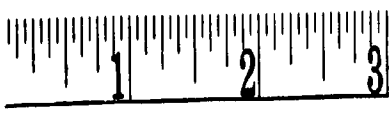
DOCTORAL DISSERTATION SERIES

TITLE EXPERIMENTAL INDUCTION OF ANXIETY BY CONDITIONS OF UNCERTAINTY

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EXPERIMENTAL INDUCTION OF ANXIETY BY CONDITIONS OF UNCERTAINTY

by
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A. K. P. S.

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CHAPTER I

INTRODUCTION

After reviewing the literature on anxiety and fear, one can hardly fail to be impressed by the lack of agreement in regard to the nature of anxiety and its genesis. In 1890, William James (25) held the view that anxiety reaction is instinctive, phylogenetically determined, and not learned. Some years later, Watson (57), on the basis of the reactions of infants to loud sounds or loss of physical support, deduced the conclusion that most human fears are dependent upon individual experience. Although he did not regard those reactions as instinctive, nevertheless, he said that they were not learned. In recent years, some students of the conditioned response have come to conceive of anxiety as a conditioned response to stimuli and cues associated with pain. Mowrer (42) treats of anxiety as a motivating and reinforcing agent similar to hunger and thirst. Freud (16) said that in human beings instinctive anxiety probably does not exist.

In the psychoanalytic literature, the term anxiety has been employed in several senses at different times. It was originally a name for the specific conscious emotion,

irrespective of what object or situation evoked it. Later, this emotional state came to be recognized as anxiety only when it was precipitated by an object or some situation that did not involve any real danger. In fact, it came to acquire several other meanings too, which will be obvious from the discussions in the next section.

Again, with regard to the relation of anxiety to fear, some have offered the view that both are synonymous, and, on the contrary, a number of psychoanalysts and others have attempted to draw a distinction between the two. In the same way, there are several other issues relating to the notion of anxiety upon which authors are divided, but let us leave them for discussion elsewhere.

In the face of the above facts, one naturally feels tempted to ask himself the cause of so much ambiguity and confusion attached to the concept of anxiety. And the answer that comes to mind is that it may be so because of insufficient adequately controlled experimental study of this problem.

The investigation reported herein is an attempt to meet in part the need for experimentally based theory of anxiety.

CHAPTER II

REVIEW OF THEORETICAL AND EXPERIMENTAL STUDIES ON THE GENESIS OF ANXIETY

We propose to review briefly in this section the typical interpretations of anxiety and its genesis.

A. Genesis of anxiety in terms of mental factors:

We have under this class the views of a host of writers who mainly emphasize the importance of some mental factor or factors in the production of anxiety. Broadly speaking, all agree in the view that what is common to all anxiety states is a sense of something impending, of anxious expectation of something harmful that is attached to certain situations, ideas, or objects. This seems similar to what Freud has often spoken of as "free-floating" anxiety. But when, they differ considerably amongst themselves then they speak of the origin of anxiety in terms of diverse factors. To mention a few only, Mannhardt (36) attributed anxiety primarily to overwork; Oppenheim (47) to some psychical shock or grief; Dagonet (7) to the feeling of depression supposed to infect the mind with a sense of danger; Dubois (11) to faintheartedness and defective reasoning; and Varendonck (56) to a mode of adaptation to

the new.[1] Symonds (52) defines anxiety as mental distress due to some anticipated frustration.

B. Genesis of anxiety in terms of physiological factors:

In this category, we have the views of a number of writers like Roller (50), Luys (35), Ball (1), Hatschek (21), Regis (49), Hoche (23) and others who have spoken of the origin of anxiety in terms of physical symptoms. Roller propounded the hypothesis of a functional disturbance in the medulla oblongata; Luys spoke of ischaemia of the brain and Ball of reflex impulses arising in the internal organs and conveyed through the sympathetic; Hatschek postulated a special excitability of the subcortical or spinal and sympathetic centers; Regis thought of coanesthetic disturbances as the origin of anxiety; and Hoche stated that anxiety could arise either as the result of reflex irritation, or, of poisoning with carbon dioxide.[2] Recently, Ziegler (60) has also suggested that the anxiety reaction is primarily due to some physical symptom.

It will be evident that the above views draw heavily upon the James-Lange theory of emotions. But Janet (26) has shown the absurdity of the James-Lange theory by referring to several cases of organic diseases in which the physical symptoms of anxiety syndrome may occur, without

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[1]Ernest Jones, "The Pathology of Morbid Anxiety," J. Abnorm. Psychol., 6, 1911-12, Pp. 81-106.

[2]Ibid.

the patients'experiencing the feelings of anxiety. Similarly, Loewenfeld (34) has spoken of the occurrence of abortive anxiety attacks, which stands in direct opposition to this theory. Hadfield (19) has drawn attention to the fact that there are many patients having marked toxaemic conditions who may even die of them without exhibiting the symptom of anxiety. Hall (20) has also amply shown the crudeness of this hypothesis.

Kubie (31) has put forward a physiological interpretation of anxiety by combining the notion of startle pattern of Landis and Hunt with Pavlov's concept of conditioned reflex. According to him, anxiety arises

> in the interaction between excitatory and inhibitory processes, at the point at which a diffuse irradiation of excitatory processes is actually imminent, or when a reminiscence of such an irradiation is stirred in response to a conditioned stimulus.

And just as light can produce salivation, an appropriate conditioned stimulus must arouse an anticipatory image of the startled state itself. Thus, anxiety is regarded by Kubie as an anticipatory warning which occurs in the individual's effort to protect himself against the outbreak of the basic startle state. In short, as Kubie writes,

> Physiologically it is a waiting to be startled; it is waiting for the irradiating excitatory processes to burst through the dykes formed by the inhibitory processes. Psychologically it is free anxiety where the conditioned stimulus is not constant or not recognized, and phobic anxiety where it is constant and recognized.

C. Genesis of anxiety in biological terms:

Darwin (8) was the first to formulate the hypothesis that the tendency to fear certain objects is inherited from past generations. Hall (20) also emphasized this view. According to him, fear can only be understood genetically; its reinforcements and physiological expressions are full of atavistic rudiments, for men do not inherit so much the effects of specific objects feared as the physical and psychic diathesis of fear. The view of James (25) has already been noted earlier.

D. Psychoanalytic theory of anxiety:

Freud originally put forward the thesis that through repression the instinctive representative is distributed, displaced, and the like, and the libido of the instinctual impulse transformed into anxiety. In other words, he held that when libido is repressed, it becomes converted into anxiety and then reappears as free-floating anxiety. This view was essentially based on his observations upon the clinical patients. Later, Freud (16) argued that if the thesis as stated above was correct, then the study of phobia should furnish proof of the same. But unfortunately, it failed to confirm the thesis. On an analysis of phobia, it appeared to him that the anxiety of zoöphobia was transformed castration anxiety, therefore a real anxiety, a reality fear, fear of a danger actually threatening or believed to do so. He thus concluded that it was not repression that caused anxiety, but the process

was just the reverse. And, subsequently, he abandoned his earlier view and said that the "ego is the real locus of anxiety." When the ego perceives danger, anxiety is aroused. Thus, according to Freud's final view, anxiety rises as a response to a situation of danger and its function is that of a signal for avoiding the situation of danger.

