THE EFFECTS OF SOCIAL STIMULI, AURAL DISTRACTION, AND TASK DESIGN ON PERFORMANCE AND PHYSIOLOGICAL RESPONSE IN CHILDREN

BY

GEORGE BOUTHILLETTE

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GEORGE BOUTHILLETTE

Bachelor of Science
University of Oklahoma
Norman, Oklahoma
1952

Master of Arts
University of New Hampshire
Durham, New Hampshire
1954

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the Oklahoma State University
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Thesis Approved:

Robert W. Leonfield
Thesis Adviser

Julia L. McHale

Harry K. Barbour

Leonard Worrell

Earl E. Marshall

Dean of the Graduate School

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

THE PROBLEM

Purpose of the Study

The purpose of the present study is to investigate the modifying relationship between the effects of positive social stimuli and distracting stimuli upon behavior in a task situation. Specifically, the questions posed are (1) to what degree, if any, does social stimuli modify the effect of distracting stimuli, and conversely (2) to what degree, if any, does distracting stimuli modify the effect of positive social stimuli in a task situation. It would be important to learn whether positive social stimuli actually reduce the effects of distracting stimuli or whether distracting stimuli reduce the effects of positive social stimuli when both are interacting in a task situation.

The role of positive social stimuli and its supportive function are seen in the young child in the presence of the mother, the youth as a member of a teen-age gang, and the worker as a member of a union. In the presence of others, one may obtain a feeling of comfort and may attempt tasks which one would not attempt otherwise, e.g., the worker will go on strike in the presence of other union workers. Further, it frequently occurs that extraneous distracting stimuli such as conversation, radio, television, or other similar event orients the individual away from a task. On the one hand we have events which aid task productivity, and on the other hand, we have events which interfere with task productivity.

It would be interesting to learn if these two different kinds of events interact, if they do, and how they affect behavior in a task situation independently and in combination with each other.

In this study, positive social stimuli will refer to the presence of another person, whom the subject (S) has interacted with previously and selected by the S to be a companion, during one of the experimental sessions. In such a setting, an interpersonal communication of a feeling of comfort or support is expected to take place, being communicated from the person selected by the S to be in his presence to the S himself. This communication of comfort should serve to aid the S in task productivity.

Distracting stimuli will refer to the presentation of an auditory type of disturbance which will be designed to interfere with the performance of the task. This external source of noxious stimuli will serve as a stress agent. In such a setting, a communication of stress is expected to take place from the source of the aural distraction to the S. This should serve to impede task productivity.

Theoretical Frame of Reference

The effects of present experience, particularly social stimuli in the situation, on the response to stress have been delineated quite well by Bovard (1959). In a previous paper, Bovard (1958) had shown how past experience, particularly handling during the early stages of development, had an effect on resistance to stress in later life. In the more recent paper, he proposed that social stimuli in the same environment as a psychological stress agent, creates in the organism a chain of events which leads to a diminished response to stress. As indices of this response, either the pituitary-adrenal cortical or the sympathetico-adrenal medullary axes are involved. Both components occur in

association and simultaneously and are both mediated by the posterior hypothalamus (Graham, 1953). Thus, Bovard suggested a research study in which a physiological response measure to psychological stress be utilized under two conditions of stress: (1) the organism alone, and (2) the organism in the presence of one or more members of the same species with whom the S has had previous interaction. As one index, he suggested finger temperature as used in a study by Newton, Paul, and Bovard (1957). In that study, Ss were placed under two different role-playing situations, one positive and the other negative in tone, and recording of finger temperature was obtained to compare the differential effects. This measure satisfactorily differentiated the two groups under two different conditions, consisting of a condition involving being "fired" and the other being "promoted." Bovard concluded his paper with the impression that the presence of others, particularly others with whom one has previously interacted, has a positive effect under stress. Consequently, he proposed an hypothesis to account for the observed effects, noted in his review of the literature, as follows:

> Now a simple hypothesis to account for the observed effects is that the presence of an appropriate social stimulus in the same environment as a psychological stress agent, calls forth in the organism a "competing response" which inhibits, masks, or screens the stress stimulus, such that the latter has a minimal effect. (Bovard, 1959, p. 269)

At the physiological level, he suggested that this effect is accounted for in terms of dampening of the two neuroendocrine components which respond to stress, through inhibiting activity of the posterior hypothalamic centers that trigger stress reactions. Inhibition of this activity is hypothesized to result from stimulation of the anterior hypothalamic centers by social stimuli. Thus, stimulation of the latter region would appear to inhibit activity of the former. This could be

tested through the use of physiological indices to stress under social stimuli and without social stimuli for various species.

The effects of threat of electric shock, aural distraction, and task design on rate and accuracy of performance were studied by Murphy (1959). In analyzing the overall effects of distraction on performance in this study, he found that the effects were different under the threat and the nonthreat conditions, obtaining an inverse relationship. In the nonthreat situation, distraction produced a performance decrement; but in the threat condition, distraction resulted in a performance increment. A possible explanation for this relationship was suggested by Lazarus, Deese, and Osler (1952). They suggested that deep involvement with the consequences of failure may be disrupting to performance on tasks requiring concentration. Murphy added that if one can make the assumption that preoccupation with the consequences of making an error (i.e., shock in his study) was disruptive to performance, one may take an additional step and suggest that the introduction of distracting stimuli served to distract from this preoccupation and as a result reduce the effects of threat of electric shock. Thus, distracting stimuli would appear to have an additional effect, being able to distract the S not only from his task, but also from other stimuli, whether they be positive or negative in valence.

The above hypotheses and explanatory statements on social stimuli and distracting stimuli as provided by Bovard (1959) and Murphy (1959) respectively, can be interpreted from a number of different theoretical viewpoints. Basically, Bovard presents an interpretation of the effects of social stimuli at the physiological level of analysis, emphasizing the neuroendocrine components, which is very much in keeping with an activation theory of emotion (Lindsley, 1951). However, he does not

ignore the learning and experiential factors involved as is revealed in his earlier paper (1958). One could isolate out the physiological aspects and interpret the findings strictly at the behavioral level in keeping more with an S-R theory (Miller and Dollard, 1941; Dollard and Miller, 1950). The statement that certain kinds of early experiences condition the organism to resist the effects of stress better in maturity certainly indicate that these experiences have a modifying action on the organism's behavior in later life, which would fit most learning theories. Furthermore, this would not be foreign to a psychoanalytic type of interpretation in which early experiences are considered crucial in most cases, and certainly this would even be more true with the neo-Freudian approach as exemplified by interpersonal theories of personality (Horney, 1937; Fromm, 1941; Sullivan, 1953). Sullivan (1953) described the processes underlying the interpersonal communication of anxiety through "empathy," and he (1947) indicated that relief of anxiety can be conveyed similarly. Furthermore, he considered empathy to be most applicable in describing the arousal of anxiety in the infant by the mother and stated that this mode of communication can last throughout life. And, lastly, the role of social stimuli as hypothesized by Bovard would fit in well with a phenomenological or self theory. The interpretation would be twofold in nature. First, there is the matter of the presence or absence of an object or person in the S's phenomenal field at any given time; and, second, the valence of this object or person, either positive or negative, as perceived by the S from his own internal frame of reference (Rogers, 1951, 1955; Syngg and Combs, 1949). The manner in which Bovard defined an appropriate social stimulus would satisfy this type of framework. According to Bovard, an appropriate social stimulus consists of a person with whom the S has previously interacted with and as a person selected by the S to be in

his presence during certain parts of the experimental situation. Thus, such a person would be in the S's phenomenal field and possess positive valence from his own frame of reference as perceived by the S.

The theoretical interpretation of the role of distracting stimuli would follow a similar line of analysis as social stimuli, recognizing it as an external source of stimuli like social stimuli. However, the difference between the two would be in terms of its valence. Another difference would be in its complexity, being less complex in interpretation by the S than social stimuli which may take more different forms and dimensions. Interestingly, Davitz and Mason (1955) suggested that social stimuli is a form of distracting stimuli in itself since the former adds new stimuli to the situation and acts to distract the S from fear producing cues, resulting in a reduction of the response to fear. Thus, from this viewpoint, we could look at social stimuli and auditory stimuli as competing distracting stimuli, one producing a dampening of stress and the other producing stress per se, with the level of each determining which one would override the other. From this viewpoint, one could interpret the findings without depending upon a physiological level of analysis.

The definition of stress varies with the particular theoretical viewpoint of the researcher. No attempt is made to review the different definitions posed. In this investigation, the term stress will be used in its general sense rather than personal one. Any stimulus may in principle interfere with normal patterns of behaving because of the particular threatening or deleterious meaning it may have acquired for the individual who is perceiving it. However, we may distinguish a class of stimuli which is more likely to be disrupting or noxious to most individuals. The term stress has been applied to this class of

conditions. Consequently, we may conceive of a continuum of disturbing stimuli differing in meaning to the individual and in their tension producing effects. At one end of the continuum are such stimuli, often highly symbolic in nature, which have meaning only to a particular individual or limited number of individuals and which to the observer may appear to be innocuous. At the other end are such stimuli, referred to as stress, which by their explicit onerous value to basic survival are likely to overload the adaptive capacity of all or most persons. Besides this continuum, stressful events may vary in degree, e.g., heat. Stressful events are capable of impairing efficiency, disrupting performance, disturbing habitual patterns of behavior, and arousing unpleasant emotional responses. In the present study, varying the level of difficulty of the task and introducing auditory distraction, we are able to disrupt performance (Murphy, 1959) and are able to arouse a physiological response to stress (Bovard, 1959).

