20$ $N_2 = 40$ *$p < .05$ *$p < .01$

Table 15
T-Tests on Positive and Negative Affect Scores, Skin Temperature Ratings, Heart Rate Ratings, and Change Scores Between Groups B and C

	Group	X	t	p
PA1	B	22.25	1.04	.307
	C	20.45		
PA2	B	20.95	.68	.499
	C	19.70		
PA3	B	20.70	1.59	.121
	C	17.60		
PACS1	B	4.60	.28	.784
	C	4.30		
PACS2	B	3.95	1.44	.157
	C	2.90		
NA1	B	13.80	.63	.533
	C	12.95		
NA2	B	13.35	.54	.596
	C	12.65		
NA3	B	12.40	.32	.750
	C	11.95		
NACS1	B	3.25	.90	.375
	C	2.20		
NACS2	B	1.55	-.27	.790
	C	1.70		

$N_1 = 20$ $N_2 = 20$

Table 15 (cont.)

	Group	X	t	p
TEMP1	B	80.70	.64	.526
	C	79.98		
TEMP2	B	80.94	.78	.439
	C	80.11		
TEMP3	B	80.85	.64	.524
	C	80.16		
TEMPCS1	B	16.35	.21	.804
	C	16.15		
TEMPCS2	B	9.75	.13	.898
	C	9.30		
HR1	B	74.98	-1.17	.248
	C	79.34		
HR2	B	73.59	-1.20	.236
	C	77.72		
HR3	B	73.23	-1.49	.145
	C	78.13		
HRCS1	B	62.75	-.07	.943
	C	63.40		
HRCS2	B	50.70	-1.48	.146
	C	61.05		

$N_1 = 20$ $N_2 = 20$

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