Freud, further, spoke of a certain predisposition to anxiety on the part of the infant although he did not agree with the notion of birth trauma as advocated by Rank (48). He, first of all, accounted for objective anxiety in the child with the help of the idea of separation in the child from the mother and then extended the same to explain other forms of anxiety, e.g., castration anxiety in terms of fear of separation of the penis. Similarly, fear of castration later on develops into dread of conscience, into social anxiety when there is the fear of separation or exclusion from the horde.

Another point worth noting at this place is Freud's distinction between neurotic anxiety and objective or real anxiety (15, 16). Freud held that a real danger is a danger which we know and which threatens from some external object and a true anxiety is the anxiety in regard to that real danger. The neurotic danger, on the other hand, arises from an instinctual demand and insofar as this instinctual demand is a piece of reality, neurotic demand

may also be founded on reality. But, when we do not know the danger, then the anxiety is called neurotic anxiety. Besides, sometimes, it so happens that the danger is known and of the real type, but the anxiety in regard to it is disproportionately great, greater than it ought to be in our judgment. Such an anxiety is also called neurotic. It is by this excess or disproportionality that the neurotic element is revealed.

According to Jones (28), anxiety is an expression of the ego's effort at defense. He objects to Freud's notion of the transformation of libidinal impulses into anxiety and defines anxiety or morbid anxiety, as he calls it, as

> a perverted manifestation of the fear instinct, which, in the case of neurotic conflicts, has been stimulated to activity as a protection against the threatening libido.

Horney (24) writes,

> Fear and anxiety are both proportionate reactions to danger, but in the case of fear the danger is a transparent, objective one and in the case of anxiety it is hidden and subjective.

Thus, the neurotic anxiety according to Horney, concerns not the situation as it stands actually in reality, but the situation as it appears to the patient.

According to Fairbairn (13), anxiety differs from fear only in that while fear is an acute condition, anxiety is a chronic condition and the symptoms of anxiety differ from those of fear in the same way in which the

symptoms of any chronic disease differ from those of the same disease in its acute form.

Fromm (17) opposes the biological orientation of Freud and explains it by a cultural orientation. According to him, man's nature, his passions and anxieties are a cultural product and that the anxiety with which an individual reacts to a danger does not depend exclusively on the realistic greatness of the danger.

> An individual who has developed an attitude of helplessness and passivity will react with anxiety to a comparatively small danger.[1]

Fenichel (14) puts more emphasis on birth trauma than Freud did. According to him, all anxiety, in the last analysis, is a fear of experiencing a traumatic state. He points out that the symptoms of the traumatic neurosis show that primary anxiety is not limited to infancy. It is an automatic and unspecific response to the traumatic situation and that it occurs whenever the organism is flooded with excitement. And when the ego is developed "anxiety" is tamed so that it is used as a warning signal. But sometimes the ego's capacity to give warning signal fails and in that case the slight anxiety resulting from the judgment of danger acts like "a lighted match in a powder keg" and the individual regresses to the state of primary anxiety. This is noticed in patients

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[1]Quoted by Horney, The Neurotic Personality of Our Time, p. 70, footnote.

having anxiety hysteria and so also in normal persons when they react to danger with paralyzing panic.

Sullivan (51) holds that anxiety is always related to interpersonal relations and further distinguishes anxiety from fear, though admitting that as felt experience both marked fear and uncomplicated anxiety are identical. There are three points of difference, between fear and anxiety: (1) the significant pattern of situations giving rise to the tension of fear is roughly the same for all people, but in the case of anxiety it can be almost infinitely varied among people; (2) whereas, fear may "impede" the processes of observation, analysis, understanding, etc., anxiety invariably "interferes" with their effective application to the current situation; (3) the tension of fear is manifested in activity which removes, i.e., destroys the provocative situational factors, escapes them, neutralizes their importance or defers being afraid to the near future, but as he says,

> In vector terms the tension of anxiety is always 180° to any other tension with which it coincides.

No other tensions can suppress or defer activity resulting from anxiety.

E. Experimental Studies:

The experimental work may be roughly classified into two classes: (1) studies dealing with the original or primitive conditions for the primitive reaction of fear or anxiety, and (2) studies dealing with anxiety in special or specific conditions.

Under class (1), we may take such studies as those on children's fears by Watson (58), and the experiments by Landis and Hunt (33) on startle pattern.

Watson (58) claimed that the innate fear responses of the infant are elicited by (1) mechanical disturbance, e.g., sudden removal of support or an unexpected push; and (2) loud sounds. But Valentine (55) has stated that loud sounds do not invariably produce fear, though usually they do.

Watson, further, stated that the fear pattern can be conditioned to stimulations which did not originally produce it. Hilgard and Marquis (22) have, however, criticized the doctrine of conditioned emotions on the ground that emotional development takes place in a complex social context which has never been dealt with in terms of the principles of conditioning.

Landis and Hunt (33) did several experiments on startle pattern. By startle pattern, they meant the general reflex response of skeletal muscles to a sudden stimulus. It is a rapid transitory reaction which is completed in a fraction of a second. They, further, regarded startle pattern as pre-emotional.

Blatz (2) thought that he aroused the emotion of fear in the laboratory by precipitating the subject backwards unexpectedly while he was seated in a chair and found cardiac palpitation, irregular breathing, and other bodily changes of strong emotion.

Under class (2), we find a series of studies treating anxiety as a response capable of being conditioned to various specific situations. Such treatment takes the primitive anxiety reaction for granted, and, therefore, is not concerned with the nature of the primitive reactions or the primary conditions under which it occurs.

Mowrer (42) explicitly put forward the hypothesis that anxiety is a learned response, occurring to signals that are premonitory of situations of injury or pain, and further stated that when anxiety is learned as a response to a new situation, it serves as a drive and anxiety-reduction acts as a reward. This hypothesis led to a series of experimental studies by Mowrer (43), Mowrer and Lamoreaux (44, 45), Mowrer and Vick (46), and Coppock and Mowrer (5), illustrating its relevance. Dollard (10) also applied this hypothesis quite convincingly. A few other studies are Brown (3), Brown and Jacobs (4), and Miller (39, 40, 41).

In addition, there are several studies dealing with the magnitude of anxiety state under different specific conditions. Estes and Skinner (12) attempted to measure the magnitude of the anxiety state by the rate with which rats pressed a lever under periodic reinforcement. Tomkins (53) attempted to measure anxiety by comparing motor learning in human subjects under normal conditions and under threat of electric shock for errors, and

pointed out (54) that the assumption that the non-shock trials were free from anxiety was found to be fallacious.