Statement of the Problem

The above studies suggest the need to investigate the effects of positive social stimuli interacting with distracting stimuli upon task performance and physiological response to stress. In order to investigate these two effects, it is necessary to have two levels of social treatment, i.e., social stimuli and no social stimuli, and two levels of auditory distraction, i.e., auditory distraction and no auditory distraction. Further, it will be necessary to have a stress activity which, in and of itself, will produce differences in performance and physiological response. This stress activity would provide the opportunity to establish a stress threshold or limen. Yet, in order to compare the effects of social stimuli under nondistraction and under distraction,

it is necessary to introduce stress which is not external to the task, but, rather, inherent in the task itself. Lazarus, Deese, and Osler (1952) have suggested that a task itself may be inherently stressful due to the demand it makes upon the S. Conrad (1950) has referred to this type of stress as "load stress." Thus, utilization of tasks designed to produce significant levels of load stress is indicated. As a result, it is desirable to have two levels based on load stress in order to determine the relationship between social stimuli and distraction under different basic stress levels.

The response measures include performance and physiological indices. The performance measures include rate and accuracy in performing a task, and the physiological measures include finger temperature and palmar sweat indices. These are response measures utilized by Murphy (1959) and suggested by Bovard (1959) respectively. Both of the physiological response measures are indicated to test Bovard's hypothesis. The Ss of the present study are normal male children ranging in age from eleven to twelve years. They will serve to test the hypotheses and propositions in question as suggested in the above studies, and contribute to a better understanding of the response to stress in children. There is a dearth of knowledge in the experimental literature on this response in children.

From the above, it would be necessary to have a research design which would provide: (1) a stress activity inherent in the task and which the S could perform to establish a stress limen, (2) a positive social stimulus to communicate comfort and non-comfort, (3) a distracting stimulus to communicate stress and non-stress. The Ss while performing the basic stress activity, would be subjected to the independent variables of positive social stimulus and distracting stimulus.

The dependent variables of task performance and sympathetico-adrenomedullary responses would be obtained under the above independent variables. Thus, we would be able to measure the modifying effects between social stimulus and distraction, and those of the basic stress activity. The treatments would come from the social variables, and the conditions would include distraction and task design under the social treatments.

From this we would expect to find: (1) There are differences in performance and physiological response to stress between social and nonsocial treatments under distraction and nondistraction conditions respectively; (2) There are differences in performance and physiological response to stress between social and nonsocial treatments under two different levels of task activity. It is predicted that social stimuli will result in performance increment and dampening of the physiological response to stress, and that distracting stimuli will result in performance decrement and increased level or accentuation of the physiological response to stress. Also, of course, the more difficult of the two task designs will result in greater performance decrement and greater accentuation of the physiological response to stress.

CHAPTER II

REVIEW OF THE LITERATURE

Having presented the statement of the problem in the previous chapter, we can now examine the state of knowledge pertaining to the relevant variables of this study involving response to stress.

Nature and Scope of the Literature on Stress

Numerous studies have been conducted on the effects of psychological stress on behavior, particularly as they relate to performance and physiology. Since the scope of the literature on stress is so vast it would be prohibitive to review all of the literature, and, also, it would be beyond the scope of this present investigation as defined in the previous chapter. As a result, the present survey of the literature does not include references to all the experiments on stress. This review is specifically concerned with those studies in which some attempt has been made to determine the effects of social factors on the response to stress, particularly as they are manifested by performance and physiological response measures.

Psychological stress research has been approached from a number of different methodological schemes and theoretical viewpoints. Three major methods are seen in the experimental study, the field study, and the clinical study. Each has its strengths and weaknesses. The experimental method provides optimal control of variables but excludes the multivariable context found in real life situations. The field method focuses its

attention on actual life situations but does not approach the reliability of the experimental method. The clinical method provides depth in study of individuals but is limited in its ability to generalize. Following are a number of different methods and viewpoints found in the review of the literature on stress.

Experimental Method: Bovard (1958, 1959), following the lead of Seyle (1950), approaches stress research from an experimental and psychophysiological viewpoint, but with primary interest on the effects of interaction of early experience and present social stimuli on stress behavior. He feels that the next step in stress research is to uncover the neuroendocrine mechanisms of behavior. Feeling that the results of pure behavioral research have reached the point of diminishing returns, he would like to discover the underlying neuroendocrine mechanisms associated with early and present social experiences which result either in resisting the effects of stress, or in raising the threshold for response to stress in general. He concludes that past and present social experiences can modify the pattern of neuroendocrine response in the organism such as to result in an associated change in response to stress.

A different, but in some ways similar, approach is exemplified in the recent experimental study by Murphy (1959). He undertakes stress research at a purely behavioral level, with particular emphasis in the general effects of task design on efficiency and various stress stimuli on perceptual-motor performance. This is the most common type of experimental stress research found in the psychology literature. Such studies permit manipulation of variables by the E, and contribute to general behavior theory. Experimenters following this line of research feel generally that this is the kind of research which is most basic and needed to promote psychological knowledge at this stage of development in

psychology.

Lazarus and Baker (1956) feel that research which assumes homogeneity of subjects seeks to understand the general effects of a stress condition on skilled behavior, but it is their opinion that individual differences of subjects in reaction to stress far outweighs the importance of any main effects of stress stimuli. They define stress not only in terms of some external stimulus agent which affects the organism, but also as a state of the organism, antecedents of which need to be discovered. Stress is treated as a hypothetical construct intervening between certain antecedent conditions and the behavioral responses of the organism. Further, they suggest taking into consideration the individual's perception of the situation as a variable.

Clinical Method: Janis (1958) is critical of a purely experimental or field type of study, indicating that these studies do not explore the depths of personality. According to him, the former leaves you with inconsequential findings and the latter leaves you with undependable results. His approach is clinical with the psychoanalytic frame of reference. He suggests the use of depth interviews plus systematic observations and behavioral ratings of Ss. In a recent study of surgical patients, Janis (1958), demonstrated his dual psychoanalytic and behavioral approach to psychological stress.

Field Method: Wallace (1956a) approaches the study of stress from systematic observation of human behavior in extreme situations. He made a study of the effects of the tornado in Worcester, Massachusetts, exploring individual, group, and community behavior (Wallace 1956b). The approach is social, analyzing human behavior in actual life situations rather than in a laboratory situation or clinical setting. A number of studies using this approach are referred to under another subheading in

this chapter (Mandlebaum, 1952; Marshall, 1951; Titmus, 1950).

Social Stimuli and the Response to Stress

The experimental study of the role of social factors on stress behavior is receiving attention from a number of diverse sources. Bovard (1959) defined psychological stress in relation to neuroendocrine functions, and presented some interesting hypotheses concerning the effects of social stimuli on the nervous and endocrine system which results in reduced response to stress. At the psychological level he suggested that the presence of others, particularly others with whom one has previously interacted, has a protective effect under stress; and at the physiological level he hypothesized that social stimuli stimulate the anterior hypothalamic center, resulting in an inhibition of activity in the posterior hypothalamic center, which is stimulated by stress stimuli. In turn, this leads to dampening of the response to stress. Thus, according to Bovard, a "competing response" is established in the hypothalamic centers. He stated that stimulation of the anterior region appears to inhibit the posterior one. However, he stated that there is yet no evidence for the hypothesis that social stimuli activate the anterior hypothalamus.

Upholding Bovard's (1959) hypothesis, at the behavioral level, are a number of field studies suggesting the supportive effects of the small group under stress. Titmus (1950) reported that separation of the family and evacuation from London appeared more stressful to the children than did enduring the many attacks on London with the family intact. Likewise, Mandlebaum (1952) reported that studies of combat operations suggest the effectiveness of the small group in supporting each other in the face of extreme stress in battle. Similarly, Marshall (1951) found that soldiers

separated from their original units and placed back in the front line with new units were relatively ineffective, but that soldiers who have been placed back or stayed in the same unit were more effective in combat. These studies indicated that interpersonal relations with others with whom one has interacted previously in a positive manner reduced the response to stress. But, when one is removed from the familiar social situation, there is an increase in response to stress. Thus one would conclude that the presence of others with whom one has established an appropriate positive relationship has a protective effect under stress.

In human laboratory studies, further support is given to the role of interpersonal factors in reducing the response to stress. Reiser, Reeves, and Armington (1955) demonstrated that release of emotional tension through verbalization was a function of the persons interacting. Likewise, Seidman, Bensen, Miller, and Meeland (1957) discovered that Ss had greater tolerance for self administered electric shock when in the company of another person who they believed took part in receiving the shock. The latter study supports the concept of communication of the feeling of emotional support through the presence of another person.

A number of studies have approached the problem of socially facilitated reduction of the response to stress through animal experimentation. Masserman (1943) found that the presence of a nonfearful cat had a calming effect on a fearful one. Liddell (1950) demonstrated that a young goat isolated in an experimental chamber and subjected to a monotonous conditioning stimulus developed traumatic signs of experimental neurosis, while its twin in the next chamber and subjected to the same stimulus, but with the mother goat, did not. A study by Davitz and Mason (1955), comparing the effects of the presence or absence of a rat on the level of response to fear in another rat, found

that the presence of a nonfearful rat significantly reduced the strength of a response to fear in a fearful rat. Conger, Sawrey, and Turrell (1957) demonstrated that rats, when alone in a chronic approach-avoidance conflict situation, had significantly greater resultant ulceration than animals tested in a group situation.

In a very recent study, Mattsson (1960) designed an experiment to study a two-person situation where communication of anxiety and communication of comfort (relief of anxiety) could be demonstrated. The hypotheses tested were as follows: (a) a person who interacts with a more anxious person will himself become more anxious, and (b) a person who interacts with a less anxious person will himself become less anxious. The Ss were 80 male college students. During the experimental session, shocked Ss and nonshocked Ss were paired under two combinations of four conditions: (1) nonshocked S working with shocked S; (2) shocked S working with nonshocked S; (3) nonshocked S working with nonshocked S; (4) shocked S working with shocked S. Shock was introduced as a variable to produce anxiety in the Ss. The response measures included changes in blood presure and finger sweat, and scores on a self-rating scale. Anxiety level was determined by use of a short form of the Manifest Anxiety scale (Bendig, 1956). The findings indicated that the first hypothesis was supported, but the second hypothesis was not. The following reasons were proposed to account for the fact that communication of comfort had been less effective than communication of anxiety:

> (a) the cues of comfort, that were to be communicated to the anxious S, were not strong enough; (b) the level of anxiety in the control Ss, against which the communicated comfort was compared, was not high enough; (c) the shocked Ss may not have attended to the cues of comfort displayed by their partners; and (d) feelings of comfort cannot be communicated as easily as feelings of anxiety. (Mattsson, 1960, p. 495)

Of course, in the above study, all Ss were exposed to social stimuli. Also, the persons with whom the S interacted were selected by the E, not the S. Consequently, it did not represent a comparison of the effects of social stimuli vs. no social stimuli, and did not take into account the S's personal perception of the person with whom he was to interact with. However, the study revealed that nonshocked Ss working with other nonshocked Ss manifested less anxiety than nonshocked Ss working with shocked Ss. The presence of a shocked S represented both a social stimulus and a stress stimulus, but the nonshocked S represented only a social stimulus. The combination of effects may have been additive.

In summary, we found studies at the human and animal levels in which the presence of another member of the same species had a protective effect under stress. Previous interaction with the other person or animal, as the case may be, could be assumed to accentuate the effect of social stimuli on the response to stress. However, the study by Mattsson (1960) did not support the effect of communication of comfort which would be equivalent to the presence of a supporting person in reducing the response to stress. This was probably so because the other person had no positive relationship with the Ss.

Finger Temperature and Palmar Sweat as Measures of Response to Stress

Experimental testing of Bovard's (1959) proposition that social stimuli dampen the response to stress, through neuroendocrine activity, could involve, as indices of this response, either the pituitary-adrenal cortical or the sympathetico-adrenal-medullary components (Ramey and Goldstein, 1957; Cleghorn, 1953). The sympathetico-adrenal-medullary

response is much more accessible to experimental manipulation by psychologists than the pituitary-adrenal cortical response. The former can be measured more directly and easily. Thus, Bovard suggested the use of this component, which includes finger temperature and palmar sweat responses as measures of response to stress.

Mittlemann and Wolff (1943) in a study of finger temperature changes during psychoanalytic interviews, observed that rapid changes occured which appear to correlate with emotional feeling tones. Bovard (1951), Paul (1956), and Newton, Paul, and Bovard (1957), in studies of the effect of brief stress and nonstress role-playing situations on finger temperature, demonstrated that this measure was related to response to stress.

Plutchik and Greenblatt (1956), in a study of skin temperature changes, found that magnitude, rate, and duration of change were a function of initial temperature. This indicated a need to obtain groups which are comparative on basal temperature under similar environmental temperature conditions for experimental investigations using this measure to compare groups. For an adequate experimental design, using Ss as their own control helps to eliminate the difficulty of matching Ss for comparative purposes. Temperature of the finger was found to provide the most adequate measures of this response.

In personal communications with Bovard,[1] he related the use of individuals as their own control and observed a rapid drop in finger temperature under stressful conditions. He suggested the use of the thermocouple and tele-thermometer used in this study to obtain the finger

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[1]Bovard, E. W. Personal communications. 1959

temperature responses.[1] Also, he suggested using an index in which a basal finger temperature is obtained and that the resultant experimental one is subtracted from it for each individual.

Gladstone (1953) reviewed the literature on palmar sweat and presented an improved modified instrument of the Silverman and Powell (1944a) technique which could be utilized with groups. In the present study, Gladstone's modified technique was used to measure individual palmar sweat responses.[2]

Kuno (1934, 1956), Darrow (1936, 1937), Silverman and Powell (1944a, 1944b, 1944c), and Gladstone (1953,1954) have all worked directly with palmar sweat and have found that it is correlated with emotion-like responses. Gladstone (1954) presented a procedure for obtaining the palmar sweat index and provided a finger temperature correction factor.[3]

Kuno (1934) first reported the relationship that palmar sweat was a partial function of emotion, and demonstrated that mental arithmetic increased palmar sweat. Furthermore, he showed that sweat glands exist on the finger and that these sweat glands manifest the ordinary response of discharging sweat with mental and emotional stimulation. From measurement of sweat response over the entire human body, he found that sweat glands are present most densely on the palm and the sole, next on the head, and much less on the trunk and extremities. Also, that human sweating may be classified into thermal and mental sweating. He stated that mental and emotional sweating appear on the palm of the hand, the sole of the feet, and the axilla only, while thermal sweating appears over the body except on the palm and sole. Mental sweating is moderate in amount and is not progressive in nature. It rarely attains a state

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[1,2,3] The technique is described in more detail in chapter III.

of copious sweating such as streaming down the skin. Mental sweating is a function of sensory stimulation, such as intense noise or distraction, and of work, particularly when it involves directed and sustained attention and concentration. Of course, these variables are associated with external and load stress. Anxiety results in mental sweating as well as stressful situations which are social in origin. Gladstone (1953) showed that the avarage palmar sweat of a group would increase when the average mental or emotional stress of the group would be increased. Interestingly, Silverman and Powell (1944c) found that palmar sweat was more profuse with hospitalized neuropsychiatric patients than in normals.

Kuno (1956) has demonstrated that sweat glands which respond to mental and emotional stimuli have no latent period before its onset, but, rather, immediately attains a certain level of secretion which corresponds to the intensity of the stimulation and the individaul's own perception of the situation, and remains as long as stimulation persists and subsides at once after it ends. A study of the distribution of sweat activity on the palm was undertaken by Kuno. The findings of the study revealed that the most profuse emotional sweating takes place on the finger tips. Profuse sweating is most found on the large protuberant regions of the palm which are the areas which may come in close contact with objects grasped.

The correlation of the skin galvanic resistance to palmar sweating is an interesting one. Kuno has shown through dual measures that the galvanic skin test may indicate with fair certainty the onset of sweat by a sudden decrease in conduction, but further changes in conduction do not adequately show changes in rate of sweating. Maximum palmar sweating is achieved within five seconds after onset of stimulus, but decrease in palmar sweat is less precipitate, requiring five minutes to fall to a basal level. However, so long as the stimulus remains constant, the palmar sweat

remains constant.

Two recent studies of palmar sweat substantiated further the value of using this response as an objective measure of anxiety and response to stress. Bixenstine (1960) demonstrated the use of palmar sweating as a measure of psychological tension in the clinical situation, and related this measure to therapeutic progress in a young graduate student and his wife. He found that palmar sweat was capable of giving the E a very meaningful picture of a person's ongoing experiences. It was interesting to find that changes in the student's palmar sweat level was associated with similar changes in his wife's palmar sweat level supporting an interpersonal basis to obtained palmar sweat measures. Also, Bixenstine found that level of palmar sweat was greater at the end of a therapeutic session than at the beginning, indicating, in this particular case, therapy was experienced as tension inducing rather than tension reducing. This would seem to contradict Bovard's hypothesis that the presence of an appropriate social stimulus would reduce the response to stress. However, this may be interpreted as a case of individual difference in response to the particular situation as perceived by the S, or the particular relationship may be inherently stressful in itself, becoming more stressful as a person relates his problems, holding the presence of another person constant.

The other recent study using palmar sweat was conducted by Mattsson (1960). This study was designed to test the communication of anxiety and comfort in a two-person situation. He found significant differences beyond the .01 level for this measure, supporting the hypothesis that a person who interacts with a more anxious person will himself become more anxious. However, palmar sweat measures did not support the hypothesis that a person who interacts with a less anxious person will himself become

less anxious. The reasons proposed for the rejection of the latter hypothesis were mentioned earlier in this chapter. Again, this brings up the question of the supportive effects of social stimuli on the response to stress. Of course, the Ss did not have the choice of selecting their mate under the various conditions. Bovard (1959) stated that there is a personal perceptual aspect in his definition of an appropriate social stimuli which would reduce the response to stress.

There have been only a very limited number of studies involving children. Kuno (1937, 1956) demonstrated that palmar sweat measures could be obtained satisfactorily with children. On an arithmetical concentration task, a load-type stress situation, he found that palmar sweat increased with increased difficulty of the task in seven year old Ss. Gladstone (1953) obtained very significant results, reaching the .001 level with high school students under situations which differ in affective value. The results indicated that the test was valid as a test of emotional level. However, in test-retest reliability following a period of one week, college students obtained a coefficient of .69, but high school students obtained a coefficient of .45. Obviously more information is needed on the palmar sweat responses of children in stress situations.

Performance Under Task Design and Auditory Distraction

The role of task design and auditory distraction in the present study was to provide appropriate stress to test the hypothesis. Task design is a form of load stress and is inherent in the task itself (Conrad, 1950). The tasks used in this study consisted of two of the range-ring patterns designed by Garner, Saltzman, and Saltzman (1949) in their study of task design and performance speed. Auditory distraction is a form of external stress and consists of stimuli which

bothers, disturbs, or distracts the S during the performance of his task.

The great majority of studies on the effects of psychological stress upon performance demonstrated that performance was impaired (Holtzman and Bitterman, 1952; Katchmar, 1954; Lazarus, Deese, and Osler, 1952; Miller, Bouthilet, and Eldredge, 1953). However, there were exceptions where performance was not impaired (Gates and Rissland, 1923; Hurlock, 1924; and Verville, 1946).