F. May's synthesis of the theories of anxiety:

According to May (37), both fear and anxiety are responses to threat and the difference between the two lies in that, whereas, anxiety is unspecific, undifferentiated, and objectless, fear, on the other hand, is specific, differentiated, and objectivated. Anxiety is basic both in the sense of being original response to threat and in the sense of a response to a threat to some value which the individual holds essential to his personality. Fear, on the other hand, is a response to a threat before it gets to this basic level. This distinction, May believes, has its supporting evidence in the biological data of Goldstein, the neurological data of maturation, and the psychoanalytic data of Freud and others. He then speaks of the normal and the neurotic forms of both fear and anxiety.

On the basis of an analysis of a number of clinical case studies, May further holds that it is the cleavage or contradiction between expectations and reality, which first occurs in the person's relations with his parents, that underlies any anxiety, whether normal or neurotic. When the cleavage appears in the form of an irreconcilable contradiction, the individual engages in a neurotic distortion of reality and the anxiety is called neurotic. But when the individual makes an attempt to resolve the cleavage by bringing expectations and reality

together, the cleavage results in creative activity and the anxiety is called normal. Kierkegaard, Goldstein, and Liddell have also emphasized the importance of the capacity to experience a gap between expectation and reality and with it the capacity to bridge over the gap.

CHAPTER III

OBJECTIVE OF THE PRESENT STUDY

The preceding review of literature reveals a great diversity of opinion about the nature and genesis of anxiety. Several reasons for this state of affairs might be suggested. First, most of the views advanced are based on clinical case histories. Second, as Kubie (31) has pointed out,

> the confusion which has arisen over the psychoanalytic concept of anxiety rests perhaps upon a triple category: "anxiety" as a symptom or finding; "anxiety" as a basic force; and "anxiety" as a disease process.

But by far, the most important factor is the lack of experimental investigation in this area, which in turn is due to one or both of the following factors: (i) difficulty of arousing anxiety in the laboratory and maintaining it for some time; (ii) difficulty of studying anxiety when it usually occurs in normal conditions.

There have been, to be sure, important experimental studies, but most of them have been animal experiments, the results of which may not have much generality, particularly when extension to human problems is attempted. There is, therefore, the necessity of determining the

common factor or factors underlying different situations which arouse or instigate anxiety in any individual. May (37) has attempted a synthesis of the divergent theories of anxiety, and to a great extent, he has succeeded in bringing together the loose ends of several theories. But the way in which he treats of normal and neurotic forms of both fear and anxiety seems to confuse the distinctions made rather than clarify the same.

The fundamental problem before us is to discover the basic factor that leads to the arousal of the anxiety state. And this necessitates an investigation into the primary conditions under which fear or anxiety is originally aroused. This is so, because in order to understand adequately the reactions that occur under specialized conditions, we need to understand the primitive reactions under general non-specialized conditions.

As discussed earlier, a large number of psychoanalysts and others seem to hold the view that anxiety is aroused when an individual perceives some danger. In other words, anxiety is regarded by them as a response to a signal of danger. But the question is: What is meant by danger? Danger is a meaningful concept. And if that be so, how can the primitive reactions of the infant that take place, prior to the infant's acquisition of the meaning of danger, be accounted for by those theories which emphasize in some way or other the importance of the

perception of danger or threat as the cause of the arousal of the anxiety state? The various experiments by Watson on children's fears as also the experiments by Landis and Hunt on startle pattern furnish supporting evidence to the view that the primitive reactions of fear or anxiety occur long before the meaning of danger or threat is grasped by the child. It follows then that those theories which emphasize the recognition of danger or threat in the arousal of the anxiety do not consider the basic factor that is involved in the arousal of the anxiety state.

Kubie (31) held that anxiety is an anticipatory warning that happens in the organism's effort to protect against the outbreak of the basic startle state. The startle pattern seems to be a general postural reaction of motor alertness on the part of an organism. And, if that be so, it may itself be taken to serve protective function. It seems then meaningless to say that anxiety occurs as a protection against the outbreak of something which itself appears to serve protective function.

What then is the factor that underlies the primitive reaction of anxiety or fear? It is some kind of uncertainty in the situation that gives rise to the primitive reaction of anxiety. By "uncertainty," we mean something that is indeterminate and meaningless. The infant, for instance, gets afraid at the slamming of the door. He is afraid, not because he perceives danger in it, but because the situation is intensely stimulating yet lacks meaning, i.e., involves uncertainty.

As we have raised above the question of meaningful and meaningless situations, it becomes necessary for us to define those situations explicitly, which, to be sure, will also clarify the logical basis for undertaking the present experimental investigation. A situation is said to be meaningful when specific reactions, whether perceptual or behavioral, are available. For instance, an individual, although in a hurry to cross a street restrains himself when he sees the traffic very fast and crowded. The situation is a meaningful one. The individual realizes danger in crossing the street and so he defers his movement until the crowd is gone.

But very often, an individual confronts a situation, for which, either no specific reaction is available, or, sometimes two or more specific reactions are in rivalry so that none becomes dominant. Such a situation is relatively meaningless. A loving father, for instance, expects his son to be back home at a particular time, but the son does not appear at that time. This provides a situation of indeterminateness or uncertainty for the father and he becomes anxious. Now, if a situation happens to consist only of stimuli which elicit specific "reflexes" (protective, postural, sense organ adjustment, etc.) then appropriate reflexes occur. When, however, the situation is otherwise, i.e., involves phenomenally a high degree of indeterminateness or uncertainty, the individual has no alternative but to react in a primitive, usually

non-specific manner. The primitive, non-specific reactions which occur under these circumstances include the startle pattern and the so-called "emergency," sympathetic pattern as well as others that need not be considered here. (The question of para-sympathetic reactions is left open.)

It is an everyday observation that some persons fall into an anxiety state under such conditions as that described above, whereas, others do not. This is because the same situation is not perceived in the same way by every person, nor does the same situation have identical meaning for every one. Perception is dependent upon education, experience, culture and environment. And, it is often the lack of clear perception that seems to arouse uncertainty in the situation, which again leads to the state of anxiety. Phenomenal uncertainty of either perception or expectation, or both, may thus be regarded as intimately related to, perhaps identical with, anxiety and fear, which differ only in degree. It may also be kept in view that anxiety is phenomenal; it is something that the individual feels within himself.

We can now dispose of, at this place, one question which has been a matter of rather serious consideration by many, viz., whether anxiety should be treated as innate or learned reaction. It is true that the capacity for anxiety is innate. This is obvious from the facts of initial responses of the infants to many objects exciting fear. But

then, it is no less true that an individual learns anxieties in course of time in accordance with the culture and society of which he happens to be a member and in which he actively participates. This fact has been amply emphasized by Allison Davis (9).