Studies by a number of investigators have shown that the effect of a given increment of stress was greater when added to higher rather than a lower existing level of stress. (Chapanis, 1954; Conrad, 1950; and Mackworth, 1952). However, several studies performed using distraction stress resulted in performance decrement under one condition and performance increment under another condition. These studies showed that an inverse relationship was produced by distraction stress (Angelino and Mech, 1955; Auble and Britton, 1958; Murphy, 1959).

Murphy (1959) performed a study which was very relevant to the present investigation in terms of variables and method used. He conducted a study of the effects of threat of electric shock, aural distraction, and task design on performance. Essentially, he integrated two different but closely related lines of research in psychology; (a) studies of the effect of psychological stress on performance; (b) studies of the effects of task design on operator efficiency. Murphy found a marked performance decrement under threat of shock. The difference between the effects of threat and nonthreat was highly significant, being beyond the .001 level. However, the effect of distraction was not significant. An interesting explanation is given for this finding. It seems that distraction affected performance differently under the threat and the nonthreat conditions. There was an inverse relationship between the effects. Under nonthreat,

distraction produced a performance decrement and under threat it produced a performance increment. He explained this state of affairs in terms of the role of distraction in serving to distract from threat and thereby reduced the effects of threat on performance. This effect was suggested earlier by Lazarus, Deese, and Osler (1952). Very significant results were obtained for the four patterns making up the various task designs. The level of significance was beyond the .001 level. The greatest difference was found between pattern A and pattern D (Pattern A and D were used in the present study. See Figure 1). The interaction between pattern and distraction was not significant. This is without a doubt related to the inverse relationship of the main effects of distraction under the threat conditions.

In general, distraction, in the form of auditory stimuli, results in impaired efficiency. The evidence is not consistent but does tend to show that distracting sounds affect accuracy and speed of performance (Berrien, 1946). However, the study by Angelino and Mech (1955) indicated an inverse relationship between general adjustment as measured by the California Test of Personality and routine performance under auditory distraction. Also, Auble and Britton (1958) obtained a similar inverse relationship. According to their study, the most anxious Ss, as determined by the Manifest Anxiety Scale (Taylor, 1953), performed significantly better under auditory distraction than they did under quiet conditions, while the least anxious Ss performed better under quiet conditions, but not significantly so. This inverse relationship is explained on the basis of personality differences and is in keeping with the results of Angelino and Mech (1955).

We can conclude that the effects of auditory distraction as a form of stress has had varied effects on performances. Murphy's (1959)

proposition that distraction distracts from threat may be extended to include other sources of stress stimuli, or even other independent variables such as positive social stimuli.

Stress Research Conducted with Children

Recent studies of the effect of social factors on the response to stress and the effect of psychological stress on performance use adults to a much greater degree than children as Ss. However, on the other hand, there are numerous developmental, field, and clinical observations on children's emotional behavior, and experimental studies in related areas (Baker, Dembo, and Lewin, 1921; Bloch and Martin, 1955; Despert, 1942; Hayward and Freeman, 1941; Titmus, 1950; Wenger and Ellington, 1943). Fortunately, recent development of the children's form of the Manifest Anxiety Scale (Castaneda, McCandless, and Palermo, 1956a), and recent increased interest in basic research in child psychology, has stimulated research in studying the relationship of anxiety to performance and complex behavior. Castaneda, Palermo, and McCandless (1956b) and Palermo, Castaneda, and McCandless (1956) have reported norms and reliabilities on the children's form of the Manifest Anxiety Scale on performance and complex behavior, respectively. Since interest in anxiety usually is accompanied with interest in stress, it is believed that studies in the latter will ensue.

The alleged deficiency in the quality and quantity of research and lack of interest in theory by child psychologists was pointed out in two recent papers, one by McCandless and Spiker (1956) and the other by Terrell (1958). There is no question as to the need for better understanding of children's behavior in response to stress, especially as it is related to social factors.

Analysis of the literature indicates that the combination of the variables of interest in the present study have not been utilized previously. Further, it is obvious that nothing has been done to combine the effects of these three variables using children as Ss.

To investigate these variables, we present our design for such a research in the next chapter.

CHAPTER III

METHOD

As indicated in the previous chapter, our goal is to investigate the effects of social stimuli in a task and distraction situation. Following, we delineate the variables, subjects, task, measurement techniques, procedure, and research design.

In this study, briefly, there are four combinations of two levels of task and two levels of distraction conditions arranged so as to have four groups of 20 Ss in each condition. Each group undergoes two different levels of social treatment. The task consists of dealing a deck of cards with eight range-rings in which a mark appears on one of the rings. The S is required to call out the number of the range-ring indicated by the mark as quickly as possible, avoiding errors.

Variables

Three independent variables, each at two different levels, and two dependent variables, each with two different measures, were utilized in this study. Following were the independent variables.

1. Social stimuli: There were two levels of this independent variable - (a) absence of social stimuli, and (b) presence of positive social stemuli. Social stimuli was defined as the presence of a child selected by the S to sit with him during the experimental sessions (Bovard, 1959). The child would sit to the left of the S. During the experimental trials, the E observed the Ss behind a screen. This was

necessary to eliminate the effects of the E as a social stimulus in the "no social stimuli" conditions.

2. Aural distraction: There were two levels of this independent variable - (a) absence of aural distraction, and (b) presence of aural distraction. The distraction was produced by presenting to the subject a series of random numbers aurally during the experimental session, as in Murphy's (1959) study. During the experimental session, the S was required to call out marked range-ring number. The aurally induced random numbers were recorded on tape and presented to the S through earphones in a moderately loud conversational tone, approximately 75 to 80 decibels above threshold. The recorder was turned on about three seconds before the beginning of the experimental session and was turned off at the end of the session after the S has completed the deck. The earphones were adjusted to the S after he completed his last preliminary trial.

3. Task designs: There were two task designs in this independent variable producing two levels of load stress. These were the task materials, consisting of pattern A and pattern D as described by Murphy (1959), also described under the subheading of task below, and illustrated in Figure 1.

The two dependent variables, performance and physiological response, were the following.

1. Performance: Two criteria of performance were used: (a) time in seconds to deal a deck of 32 cards, and (b) number of errors made.

2. Physiological measures of response to stress: Two response measures of stress were utilized: (a) finger temperature, and (b) palmar sweat. The finger temperature measure was obtained by use of a surface temperature thermocouple as used and described by Newton, Paul,

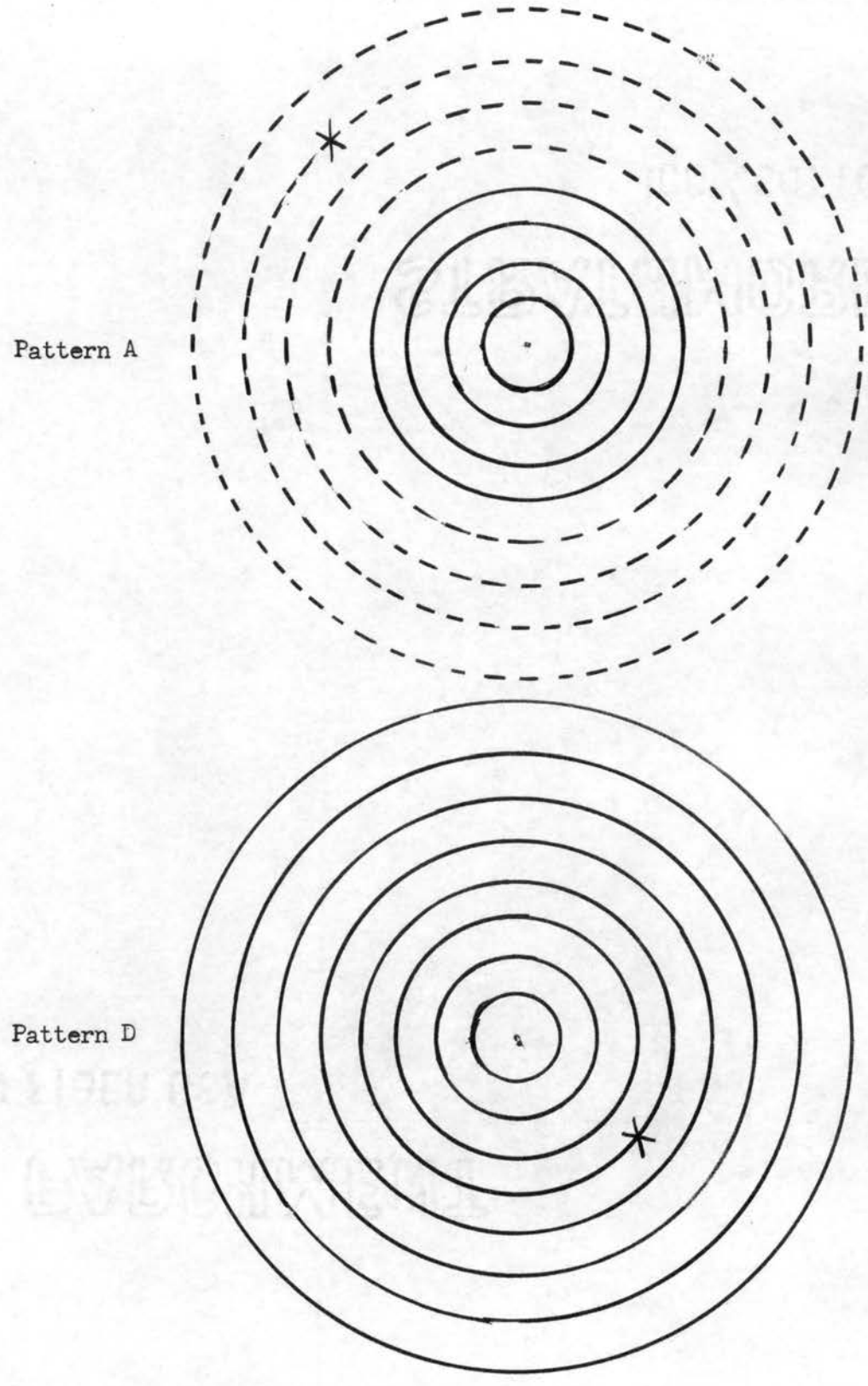

Fig. 1. Range-ring patterns used in the Experiment to Produce different levels of load stress.

and Bovard (1957), and the palmar sweat measure was obtained by a technique recommended and described by Gladstone (1953). The physiological measures were recorded immediately following the completion of each task under the various conditions.

Subjects

The Ss consisted of 80 male children enrolled in the sixth grade of eight Oklahoma City public schools, having a total sixth grade enrollment of nearly 400 pupils. Children enrolled in special classes for the physically handicapped, mentally retarded, or emotionally disturbed were not included. The Ss were randomly assigned to one of the four experimental groups under various stress conditions as follows: (1) Group I, task A-no distraction; (2) Group II, task A-distraction; (3) Group III, task D-no distraction; (4) Group IV, task D-distraction. Each S selected another child of his choosing to participate in the experiment under the social treatment situation.

Task

The materials used in the study were the same as that utilized by Murphy (1959) and, formerly, by Garner, Saltzman, and Saltzman (1949), consisting of two different range-ring patterns with eight rings each and a mark appearing in any of the four quadrants on any one ring, without duplication, making 32 cards in each of the two decks. The decks were arranged according to range-rings patterns, and consisted of pattern A and pattern D as used by Murphy. The investigators who have used these materials in the past found that the two patterns resulted in very significant differences in performance beyond the .001 level. The two different task designs appear in Figure 1. Task D has

significantly greater load stress value than task A.

The purpose of the task is to produce a stress limen independent of the distraction stress. The S is required to deal a deck of cards calling out the number of the correct range-ring on which a mark appears. This is to be performed as quickly as possible, avoiding errors as one is dealing and calling out the numbers. The cards are placed in the deck in a pre-arranged order so that the E can record errors as the S is calling out the numbers. Each S deals a deck of cards, representing one of two different load stress levels, either distraction or nondistraction conditions, depending on which of the four conditions he is assigned. However, each S must undergo two different levels of social treatment, i.e., social and nonsocial treatment.

Physiological Measurement Techniques

Since environmental temperature effects skin temperature and palmar sweat responses, the physiological measures were obtained in a room under fairly constant temperature. The recordings were made only if the room temperature was between 68°F to 72°F. Fortunately, a thermostat controlled the room temperature and kept it at a fairly constant level. To avoid the influence of differences between street and room temperature, Ss were allowed to rest in a room 20 minutes.

1. Finger temperature: A thermocouple, consisting of a lead attached at one end to the temperature recording apparatus (tele-thermometer), and at the other end to the ventral surface of the distal phalanx, third finger, left hand, was used to obtain finger temperature measures. As there are marked individual differences in finger temperature, an initial three minute period was used to establish a basal mean temperature for each S. Variations in finger temperature due to experimental manipulation were

calculated from this base figure for each S by the following method: The mean temperature obtained at the end of the experimental sessions over a three-minute period were subtracted from the basal figure to establish an index of change. Thus, a negative index would indicate a rise in finger temperature and a positive one a fall. A fall in temperature is associated with emotional stress (Bartlett, Bohr, Helmendach, Foster, and Miller, 1954; Bovard, 1951; Mittleman and Wolff, 1943; Friedman, 1950; Paul, 1956; Plutchick and Greenblatt, 1956).

A Model 409 surface temperature thermocouple and a Model 44-TD tele-thermometer were obtained from the Yellow Springs Instrument Co., Inc., through the Department of Psychology, Oklahoma State University, to obtain the finger temperature measures. This equipment is similar to that utilized by Newton, Paul and Bovard (1957). Bovard[1] suggested the use of the above type equipment and recommended the procedure used in this study to obtain finger temperature measures with it.

2. Palmar Sweat: Gladstone (1953) developed a modified version of the Silverman and Powell (1944a, 1944b, 1944c) technique for measuring palmar sweat, which involved painting the palmar surface with a ferric chloride solution and holding the palmar surface on a tannic acid treated paper for three minutes. Gladstone's technique, which is utilized in this study, consists of preparing a 5% tannic acid treated paper from a fairly uniform translucent paper (Dietzgen Number 198M) and a salt solution, consisting of a mixture of 13g, anhydrous ferric chloride and 400cc reagent grade or chemically pure acetone. An individual opal glass container with a thermosetting, threaded, plastic cover with a solid polyethane liner is used for each S. Six white, medium blotters

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[1]Bovard, E. W. Personal communication. 1959. (See Bovard, 1959).

about 1/8" smaller than the jar interior were used with 5½ cc of salt solution. Gladstone suggested the use of the container between one and five hours after filling. The instructions for administration of this test were as follows:

1. Loosen the cap, but do not remove it.
2. Wipe off your fingers on this piece of cloth.
3. Remove the cover.
4. Press your first and second fingers one after the other on the blotters. Press each finger twice.
5. Wave your hand for 20 seconds. (Illustrate and observe the time on a stop watch.)
6. The E replaces the cover while S is waving his hand.
7. Press your finger on the paper attached to the clamp. The whole flat of the fingertips should be on the paper.
8. Time; remove the fingers from the clamp. (This is at the end of three minutes.)

The palmar sweat index is obtained by computing a ratio of the print measure to the paper measure near the print, and then subtracting a correction factor which is related to finger temperature (Gladstone, 1954). Thus, increased sweating results in a lowered palmar sweat index.

Measurement of the darkness of the palmar sweat print was obtained by passing a standard amount of light through the center of the print, catching the light rays which are allowed to pass through the paper and print on a light sensitive cell, and measuring the resultant electric current transmitted to a microammeter, which provided a relative measure. The procedure used in obtaining the measurement required precaution in avoiding errors and consistency in approach. It was required that the print be placed over the light opening on top of the apparatus, centering the print upon the opening as nearly as possible to the center whorl, or corresponding fingerprint configuration, in the center of the light. Palmar sweat prints which were not large enough to cover the

opening were discarded as a matter of procedure since the measurement obtained would not be valid. After the print was laid down over the light opening, the light sensitive cell was pressed over the print, pressing the paper flat between the two surfaces. Caution was taken to press the light cell over the print with the same pressure each time. As the light cell was attached to an arm which in turn was attached to the apparatus, the problem of placing the light sensitive cell over the same place each time was solved. Deflections on the microammeter was inversely proportional to the darkness of the print. Darkness of the print is dependent upon the amount of sweating and is associated with emotional response of the stressful nature (Darrow, 1936; Darrow and Henry, 1949; Gladstone, 1953, 1954; Kuno, 1934, 1956; and Silverman and Powell, 1944a, 1944b, 1944c).

All of the materials and equipment, except the chemicals and special paper, for obtaining palmar sweat measures were supplied through the Department of Psychology, Oklahoma State University. Gladstone (1953) provided the recording apparatus necessary for obtaining palmar sweat measures. It included a light sensitive cell connected to a microammeter and mounted on a base with a $\frac{1}{2}$" x $\frac{1}{4}$" hole, allowing light from a lamp to pass through. Gladstone[1] provided special instruction on the use of the equipment.

Procedure

The procedure was similar to that of Murphy (1959) with the exception that social stimuli was introduced and threat of shock was eliminated as independent variables, physiological measurement techniques were added as

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[1]Gladstone, Roy. Personal communication. 1959. (See Gladstone, 1953).

stress response measures, and only two decks rather than four decks were used. In order to establish a limen, preliminary sessions were employed.

Preliminary sessions: The S was seated at a table opposite E, and was handed a preliminary deck of cards. The cards in the preliminary deck were identical with the task cards in every respect except that instead of a pattern of range-rings, a number from one to eight appeared at the center of the card. There were 32 preliminary cards in each deck. The S was instructed to deal the cards from the top of the deck as rapidly as possible and to call off the numbers marked in the center of each card. At the signal, "ready - go", the S ran through the preliminary deck and was given two trials with this deck. The errors and time required to deal deck was recorded following the second trial. The errors and time score following the second preliminary trial was the Ss preliminary error and time scores. Likewise, the finger temperature index and the palmar sweat index obtained at this time was the Ss preliminary indices.

Immediately after the preliminary time score was recorded, the S was handed one of the decks of task cards depending upon the condition he was assigned. He was instructed to avoid making errors. Each time the S made an error, he was stopped and his attention was called to the error. Then he was permitted to proceed with the rest of the cards in the deck. As soon as one deck was completed, the S was given the other one, with a different pattern of range-rings, until both task decks were run through once in this manner.

The task decks were then presented for a second time and the S was was advised that he would no longer be informed if he made an error. For the second series in dealing the task cards, each of the cards were presented in reverse order. The E recorded the time required to deal each deck and the number of errors made.

After completing the second series of preliminary trials, each S was told that he would be required to deal one of the two decks two more times. He was asked to try to do much better than the average score of the Ss who had dealt the same cards during the previous week. He was further informed that he would be paid five cents for each second that his average time score for the next two series better the average score for the previous week, but that five cents would be deducted from his winnings for each of the average numbers of errors he made.

Experimental sessions: Following the preliminary sessions, as described above, Ss were randomly assigned first to one of the four stress conditions (Task A - no distraction, Task A - distraction, Task D - no distraction, Task D -distraction) so as to provide 20 Ss in each condition. Within each of the four stress conditions, the Ss were further randomly assigned to one of two sub-groups of ten Ss each. One sub-group was subjected to the social treatment, while the other sub-group was not. In order to counterbalance the effect of the treatment, the procedure was repeated with the social treatments reversed. Thus, each sub-group under each of the four major groups were subjected both to social and nonsocial treatments.