The importance of uncertainty in the arousal of anxiety has been recognized in one way or another by many writers.

Freud (16) has explicitly stated that anxiety is undeniably related to expectation. One feels anxiety lest something occur. It is endowed with a certain character of indefiniteness and objectlessness. This is certainly close to what we have stated above. Coriat (6) also believed that all anxiety is related to expectation.

According to Fenichel (14),

> An expenditure of energy is associated with the anxiety or the fearful expectation felt by a person who is uncertain whether he will be able to master an unexpected excitation.

He further writes,

> Both anxiety and functional pleasure disappear when the ego is sure of itself and no longer holds an anxious expectation in readiness.

Goldstein (18) writes:

> Abnormal states of anxiety grow out of various causes, but fundamentally they result from the fact that the individual is in a state of uncertainty about his existence, taking this term in its broadest meaning. This uncertainty may be based upon external or internal difficulties; it may rest upon events in the personal life of the individual or upon the condition of a group, a class, a people, a nation, and so on.

Kardiner (29) points out that, whether neurotic or otherwise, anxiety is always an indicator of a deficiency of resources to combat what the individual regards as a threat to his existence or safety. He further, states that anxiety is usually accompanied by helplessness or a tendency to flight. Kardiner (30) also refers to different kinds of insecurity as responsible for anxiety in different cultures. Wegrocki (59), while pointing out the complexity of factors leading to the arousal of anxiety, has stated that anxiety may arise in response to any form of insecurity which an individual may experience.

The importance of uncertainty in the arousal of the anxiety state is also noticeable in the different systems of Indian Philosophy. Although the Indian thinkers were probably not concerned primarily with the specific problem of anxiety, nevertheless, they treated "ignorance" as the cause of different kinds of miseries including anxiety. By "ignorance," they meant lack of a clear knowledge of the true nature of things, which is fairly close to what is often referred to as lack of clear perception. Buddha (6th century B.C.),while speaking of worldly pleasures, pointed out that the transitoriness of pleasures and the feelings lest they should be lost make pleasures lose their charm and turn them into positive sources of fear and anxiety. In Bhagavad Gita again, we find reference to the uncertain character of things and events as giving rise to the state of anxiety.

We can now say that anxiety is something which the individual feels within himself and that it is caused by some kind of uncertainty. And if that be so, we should be able to find experimental evidence to this effect.

The objective of this study is, therefore, to create uncertainty in the expectation of an individual under laboratory conditions and thereby to demonstrate experimentally that uncertainty actually leads to anxiety. It is presumed that anxiety will manifest itself through several indicators of sympathetic activity. This has some supporting evidence from studies by Blatz (see page 11).

More specifically, the aim is to get experimental verification of the following hypotheses:

A. If some kind of uncertainty, either in expectation or perception, or both, be introduced in a laboratory situation, a reportable state of anxiety will develop.

B. The anxiety state aroused in the subject under the conditions stated in A will be accompanied by certain physiological reactions. For this study, we propose to measure the following: (i) change in respiration. (ii) change in skin resistance, and (iii) change in pulse rate.

C. The greater the uncertainty, the greater the anxiety will be reported by the subject and the greater will be the change in his respiration, skin resistance and pulse rate.

Here, uncertainty refers to the physical or objective uncertainty. And, it is presumed that the same degree of physical uncertainty may not correspond to the same degree of subjective uncertainty for each subject, and consequently, individual differences are to be expected.

CHAPTER IV

EXPERIMENTAL PROCEDURES AND TECHNIQUES

A. Apparatus

The apparatus employed in this experiment was a complex structure comprised of (a) a polygraph, (b) a recording galvanometer, (c) a pneumograph, (d) a device for the random movement of a spot of light on a ground glass screen, and (e) a device for administering electric shock to the subject. A brief account of the purpose served by each is attempted below. Besides, certain points will be clear as one will get along to the description of the various conditions under which experimentation was conducted. It is, however, not considered essential to give the mechanics of the apparatus and equipment.

The general plan of the experiment required continuous alert activity on the part of the subject -- an activity which provided minimum possibility of learning and where high level performance was advantageous to the subject and low level performance was disadvantageous to him. And thus, the following device was introduced. The subject was seated in a chair in front of a circular ground glass screen about 23 inches in diameter and on that field was projected by means of a mirror an illuminated

spot. The mirror was made to oscillate in two dimensions at right angles and the oscillation was governed by two irregular motor-driven cams so that the spot wandered on the screen in a completely unpredictable way. But there was a lever by means of which the subject could compensate for the action of the cams so that the spot would stay in the center of the screen if the subject kept the lever moving in the right way. This mechanism was connected with the polygraph so that the amount of error (i.e. the distance to which the spot moved away from the center) was recorded. Finally, there was a provision for adjusting the amplitude of the movement of the spot from zero difficulty to the maximum. The maximum was such that nobody could avoid occasional error. It was possible to make this adjustment of difficulty during the experiment without the subject knowing about it. This was introduced for the purpose of matching the level of difficulty to the subject's level of performance in order, it was hoped, to keep the total number of errors, and therefore, of shocks, constant for all experimental periods for each subject.

The recording galvanometer was used in conjunction with an electronic network which automatically kept the current passing through the skin of the subject constant at 40 micro-amperes and measured the apparent resistance in terms of the potential difference across the electrodes. A continuous record of the changes in the resistance of

the skin was maintained by connecting the galvanometer to a stylus on the polygraph. One of the two electrodes used was attached to the palm of the left hand and the other was fixed into an opening in a rubber boot, filled with physiological salt solution, on the subject's left foot. Each electrode was made of a fritted glass filter of fine porocity, filled with physiological salt solution in which a loose coil of anodized silver wire was immersed.

The pneumograph used was a common one. It was tied around the chest of the subject.

The shocking circuit was also an electronic network which automatically maintained constant current, regardless of changes in the subject's resistance. A pair of metallic electrodes, coated with standard electrode paste, was attached to the right leg of the subject above the ankle. The shock given was pulsating D.C. with sawtooth wave and although its intensity varied from subject to subject inasmuch as the same amount of shock was not equally unpleasant to all subjects, it remained the same for the same subject at all sessions. In addition, there was a device for delaying each shock for any desired length of time.

The polygraph used was a four-channeled one. It recorded the following: (i) errors, (ii) shocks, (iii) respiration, (iv) skin resistance.

B. Subjects

The subjects were twelve University of Michigan students. Eleven of them were under-graduate students in the department of Psychology and the remaining one was a graduate student in the same department. Each subject reported for the experiment at the same hour on all four days. A typewritten sheet of instructions was read by each subject before the experiment began.[1]

C. Experimental Sessions

As the task performed by each subject as also the physiological reactions measured remained the same for all sessions, it may be well to state them now in order to avoid their frequent repetitions in connection with the description of the different sessions.