Summary of Experimental Design

There were four combination of task and distraction stress conditions with 20 Ss in each combination. Each S under each stress condition acted as his own control receiving two social treatments. In addition, the experimental design provided for counterbalancing order in each of the four combinations of task and distraction conditions for social treatment. The experimental design follows Lindquist's (1953) type III design.

In the next chapter, we shall report the data obtained and its statistical analysis.

CHAPTER IV

RESULTS

In this chapter we present the results obtained and analyze them statistically. The results include the data obtained during the preliminary and the experimental sessions, and for each of the response measures used, i.e., the time required in performing the task, the number of errors accumulated in performing the task, the degree of finger temperature, and the amount of palmar sweat.

The preliminary data was obtained in order to establish a limen to use as basal data for adjusting the measures obtained during the experimental trials, and to assess the four preliminary groups prior to the experimental sessions. We take up the results obtained during the preliminary sessions first and then take up those obtained during the experimental sessions. Similarly, we take up the performance response measures before the physiological response ones, under the preliminary and experimental sessions respectively.

A Bartlett's test for homogeneity of variance was performed on all data prior to analysis in order to determine if a transformation was indicated.

Preliminary Performance Scores

The performance scores consist of time in seconds to deal a deck of preliminary cards and the number of errors accumulated while dealing the deck of preliminary cards.

The means and standard deviations of the preliminary time scores for Ss assigned to each of the four experimental groups and the F-value and P-level from an analysis of variance of the preliminary time scores are provided in Table I. As can be seen from the analysis, there is no significant difference among the four experimental groups on preliminary time scores, using a P-level of .05 as the criterion level for a significant difference.

No errors were made in dealing the preliminary deck. The cards merely contained numbers in the center of each card. Each S was able to read the numbers clearly without difficulty.

Preliminary Physiological Measures

The physiological response measures include finger temperature and palmar sweat. In addition to the reasons stated previously, these measures were obtained during the preliminary sessions to familiarize the S with the techniques and procedure. These measuring techniques and procedure were simple enough that the S was able to adapt rapidly to them.

The means and standard deviations of the preliminary finger temperature measures for Ss assigned to each of the four experimental groups and the F-value and P-level from the analysis of variance of these measures are provided in Table II. As can be observed from the analysis, there is no significant difference among the four groups on the preliminary finger temperature measures, using a P-level at the .05 level of significance as the criterion level for a significant difference.

The means and standard deviations of the preliminary palmar sweat indices for Ss assigned to each of the four experimental conditions and the F-value and P-level from the analysis of variance of these measures are provided in Table III. As can be seen from the analysis, there is

TABLE I

PRELIMINARY TIME SCORES FOR SUBJECTS ASSIGNED TO EACH CONDITION*

Condition	N	Mean	Standard Deviation
Pattern A- no distraction	20	22.22	3.36
Pattern A- distraction	20	23.01	3.54
Pattern D- no distraction	20	21.53	3.44
Pattern D- distraction	20	22.34	3.90

*F = 1.11, d.f. = 3, P greater than .05 level.

TABLE II

PRELIMINARY FINGER TEMPERATURE MEASURES FOR SUBJECTS ASSIGNED TO EACH CONDITION*

Condition	N	Mean	Standard Deviation
Pattern A- no distraction	20	82.6	3.0
Pattern A- distraction	20	83.4	3.2
Pattern D- no distraction	20	83.0	2.8
Pattern D- distraction	20	81.8	2.8

*F = 0.65, d.f. = 3, P greater than .05 level.

no significant difference among the four experimental groups on the preliminary palmar sweat measures, using the .05 level again as the criterion for significance.

Experimental Performance Scores: Time

The time in seconds taken by each S to deal each one of the two decks of task cards during the second of the final two experimental series was used in the analysis. In order to reduce the variability between Ss due to differences in the sheer mechanics of dealing a deck of cards, the time required by each S to deal the preliminary deck was subtracted from his time scores obtained in the final series of the experimental session to provide an adjusted time score. This procedure was used by Murphy (1959) in his analysis of similar data. The procedure of subtracting the preliminary score from the S's final time score and performing the analysis on these corrected time scores had the effect of a covariance analysis of the final time scores with time to deal the preliminary deck as the covariable.

The means and standard deviations of the adjusted time scores for each of the two social treatments under each of the four experimental conditions are given in Table IV. As can be seen in this table, the means indicate that social stimuli produced performance increment under all four conditions. Also, each condition resulted in a different level of performance for both social treatments, with task designs producing a greater difference in performance than distraction.

A summary of the analysis of variance of the adjusted time scores is provided in Table V. The effects of order and the interactions of order with other variables proved to be nonsignificant and, as a result,

TABLE III

PRELIMINARY PALMAR SWEAT INDICES FOR SUBJECTS ASSIGNED TO EACH CONDITION*

Condition	N	Mean	Standard Deviation
Pattern A- no distraction	20	.845	.115
Pattern A- distraction	20	.831	.106
Pattern D- no distraction	20	.821	.116
Pattern D- distraction	20	.839	.107

*F = 1.06, d.f. = 3, P greater than .05 level.

TABLE IV

ADJUSTED TIME SCORES FOR EACH SOCIAL TREATMENT UNDER EACH OF THE FOUR EXPERIMENTAL CONDITIONS

Condition	N	Treatment			
		Nonsocial		Social	
		Mean	SD	Mean	SD
Pattern A- no distraction	20	15.05	5.22	12.55	4.86
Pattern A- distraction	20	15.40	5.12	13.77	4.72
Pattern D- no distraction	20	18.71	6.01	16.53	4.79
Pattern D- distraction	20	18.81	5.81	17.63	4.61

these order effects are not broken down in Table V. All effects of order contained in the two "groups within conditions" terms in the table.

As can be seen from the terms in Table V, there is a significant difference, with a P-level at the .05 level, for both social treatments and range-ring patterns. This indicates that the row means in Table VII represent a marked performance increment associated with social treatment, and the column means represent a marked performance decrement associated with the more stressful task design.

The overall effects of distraction proved to be not significant. The differences between the means of the distraction and nondistraction conditions are relatively small, indicating that it had minimal effect in producing stress as measured by the criterion of time to deal the task decks. However, distraction appeared to have produced consistent performance decrement although not at a significant level. None of the interactions among the variables as shown in Table V proved to be significant.

The analysis of the results as seen in Table V clearly demonstrate that social treatment is effective as an agent in reducing the effects of the stress variables in leading to performance decrement. The distracting stimuli did not produce sifficient effect to distract the S from the effects of social stimuli. The nonsignificant interaction between social stimulus and distraction indicated that distraction, as induced in this study, failed to influence differences in performance obtained with different social treatments.

Experimental Performance Scores: Errors

Table VI presents the total number of errors obtained for each social treatment under each of the four experimental conditions. In

TABLE V

ANALYSIS OF VARIANCE OF THE EXPERIMENTAL ADJUSTED TIME SCORES

Source	df	Mean Square	F
Task designs	1	555.77	5.95*
Distraction	1	19.18	0.21
Task x distraction	1	0.34	0.00
Groups within conditions	4	113.03	1.21
Ss within groups	72	93.41	
Total for conditions	79		
Social stimuli	1	140.24	6.67*
Social x task	1	1.49	0.07
Social x distraction	1	8.75	0.42
Social x task x distraction	1	0.02	0.00
Social x groups within conditions	4	21.50	1.07
Social x Ss within groups	72	21.03	
Total for treatments	80		

*P at .05 level.

this study all Ss were instructed to avoid making errors. Actually, as expected, the total number of errors was quite small, amounting to .87 errors per S, per social treatment. The only consistent effect appears to be a tendency for a few more errors to occur under the more difficult of the two task designs, i.e., pattern D. In comparison with the time measures, a significant difference in performance was obtained with this measure for both performance and physiological measures.

Experimental Physiological Measures: Finger Temperature

The difference between the basal and the final finger temperature measures were calculated in order to obtain measures of change as a result of different variables since such a great degree of individual difference exists in finger temperature measures. The important consideration is the change in temperature and not the temperature by itself without some base line to indicate degree of change and direction of change in temperature. Temperature level is useful to calculate the final palmar sweat index. Gladstone (1954) developed a table of correction factors for finger temperature in determining the palmar sweat index since the former is one of the factors which influence the latter.

The means and standard deviations for the obtained finger temperature measures during the final session for social and nonsocial treatments under each of the four experimental conditions is given in Table VII. As can be seen from this table, the means indicate that social stimuli resulted in the dampening of the response to stress under all four conditions. Also, each of the conditions produced a different level of finger temperature for both social treatments, and task designs produced greater differences in finger temperature level than distraction.

TABLE VI

TOTAL ERRORS FOR EACH SOCIAL TREATMENT UNDER EACH OF THE FOUR EXPERIMENTAL CONDITIONS

Condition	N	Treatment		Total
		Nonsocial	Social	
Pattern A- no distraction	20	17	19	36
Pattern A- distraction	20	15	17	32
Pattern D- no distraction	20	22	20	42
Pattern D- distraction	20	23	21	44
Total	80	77	77	154

TABLE VII

FINGER TEMPERATURE MEASURES FOR EACH SOCIAL TREATMENT UNDER EACH OF THE FOUR EXPERIMENTAL CONDITIONS

Condition	N	Treatment			
		Nonsocial		Social	
		Mean	SD	Mean	SD
Pattern A- no distraction	20	79.2	5.2	81.2	5.8
Pattern A- distraction	20	79.0	5.6	80.8	5.4
Pattern D- no distraction	20	74.4	6.6	76.8	5.8
Pattern D- distraction	20	73.0	6.0	74.8	6.2

A summary of the analysis of variance of the finger temperature measures is provided in Table VIII. The effects of order and the interactions of order with other variables proved to be nonsignificant and, consequently, are not reported by breakdown in the table. All effects of order in presentation of treatment and conditions are contained in the two "groups within conditions" terms in Table XI.