The task for the subject was to move the lever in order to keep the wandering spot within an area bounded by a ring three inches in diameter at the center of the glass screen. Allowing the spot of light to move out of the ring completely, was defined as "error."

While the subject was performing the task, a continuous record of the changes in both respiration and skin resistance was maintained on the polygraph. For the changes in pulse rate, we counted the arterial pulse beats at intervals of five minutes.

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[1]The directions for the subject may be found in Appendix A.

The experimental program for each subject consisted of four sessions: 1. Null session; 2. Periodic shock session; 3. Immediate shock session; and 4. Delayed session. Each session lasted for 20 minutes and was divided into four periods which were as follows: (a) no activity of one minute duration; (b) activity without any special condition for two minutes; (c) activity with special condition or conditions for 15 minutes; and (d) repetition of (b). As the null session was free from any special condition, the periods (b), (c), and (d) during this session actually constituted only one period of activity, without any special condition. The conditions for the three remaining sessions were alike for the periods (a), (b), and (d). The period designated as (c) was the main period in each experimental session and so sessions 2, 3, and 4 differed in respect of the condition or conditions for this period. (See Table 1)

Before beginning the experimental program, each subject was given familiarization with the experimental situation, the apparatus, and the task that he was required to perform during the experimental sessions. This was done in order to ward off the adverse effects, if any, of the experimental situation alone, upon the reactions of the subject.

1. Null Session.--This session served as the control session to provide a base line for the different

TABLE 1

EXPERIMENTAL SESSIONS AND THEIR CONDITIONS

Sessions	Conditions (a) No Activity 1 Min.	(b) Activity Without Shock 2 Mins.	(c) Main Exp. Period with Special Conditions 15 Mins.	(d) Activity Without Shock 2 Mins.
1. Null session	"	"	Activity, without shock	"
2. Periodic shock session	"	"	Activity, with shock at the end of every 72 seconds when the red light was on.	"
3. Immediate shock session	"	"	Activity, with immediate shock for error.	"
4. Delayed shock session	"	"	Ring removed. Activity, with shock for error delayed by 30 seconds.	"

physiological reactions of the subject in his normal least excited state. The subject was asked to keep, as best he could, the wandering spot of light inside the ring by moving the lever, and while he was doing this, his different physiological reactions were automatically recorded in accordance with the procedures already described.

2. Periodic Shock Session.--For this session, 15 miniature electric lamps, spaced at equal intervals at the periphery of the field flashed one at a time in regular sequence around the circle. One of these lights was red, and about one second after it flashed the subject received a shock lasting one second. It took 72 seconds to complete one cycle. The whole thing constituted, as it were, a clock to tell the subject when he would get the shock. The intensity of shock for each subject was adjusted to an intensity which he reported to be very uncomfortable, but tolerable. The subject thus received shocks during this period periodically regardless of the times of occurrence of errors.

Thus, the conditions of the periodic shock session provided maximum certainty or minimum uncertainty since the subject always knew exactly when each shock would occur. (There is, to be sure, a form of unavoidable uncertainty in this and all other sessions except the null session, viz., the uncertainty of anticipating or imaging exactly the degree and quality of pain, tingling, etc. due to the shock.)

This session was introduced to serve a two-fold purpose: (i) to reveal the shifts in the physiological reactions which were due to the administration of shocks, specifically and thus (ii) to provide a base line for isolating the shifts due to the factor of uncertainty (other than the one involved in shock) in other sessions in which shock was coupled with different degrees of uncertainty.

3. Immediate Shock Session.--During this session the subject received shock immediately for each "error," after having been so informed at the beginning of the main period.

This session involved: (i) an uncertainty of expectation since the subject could not know when he would make an error, and (ii) the imaginal uncertainty of phenomenal shock.

4. Delayed Shock Session.--This session differed from the immediate shock session in two respects: (a) the ring indicating the zone of safety was removed so that along with other uncertainties a perceptual uncertainty was also added, and (b) the shock for each error was delayed 30 seconds.

Thus, there are four physically differentiated sets of conditions and correspondingly, it may be supposed, four levels in a certainty-uncertainty continuum; zero, or approximately zero uncertainty for the null session, and progressively higher degrees for the others in the order

"periodic," "immediate," and "delayed." Our hypotheses require a finding of parallel continua for phenomenal anxiety and for the physiological indicators under observation.

Sessions 2, 3, and 4 were arranged in all the six possible orders and two subjects used for each order. (See Table 2.) This was done for the purpose of neutralizing as well as possible transfer effects from one session to the next.

Check-lists[1] were used for the purpose of systematizing the subject's phenomenal reports. The first check-list contained questions pertaining to the subject's feelings and experiences during the experimental sessions and it was given to the subject at the termination of each of the three sessions 2, 3, and 4. The second and third check-lists asked for ranking of the different sessions in order of the degree of anxiety produced in each session. The subject was therefore provided with the second check-list when he had finished his third session, and with the third check-list after he had completed all sessions.

To sum up, we can say that evidence for the first hypothesis and the first part of the third hypothesis is provided by answers on the three check-lists, and for the second hypothesis and the latter part of the third

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[1]For the items on the check-lists, see Appendix B.

TABLE 2

ORDERS IN THE PRESENTATION OF THE EXPERIMENTAL SESSIONS

Order I	Order II	Order III	Order IV	Order V	Order VI
N	N	N	N	N	N
P	I	D	D	P	I
I	D	P	I	D	P
D	P	I	P	I	D

N - Null Session

P - Periodic Shock Session

I - Immediate Shock Session

D - Delayed Shock Session

From here on, these abbreviations will be frequently used in other tables.

hypothesis, is provided by records of changes in respiration, skin resistance, and pulse rate of the subjects at the different sessions.

CHAPTER V

RESULTS AND INTERPRETATIONS

The results of this study may be classified under two main heads: (1) the phenomenological reports of the subjects, and (2) their physiological reactions.

It will be remembered that we maintained that anxiety is phenomenal and that it is something which the individual feels within himself. And so, in order to obtain evidence for this, each subject was asked to give his report on check-list 1 at the end of each experimental session. In preparing items for this check-list, we mostly depended upon what researchers have often referred to as symptomatic of the anxiety state, and what we obtained from the reports of a few subjects in the preliminary trials preceding this experiment. The reports on the check-list 1 of all the twelve subjects for the different experimental sessions are summarized in Table 3, given below. So far as the null session is concerned, two subjects reported that they experienced slight anxiety, while the remaining ones said that they were as calm as usual.