As can be seen from the analysis presented in Table VIII, there exists a very significant difference for task patterns beyond the .01 level, and a significant difference at the .05 level for social stimuli. This indicates that the row means in Table VII represent a marked dampening of the response to stress as manifested by either a rise, or lesser drop, in finger temperature, and a marked stress effect as measured by the same response measure under the more difficult of the two task designs.

The overall effects of distraction proved to be nonsignificant. The differences between the means of the distraction and nondistraction conditions are relatively small as can be seen in Table VII, indicating it had little effect in producing a significant change in finger temperature level. However, it did appear to have produced a consistent drop in finger temperature level although overall its effect was not significant. None of the interactions among the variables were found to be significant.

The analysis of the results as seen in Table VIII demonstrates clearly that social treatment is effective in dampening the response to stress as measured by finger temperature changes. On the other hand, distracting stimuli did not produce any significant change in finger temperature level and did not produce an effect on social stimuli as indicated by the nonsignificant interaction found between distraction and social stimuli. This nonsignificant interaction can be interpreted

TABLE VIII

ANALYSIS OF VARIANCE OF THE EXPERIMENTAL FINGER TEMPERATURE MEASURES

Source	df	Mean Square	F
Task design	1	11.24	7.11**
Distraction	1	0.40	0.25
Task x distraction	1	0.19	0.12
Groups within conditions	4	1.73	1.09
Ss within groups	72	1.58	
Total for conditions	79		
Social stimuli	1	1.60	5.00*
Social x task	1	0.00	0.00
Social x distraction	1	0.02	0.06
Social x task x distraction	1	0.01	0.03
Social x groups within conditions	4	0.30	0.94
Social x Ss within groups	72	0.32	
Total for treatments	80		

*F at .05 level.
**F at .01 level.

to mean that distraction, as induced in this experiment, failed to influence differences in finger temperature level obtained under the two levels of social treatment.

Experimental Physiological Measures: Palmar Sweat

The finger temperature measure obtained was used in determining the correction factor for palmar sweat as developed by Gladstone (1954). Also, the ratio of the print measure to the paper measure was calculated to obtain an index of palmar sweat. This would take into consideration any differences existing between the chemically treated strips of paper used to record the S's print.

The means and standard deviations for the obtained palmar sweat indices during the experimental session for both social treatments under each of the four experimental conditions is given in Table IX. As can be seen from this table, the means show that social stimuli had a dampening effect on the response to stress under all four conditions. Also, it is noted that each of the conditions produced a different level of physiological response for both social treatments. However, task design seems to have produced greater differences than distraction in palmar sweat secretion.

Table X presents a summary of the analysis of variance for the palmar sweat indices. The effects of order in presentation of the treatments under each of the conditions are contained in the "two groups within conditions" terms in Table X. As can be seen, the effects of order and the interactions of order with other variables proved to be nonsignificant, and are not reported by any breakdown of the terms.

Significant levels were obtained for the main effects of social

TABLE IX

PALMAR SWEAT INDICES FOR EACH SOCIAL TREATMENT UNDER EACH OF THE FOUR EXPERIMENTAL CONDITIONS

Condition	N	Treatment			
		Nonsocial		Social	
		Mean	SD	Mean	SD
Pattern A- no distraction	20	.702	.125	.751	.134
Pattern A- distraction	20	.754	.113	.784	.129
Pattern D- no distraction	20	.619	.122	.658	.116
Pattern D- distraction	20	.656	.120	.697	.124

TABLE X

ANALYSIS OF VARIANCE OF THE EXPERIMENTAL PALMAR SWEAT INDICES

Source	df	Mean Square	F
Task designs	1	8.14	6.21*
Distraction	1	2.37	1.81
Task x distraction	1	0.17	0.13
Groups within conditions	4	1.32	1.31
Ss within groups	72	1.31	
Total	79		
Social stimuli	1	1.58	5.45*
Social x task	1	0.00	0.00
Social x distraction	1	0.02	0.06
Social x task x distraction	1	0.03	0.10
Social x groups within conditions	4	0.26	0.89
Social x Ss within groups	72	0.29	
Total	80		

*P at .05 level.

stimuli and task designs, but not distraction. The interactions of these three variables proved to be nonsignificant. The differences between the means for the distraction and nondistraction conditions are relatively small as can be seen in Table IX. However, the effects of both social treatments and task designs reached the .05 level. This indicates that the row means in Table IX represent marked dampening of the response to stress as measured by palmar sweat response under social treatment, and for column means, marked response to stress under the more stressful of the two task designs. This is in contrast to the distraction effects which had little influence in producing a significant response in palmar sweating.

The analysis of the results in Table X clearly show that social treatment is effective in dampening the response to stress. However, as mentioned above, distraction did not produce any significant effects on palmar sweating. The nonsignificant interaction between distraction and social stimuli can be interpreted to mean that distraction failed to influence differences in palmar sweating level obtained under the two different social treatments.

Summary of Results

The data obtained leads to the conclusion that the effects of social stimuli is consistent in bringing about positive results, either performance increment or dampening of the response to stress as measured by both finger temperature and palmar sweat. Also, that distraction effects are nonsignificant overall. But, that task design produced significant levels of load stress. No interaction was found among the variables with all response measures used. The effects of order were nonsignificant, indicating that counterbalancing of a group within a condition in

the presentation of social and nonsocial treatments did not result in differences in response measures. Thus, the differences obtained between social and nonsocial treatments are not related to order of presentation of the treatments.

CHAPTER V

DISCUSSION

In this chapter we present an interpretation and discussion of the findings as they relate to the present hypotheses, theoretical formulations, and related studies.

Social vs. Nonsocial Treatment Under Nondistraction

The consistent significant differences found between the social and nonsocial treatments under the nondistraction condition, in both task A and task D, for performance and physiological response measures, resulted in the substantiation of the first hypothesis, stating that a difference would be found between the social and nonsocial treatments under the condition of nondistraction. Also, this supports the general hypothesis stated by Bovard (1959) that appropriate social stimuli will reduce the response to stress. The stress in this case is the load stress inherent in the design of the task. Furthermore, the finger temperature and palmar sweat indices obtained under nondistraction conditions above support Bovard's proposition that social stimuli will produce a "competing response" in the organism which will inhibit, mask, or screen stress stimuli such that the latter will have lesser effect. The physiological measures used in this study involved the sympathetico-adrenal medullary component of the neuroendocrine system.

Davitz and Mason (1955) suggested that social stimuli is a form of

distracting stimulus, adding new stimuli to the experimental situation, and would act to distract the attention of the S from fear producing cues and this in itself leads to a reduction of the response to fear. The presence of social stimuli in this study could be interpreted in the same manner with the response to stress, supporting this proposition at a more strictly behavioral level.

The results discussed above also have implications for an interpersonal basis for communication of emotional support and subsequent reduction of anxiety and stress through a two-person relationship. The interpersonal basis of anxiety has long been recognized in the social psychological, psychoanalytic, theories of personality. Horney (1937), Fromm (1941), and Sullivan (1953) have proposed theories supporting interpersonal theory.

In Rogers (1951, 1955) presentation of his self theory, he gives strong support for person-to-person communication of emotional support in counseling and psychotherapy, providing the S with a feeling that he no longer needs to fear what experience may hold. Under such conditions, the individual would be in a better position to relate and handle stressful situations. The above results of the effects of an appropriate social stimulus, i.e., the presence of another person whom the S has previously interacted with and selected by the S to be present during the experimental situation, supports a person-to-person communication of emotional support. Of course, the S's social perception and selection of another person as supportive was assumed and based upon the S's own personal frame of reference.

Explanation of the results from the above theoretical frameworks are not necessarily conflicting insofar as Bovard's (1959)hypothesis and Rogers' (1951) approach are concerned since these two psychologists

are working at two different levels of analysis of psychological phenomena.

The lack of communication of comfort in Mattson's (1960) study may well be due to the lack of appropriateness of the positive social stimulus as used by him. Interpersonal communication of comfort can take place when there exists some ego-involvement on the part of the S with the person accompaning the S in the stress situation as revealed in this study.

Social vs. Nonsocial Treatment Under Distraction

The effects of social stimuli under the distraction condition, in both task A and D, for performance and physiological response measures, produced significant differences between the social and nonsocial treatments, resulting in additional support of the first hypothesis, stating that a difference would be found between the social and nonsocial treatments under distraction. Again, the results indicate a tendency for social stimuli to reduce response to stress.

In this study it would seem plausible to assume that the distraction condition could serve to distract the S from the presence of another person whom he had selected to sit with him during the experimental trials. Also, it would seem equally plausible to assume that the effects of load stress, under either task A or task D, combined with distraction stress was greater than the effects of social stimuli, thus nullifying the effects of the latter. This would suggest a need to use a nondistraction type of external stress to test which one of the above statements is true. However, neither the first nor the second was supported in the results.

An interesting consideration is the fact that the distraction used in this study was aurally produced, consisting of a human voice. Since

the human voice has social value, and that in this study it was used as a form of distraction stress, we may think of it as a form of "negative" or "noxious" social stimuli. Of course, the effects of this "noxious" social stimulus is not comparable with the social stimuli introduced in this study to test Bovard's hypothesis. The social treatments consisted of the presence of another person with the S in a nonverbal form of communication; and, on the other hand, the "noxious" social stimuli, as presented through aural distraction, consisted of a verbal form of communication without the presence of the person producing it. One could assume that the effects of positive nonverbal communication was greater than negative verbal communication, resulting in aural distraction having lesser effect than positive social stimuli as defined previously, this would suggest a need to use a different kind of distraction stress in a modified version of the present study, i.e., one without "noxious" social effects, to test the above statement. Davitz and Mason (1955) have suggested that social stimuli is also distraction stimuli, serving to add new stimuli and distract the S from other stimuli. Thus, this would suggest a need to study the kind of social and stress stimuli used.