From Table 3, it will be clear that the subjects consistently reported anxiety during the immediate and

TABLE 3

REPORT OF THE TWELVE SUBJECTS ON CHECK-LIST 1

Question Nos.	Periodic Shock Session	Immediate Shock Session	Delayed Shock Session
1	4	5	9
2	3	3	6
3	1	1	2
4	0	4	4
5	0	1	0
6	4	2	3
7	7	12	12
8	1	0	1
9	1	11	10
10	2	4	4
11	1	3	5
12	3	3	7
13	7	9	10
14	0	3	6
15	0	1	4
16	4	7	9
Total	38	69	92

the delayed shock sessions. In addition, they also reported anxiety during the periodic shock session which was introduced principally for isolating the effects of shock from the effects of different kinds of uncertainties that were involved in the immediate and the delayed shock sessions. This is because of the fact that the electric shock by itself often makes a person anxious possibly because of the "imaginal" uncertainty referred to on page 30. It was also made clear from the reports of some subjects that their anxiety during this period was confined only to the period of shock and the red light signal. Further, the fact that the subjects answered much fewer questions in the affirmative for the periodic shock session than what they did for the immediate and the delayed shock sessions suggests the importance of degree of uncertainty in inducing anxiety. Our first hypothesis was that if some kind of uncertainty be introduced (in the laboratory situation), either, in the perception, or, expectation, or both, of the subject, a reportable state of anxiety, will develop. And now we find that the reports of the subjects after the various experimental sessions support this hypothesis.

It will also be apparent from Table 3 that the number of affirmative answers on the check-list 1 for the delayed shock session was much greater than the immediate shock session. Why was this so? The two sessions were alike, except in that the delayed shock session involved greater

uncertainties than the immediate shock session. It follows then that the reports of the subjects on the check-list I also demonstrate that with the increase in the amount of uncertainty, the amount of anxiety is also increased. And this, in fact, is, in essence, what we hypothesized in the first part of our third hypothesis.

In order to obtain more conclusive evidence for the first part of our third hypothesis, we provided each subject with check-lists II and III which called for ranking of the various sessions in order of the degrees of anxiety developed in each. The results of the check-list III for all the twelve subjects are contained in Table 4, given below. Since check-list II was used merely as an additional check against the report on check-list III to see if there was any discrepancy between the rankings on the two check-lists, and the results on the two check-lists did not show any discrepancy at all, it is not considered worthwhile to reproduce the reports on check-list II in tabular form.

TABLE 4

RANKING OF THE EXPERIMENTAL SESSIONS

Sessions	Ranks		
	1	2	3
P	-	1	11
I	3	9	--
D	9	2	1

'1' stands for most anxiety, and '3' for least anxiety.

In accordance with the terms of our hypothesis, the subjects were expected to assign rank '1' to the delayed shock session (most anxiety-producing), rank '2' to the immediate shock session (intermediate degree of anxiety), and rank '3' to the periodic shock session (least anxiety-producing). And it will be clear from Table 4 that nine subjects ranked the three experimental sessions in the same orders. Three subjects (nos. 2, 5, and 6), however, made reversals. Nos. 2 and 5 made one reversal, i.e., ranked the immediate shock session as more anxiety-producing than the delayed shock session. But no. 6 changed the orders altogether. The immediate shock session was most anxiety-producing to him as it was to nos. 2 and 5. But then, he also reported that the delayed shock session produced lesser anxiety than the periodic shock session.

We are thus faced with the problem of accounting for the discrepancies in the rankings of the different experimental sessions by those subjects. And, in fact, discrepancies of this sort were not unanticipated by us. As indicated earlier, we recognized that the same degree of physical uncertainty may not produce the same degree of phenomenal uncertainty for each subject, and consequently, there will be individual differences.

Subject no. 2 reported considerable anxiety at the beginning of the delayed shock session. But soon, he realized that he was receiving shocks during that session

for no fault of his in the sense that the ring was removed from the screen and it was not possible for him to know the boundary of the zone of safety exactly. Consequently, his attitude towards the experiment changed. He became angry, apathetic, and finally resigned. He said further that he was most anxious in the immediate shock session because he felt that it was within his control to keep the spot of light within the area bounded by the ring if he made his best effort. When the ring was absent in the delayed shock session he felt he was helpless and had lost control over the situation.

The delayed shock session had relatively little anxiety inducing value for subject 5, for reasons not certainly known, but which may have included the following: First, the perceptual uncertainty of this session due to absence of the ring was almost nil because he was able to estimate the extent of the safe zone with great exactness as verified by the experimenter in a subsequent check. Second, since the delayed shock session happened to be the last session for him, he was feeling jubilant about being near the end of the ordeal of the experiment. He was of the opinion that if this session had preceded the immediate shock session, he would have felt more anxiety during this session than the immediate shock session.

Subject no. 6, who ranked the delayed shock session as the session in which he was least anxious, reported

that neither the fact of delay in shock nor perceptual uncertainty bothered him at all. He also located the zone of safety quite accurately. In addition, he said that on the day of delayed shock condition, he was very much worried about some personal fact, which he did not reveal, but at the same time he felt that it must have influenced his report. And it seems to the writer that, probably, this subject's anxiety concerning something else was so intense that it obscured completely the temporary anxiety induced under experimental conditions, with the consequence that the hardships of the experimental situation were inconsequential for him.

To sum up, we may then say that the reports of the subjects confirm our first hypothesis and the first part of our third hypothesis. The deviant rankings by three of the subjects can scarcely be considered seriously contradictory to the hypothesis.

We may now proceed to consider the results of the physiological data. But before we state the results, it may be worthwhile to acquaint the reader with the procedures adopted in tabulating the results for the different variables. It will be recalled that each session was divided into four periods (Table 1). But as the period (no activity, one minute duration) was introduced for the sake of adjustment of the apparatus and further giving more and more familiarization to the subject with the experimental situation, we may

disregard it. Let us further call periods b, c, and d fore period, main period and final period, respectively, for these are more meaningful terms.

In general, we tabulated results for the skin resistance level, respiration amplitude, and the rate of respiration during each session for the three periods, viz., fore period, main period, and final period. We also divided the main experimental period into three sub-periods, each one of five minutes' duration.

We adopted the following procedure for tabulation of the resistance values. For the fore period, we took three readings, the first reading at the beginning of the period, the second at the end of the first minute, and the third at the end of the period, and then regarded the average of the three as the resistance of the subject during the fore period. For the main period, we took the first reading at the end of the fifth minute of that period, the second at the end of the tenth minute, and the third at the end of the fifteenth minute. For the final period, we took only one reading at the end of the second minute.

For the rate of respiration, we took the average number of respiratory cycles per minute for each of the different periods. For amplitude of respiration, we took samples of respiratory cycles for one minute or half-minute for both the fore and the final periods and samples of two minutes or one minute for each of the three sub-periods into which the main period was divided and after measuring the

inhalation amplitude of each cycle we averaged the measurements. The amplitude readings thus measured should be approximately proportional to the amount of air inhaled by the subject during the sample time interval. Such an index, therefore, has a meaning qualitatively different from that of frequency of respiratory cycles. The main consideration for choosing varying lengths of samples of respiratory cycles at different points was the presence or the absence of variability in the pattern of respiratory cycles during any period. Allowance was also made for long deep breathings by distributing their measures over the whole period equitably.

For the pulse rate, we could make observations for the three sub-periods of the main experimental period only. Besides, the data for the pulse rate suffered from two irregularities, not to mention the use of a rather crude method of counting the arterial pulse-beats. The first irregularity consisted in the fact that it was not always possible for the experimenter to count the pulse-beats at intervals that were uniform for all subjects. This was because the ballant resistance in the PGR circuit required frequent re-adjustment, sometimes necessitating postponement or interruption of the pulse counting operation. Pulse-beats sometimes could be counted in a 15 second interval only, although the count was made for a 30 second interval when possible. All results are, however, stated in terms of beats per minute.

Complete data for each variable are given in Appendix C. For statistical treatment, however, the data for each variable for the three sub-periods of the main experimental period for each session were averaged. In addition, we transformed the resistance data as suggested by Lacey, O. L., et al (32) into conductance values. The averaged data for the conductances (in micromhos), respiration amplitude,rate of respiration, and pulse rate are shown in Tables 5, 6, 7, and 8, respectively.

In accordance with the terms of our second hypothesis and the latter part of the third hypothesis we were interested in knowing two things about the physiological reactions. First, we wanted to determine whether the anxiety states aroused in the subjects during the various experimental sessions were accompanied by changes in the subjects' levels of skin resistance, respiration, and pulse rate. Second, we wanted to know whether, with increase in the degree of uncertainty, the subjects' conductances, respiration frequencies and amplitudes, and pulse rates also showed a corresponding increase. To answer these questions it was, therefore, essential to find out, first, whether the data for the above variables during the main period of each session significantly differed from the data for the fore and the final periods of the same session, and second, whether the data for these variables for the main periods of the periodic, immediate, and delayed shock sessions significantly differed from the data for the corresponding

TABLE 5

CONDUCTANCES IN MICROMHOS

Order	Sub-ject	Fore Period				Main Exp. Period				Final Period			
		N	P	I	D	N	P	I	D	N	P	I	D
P I D	6	22.4	33.3	13.9	66.7	20.1	35.7	28.6	88.5	20.0	30.3	20.0	66.7
	12	56.2	55.5	66.7	86.9	48.1	53.5	78.1	149.2	46.5	47.6	80.0	111.1
I D P	1	31.5	33.3	40.0	48.8	33.7	35.3	51.8	65.3	32.2	35.7	50.0	55.5
	2	23.2	16.0	23.2	17.0	25.6	22.6	31.2	29.4	25.6	18.5	29.4	27.8
D P I	7	17.8	10.1	19.1	24.0	14.7	15.8	30.9	52.6	13.3	12.5	25.0	37.0
	8	29.7	41.1	48.8	47.2	33.0	46.1	56.5	83.3	40.0	43.5	50.0	66.7
D I P	9	71.4	58.8	62.5	68.0	69.0	55.5	71.4	82.0	66.7	46.5	62.5	66.7
	10	58.8	42.9	63.7	50.5	59.9	42.9	78.1	113.6	57.1	34.5	69.0	83.3
P D I	3	28.8	30.3	43.5	44.0	31.2	42.2	62.5	76.9	31.2	37.0	50.0	50.0
	11	26.3	16.2	24.9	43.5	19.1	21.1	36.1	57.8	13.7	15.9	33.3	38.5
I P D	4	23.5	24.5	32.8	32.8	24.6	26.3	41.7	53.5	21.7	21.7	33.3	47.6
	5	40.0	80.0	55.5	51.8	40.0	85.5	69.9	71.4	38.5	76.9	62.5	66.7
	Total	429.6	442.0	494.6	581.2	419.0	482.5	636.8	923.5	406.5	420.6	565.0	717.6
	Mean	35.8	36.8	41.2	48.4	34.9	40.2	53.1	76.9	33.9	35.0	47.1	59.8



TABLE 6

RESPIRATION AMPLITUDE

Order	Sub-ject	Fore Period				Main Exp. Period				Final Period			
		N	P	I	D	N	P	I	D	N	P	I	D
P I D	6	20.0	23.0	18.0	24.0	22.7	22.7	24.0	31.0	24.0	23.0	18.0	27.0
	12	22.0	19.0	16.0	18.0	20.7	21.7	21.7	29.3	22.0	17.0	16.0	18.0
I D P	1	27.0	22.0	22.0	22.0	23.7	27.7	29.3	29.5	22.0	24.0	22.0	26.0
	2	28.0	27.0	22.0	27.0	28.0	34.3	29.7	35.0	27.0	34.0	25.0	26.0
D P I	7	20.0	16.0	20.0	21.0	21.3	22.2	22.5	31.2	21.0	21.0	21.0	26.0
	8	22.0	18.0	21.0	21.0	20.3	22.7	26.3	27.0	21.0	21.0	25.0	25.0
D I P	9	28.0	21.0	21.0	28.0	28.0	23.7	25.7	34.3	30.0	22.0	21.0	31.0
	10	33.0	19.0	19.0	24.0	36.0	19.5	21.0	28.3	35.0	18.0	18.0	22.0
P D I	3	21.0	26.0	26.0	26.0	23.7	30.3	36.7	37.3	26.0	28.0	32.0	26.0
	11	22.0	21.0	21.0	20.0	20.3	22.7	25.7	28.0	21.0	19.0	21.0	20.0
I P D	4	27.0	27.0	27.0	27.0	27.3	34.0	36.0	42.3	27.0	32.0	32.0	38.0
	5	25.0	32.0	30.0	32.0	26.0	40.0	46.3	52.0	27.0	36.0	44.0	50.0
Total		295.0	271.0	263.0	290.0	298.0	321.5	344.9	405.2	303.0	295.0	295.0	335.0
Mean		24.6	22.6	21.9	24.2	24.8	26.8	28.7	33.8	25.2	24.6	24.6	27.9