Social vs. Nonsocial Treatments Under Task Designs

Significant differences were found between the two social treatments under both basic stress activities. This supports the second hypothesis and, also, Bovard's propositions. This is in keeping with the statements made under nondistraction conditions.

Distraction vs. Nondistraction Under Social Treatment

The differences between the distraction and nondistraction condi-

tions, under the presence of social stimuli, for task A and task B, were not significant. As in Murphy's (1959) study with adults, the effects of distraction in the present study with children, were not significant. Furthermore, this nonsignificance exists under social treatment, which Murphy did not use as a variable in his study. However, in examination of the means for the four conditions, no inverse relationship was found between distraction and task design as Murphy found between distraction and threat of shock. On the other hand, comparison of Murphy's data between distraction and task design, and these same variables used in the present study, indicate a similar trend in relationship, i.e., performance means increase with more difficult patterns. Again, this demonstrates similar performance for adults, in Murphy's study, and children, in this study. The only difference observed was that the children in this study tended to obtain higher time and error scores than did the adults in Murphy's study. Otherwise, the results are comparable and similar in the relative sense.

Task Designs Under Social Treatment

Significant differences were found between task designs under the nonsocial treatment. This was expected and confirmed the findings of Murphy (1959). Similarly, the same findings were found under social treatment which Murphy did not use as a variable.

Relationship Among the Measures

It is interesting to relate the effects of social stimuli, under aural distraction and task design, on the measures overall. One effect which is rather obvious is the role of social stimuli to lead toward a

positive type of response. Social stimuli led to performance increment as measured by time, and to a dampening of the response to stress as measured by finger temperature and palmar sweat. The results support both hypotheses proposed in this study.

The role of distraction is not as impressive as that of social stimuli. The difference between scores and indices between nondistraction and distraction were nonsignificant. However, when looking at the data from the viewpoint of social stimuli, distraction appeared to have had an effect, especially under the more difficult task. Distraction seemed to play a role in preventing greater differences between the means for the social and nonsocial treatments.

Task designs used in this study produced significant results under nonsocial treatment in keeping with previous findings. The task materials influenced the S by placing different levels of load stress upon him. The resulting performance and physiological responses were affected in terms of amplitude or degree of manifest scores and indices, but did not seem to contribute to differences in scores and indices between the means under the two social treatments.

Generally, the results support Bovard's hypothesis but does not support Murphy's statement regarding the possible effects of distraction. The latter may not have been supported because of the possible roles that social stimuli may have taken. In line with Bovard's hypothesis, we find support for the proposition that social stimuli appears to screen the effects of stress stimuli, resulting in dampening of the response to stress. Aural distraction did not appear to take a significant role in distracting the S from the effects of social stimuli.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

The purpose of the present study was to investigate the effects of social stimuli, aural distraction, and task design on performance and physiological response in children. Eighty, sixth grade, male children acted as Ss, dealing two decks of 32 cards, each deck consisting of a different design pattern with eight range-rings. The time to deal each deck and the number of errors made in identifying a marked ring on each card were recorded. A mark appeared in any four of the quadrants on any one of the eight rings in 32 different arrangements. Also, finger temperature and palmar sweat measures were obtained. Twenty Ss were assigned to one of four experimental stress groups which involved different combinations of two different task designs and two levels of distraction. Distraction was produced by presenting a series of numbers in random order aurally to S through a set of earphones. All Ss were tested in a social and nonsocial situation. A social stimulus consisted of an individual whom the S has previously interacted with and selected by the S to sit with him during the experimental trial when social treatment was introduced to the S. The hypotheses tested were as follows: (1) There are differences in response to stress between social and nonsocial treatments under distraction and nondistraction conditions respectively; (2) There are differences in response to stress between

social and nonsocial treatments under two different task levels respectively. It was expected that social stimuli would produce positive effects under stress conditions.

The results demonstrated that social stimuli led to performance increment and reduction of the physiological response to stress at significant levels under the stress conditions. This supports the role of interpersonal communication of comfort or support under stress. The first and second hypotheses were substantiated. In regard to differences between distraction and nondistraction effects under social treatments, no significant results were found, but for task designs, significant differences were found. The results of the latter were expected, but the findings of the former were not.

The results of the study compared favorably with results obtained in similar studies using the same variables, suggesting that children's reactions tend to be similar to adult ones under stress. Of course, there were differences in response time and number of errors made, but the tendencies in response are in the same direction.

Conclusions

The results for social treatments under the nondistraction, load stress, conditions supported the hypothesis as proposed by Bovard (1959). He stated that social stimuli will dampen the response to stress as measured through physiological reactions. His hypothesis was supported further under the distraction conditions which represented an additional source of stress. However, as Murphy (1959) pointed out, distraction serves to distract from other variables as well as lead to modification in behavior in a direct manner itself. Under the distraction conditions, social stimuli did not seem to be as

effective. However, a close look at the data suggests that social stimuli had a tendency to act on all variables. Differences were a matter of degree not kind.

Differences between distraction and nondistraction under each task condition for social treatment were not significant. This is the same finding obtained by Murphy in his study between distraction and nondistraction under each task condition.

Children served as satisfactory Ss during this investigation. However, in comparison with similar variables in other studies, they tended to perform at a somewhat less efficient level. The difference in maturity level probably accounts for this difference in findings.

Implications of the Study

The present study contributes toward a better understanding of the effects of social stimuli and aural distraction under task activity on performance and physiological response to stress as they apply to children. The contribution is more theoretical than it is applied in nature, serving to relate some of the basic social and physiological variables relevant to an understanding of some of the factors contributing to control of stress and prediction of its effects.

Elucidation on the role of social factors in modifying response to stress in children have applications in such fields as child growth and development, training and education, and child guidance and psychotherapy.

Suggestions for Future Research

The following suggestions are indicated in furthering research along the line of the present study:

1. It is suggested that a measurement involving the pituitary-

adrenal cortical component of the neuroendocrine system be obtained to check Bovard's (1959) hypothesis more directly. Measurement of this response is more difficult for psychologists but it is more important theoretically.

2. It is suggested that an external nondistracting stress agent be utilized in a similar study as the present one, to compare its effects with distraction stress so as to obtain an answer to the following question: Is performance decrement due to the effects of distraction stress in distracting from social stimuli, or is performance decrement due to the combination of load stress and distraction stress acting in an additional fashion to overwhelm any effects social stimuli may have had?

3. It is suggested that a nonverbal auditory distraction stress be used, in a similar study as the present one, to compare its effects with orally induced distraction stress used in the present study, to obtain an answer to the following question: Would a nonverbal auditory distraction stress agent have less effect in distracting from social stimuli than a verbal distraction agent, and thereby result in greater dampening of the response to stress?

4. It is suggested that additional and different social treatments be tested, e.g., use of an adult instead of a child, selected by the S to be present with him during the experimental sessions, or selection of a child by E, instead of by S, who is a stranger to the S. This would present an experimental social test of various types of social stimuli which may have an effect on the response to stress.

5. Selection of anxious and nonanxious Ss to participate in a study on the effects of social stimuli on stress to determine the role of social stimuli in influencing Ss with different personality characteristics.

This involves the type of study suggested by Lazarus and Speisman (1959).

6. It is suggested that a personality assessment of persons in the presence of each S under experimental stress be determined so that personality factors associated with dampening of response to stress or performance increment be identified.

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VITA

George Bouthillette

Candidate for the Degree of

Doctor of Philosophy

Thesis: THE EFFECTS OF SOCIAL STIMULI, AURAL DISTRACTION, AND TASK DESIGN ON PERFORMANCE AND PHYSIOLOGICAL RESPONSE IN CHILDREN

Major Field: Psychology

Biographical Information:

Personal Data: Place of birth - Providence, Rhode Island; date of birth - April 2, 1927.

Education: Bachelor of Science degree, June 1952, University of Oklahoma, major - Mathematics; Master of Arts degree, June 1954, University of New Hampshire, major - Psychology; Doctor of Philosophy degree, requirements completed July 1961, Oklahoma State University, major - Psychology.

Experience: Mathematics and Science Teacher, September 1951-June 1952, Sanford High School, Sanford, Colorado; Supervisor-Instructor, July 1952-August 1954, Clarostat Mfg. Co., Dover, New Hampshire; Clinical Psychologist, September 1956-September 1957, Winfield State Hospital and Training Center, Winfield, Kansas; Chief Clinical Psychologist, December 1957-September 1959, Enid State School, Enid, Oklahoma; Coordinator of Child Guidance Services, September 1959-September 1960, Oklahoma City Public Schools, Oklahoma City, Oklahoma; Director of Community Guidance Program, September 1960-present, Oklahoma State Department of Health, Oklahoma City, Oklahoma. Also, Psychology Testing Student, September 1952-June 1954, New Hampshire State Hospital; Psychotherapy Student and Group Therapy Leader, January 1955- September 1956, Northampton State Hospital, Northampton, Massachusetts; Teaching Assistant in Psychology, September 1957-January 1958, Oklahoma State University; Visiting Lecturer in Psychology, Summer 1960, Central State College, Edmond, Oklahoma; Research Associate in Pediatrics, September 1959-present, University of Oklahoma Medical Center, Oklahoma City, Oklahoma.

Organizations: Psi Chi, 1954; Phi Delta Kappa, 1958; American Psychological Association, 1958; American Association for the Advancement of Science, 1958; Oklahoma State Psychological Association, 1960; Oklahoma Health and Welfare Association, 1960; Oklahoma Public Health Association, 1960.