TABLE 7

RATE OF RESPIRATION

Order	Sub-ject	Fore Period				Main Exp. Period				Final Period			
		N	P	I	D	N	P	I	D	N	P	I	D
P I D	6	19.0	20.0	16.0	19.0	19.2	19.0	18.7	19.0	18.0	20.0	18.0	20.0
	12	21.0	15.0	23.0	17.5	20.7	18.0	26.7	26.3	20.0	16.0	22.0	15.0
I D P	1	14.0	14.0	11.0	15.0	13.3	12.0	13.2	17.0	13.5	13.5	11.5	15.0
	2	20.0	12.0	19.0	19.0	18.8	15.0	18.7	16.0	13.0	14.0	18.0	14.0
D P I	7	16.0	17.0	17.0	17.5	17.0	18.3	18.5	18.2	17.0	18.0	18.0	17.5
	8	18.0	18.0	16.0	18.0	18.3	15.0	19.3	20.3	18.0	17.0	17.0	18.0
D I P	9	24.0	23.0	24.0	24.0	24.0	22.0	23.7	26.0	23.0	19.0	22.0	20.0
	10	15.0	13.0	15.0	19.0	15.7	14.0	18.3	19.7	16.0	12.0	18.0	18.0
P D I	3	18.0	16.0	23.0	22.0	15.0	15.0	20.3	20.7	16.0	12.0	19.0	22.0
	11	20.0	20.0	21.0	20.0	21.0	20.3	22.0	17.0	20.0	20.0	18.0	15.0
I P D	4	26.0	25.5	25.5	26.0	26.7	26.0	26.8	28.3	26.0	25.5	25.0	27.0
	5	19.0	23.0	23.0	22.0	20.0	25.3	25.7	25.0	18.0	24.0	24.0	24.0
Total		230.0	216.5	233.5	239.0	229.7	219.9	251.9	248.5	218.5	211.0	229.5	225.5
Mean		19.2	18.0	19.4	19.9	19.1	18.3	20.9	20.7	18.2	17.6	19.1	18.8

TABLE 8

PULSE RATE

Order	Subject	Main Exp. Period N	P	I	D
P I D	6	85.3	88.0	92.0	91.3
	12	88.0	90.7	95.3	98.7
I D P	1	88.0	90.7	91.3	96.0
	2	80.7	88.7	91.3	92.0
D P I	7	79.3	88.0	88.7	94.7
	8	80.7	85.3	87.3	97.3
D I P	9	88.0	90.7	94.7	98.0
	10	80.7	87.3	86.0	95.3
P D I	3	82.7	85.3	88.7	93.3
	11	88.7	93.3	91.3	96.7
I P D	4	72.0	74.7	80.0	85.3
	5	74.7	82.0	92.0	99.3
	Mean	82.4	87.0	89.8	94.8

period of the null session. Finally, we need to know whether the data for these variables for the main periods of the periodic, the immediate, and the delayed shock sessions differ significantly amongst themselves.

Consequently, we averaged the data for each of the variables for the twelve subjects and computed the significance of differences between the several means. Table 9 summarizes the results of the significance of difference tests between the means.

TABLE 9

SIGNIFICANCE OF DIFFERENCE BETWEEN THE MEANS FOR THE DIFFERENT VARIABLES DURING THE THREE PERIODS OF EACH SESSION

	Null Session		Periodic Shock Session		Immediate Shock Session		Delayer Shock Session	
Variables	Fo-M 't' ratio	M-Fi 't' ratio	Fo-M 't' ratio	M-Fi 't' ratio	Fo-M 't' ratio	M-Fi 't' ratio	Fo-M 't' ratio	M-Fi 't' ratio
Conductance	0.732	1.176	2.857	6.538	12.291	5.000	5.599	5.411
Probability	>.4	>.2	<.02	<.001	<.001	<.001	<.001	<.001
Respiration amplitude	0.339	1.081	5.316	5.000	6.071	7.735	7.500	6.041
Probability	>.7	>.3	<.001	<.001	<.001	<.001	<.001	<.001
Rate of Respiration	0.059	1.800	0.536	1.489	2.777	4.390	1.231	2.879
Probability	>.9	>.05	>.6	>.1	<.02	<.01	>.2	<.02

Fo stands for fore period, M for main period, and Fi for final period.

The following comments may be made on Table 9. First, there is no significant difference between three sub-periods of the null session. This is quite consistent with expectation, since there were no differences of condition among the sub-periods of the null session. Second, in the results for the conductance and respiration amplitude for the periodic, the immediate, and the delayed shock sessions, the differences are significant beyond .001 level of confidence with the exception of one which is singificant only beyond .02. McNemar (38) recommends that for testing the significance of difference between means of small samples, one should adopt a more stringent level of significance, viz., a P of .001 before drawing any definite conclusions. It will be seen that according to this stringent level of significance also, we can safely say that the various periods of the three experimental sessions significantly differed with respect to change in the conductance and the respiration amplitude. Lastly, so far as the rate of respiration is concerned, we notice that only three 't's' indicate significance--two beyond .02 and one beyond .01. Thus, rate of respiration, has no apparent relevance to our problem.

Having found that the main experimental period for each of the three experimental sessions significantly differed from their fore and final periods, it remains to show, whether the main experimental periods of these sessions

differed significantly from the main period of the null session and amongst themselves. The 't' ratios between the means of the main experimental periods of all the four sessions for the level of skin resistance, the respiration amplitude, the rate of respiration, and the pulse rate are shown in Table 10.

In Table 10, it will be noted that out of six 't' ratios for conductance five are significant (three beyond .001 and two beyond .01). This clearly indicates that with the increase in uncertainty, there was a corresponding increase in conductance. We get an additional evidence for this when we find that there is no significant difference between the means for the null and the periodic shock session. In a way, it also supports our position that the periodic shock session involved a minimum of uncertainty.

When we look at the 't' ratios for the respiration amplitude, we find that four out of six 't's' are significant (two beyond .001, one beyond .01, and another beyond .05). This indeed is a very satisfactory result. It is, however, surprising to find the 't' ratio between I and P to be significant when the 't's' between P and N, and between I and N are not significant.

Only three out of six 't's' for the rate of respiration are significant (one significant beyond .01, another beyond .02 and the third one beyond .05). In addition, we do not notice any regularity here in accordance with the degree of uncertainty involved in the different sessions.

TABLE 10

SIGNIFICANCE OF DIFFERENCE BETWEEN THE MEANS FOR THE DIFFERENT VARIABLES DURING THE MAIN EXPERIMENTAL PERIODS

Variables	P and N 't' ratio	I and N 't' ratio	D and N 't' ratio	I and P 't' ratio	D and P 't' ratio	D and I 't' ratio
Conductance	1.155	6.630	5.714	3.316	4.542	3.752
Probability	>.2	<.001	<.001	<.01	<.001	<.01
Respiration amplitude	0.952	1.560	4.045	2.375	7.000	5.555
Probability	>.3	>.1	<.01	<.05	<.001	<.001
Rate of Respiration	1.143	2.571	2.000	3.250	3.000	0.250
Probability	>.2	<.05	>.05	<.01	<.02	>.8
Pulse rate	6.571	6.727	8.857	3.111	6.500	5.555
Probability	<.001	<.001	<.001	<.01	<.001	<.001

The 't' ratios for the pulse rate are all significant beyond .001, with the exception of one which is significant beyond .01. The irregularities in the collection of the data already indicated were of such a nature that they could have increased the random error only, and could not have introduced the observed systematic effects as artifacts.

We may now turn to consider the question of order effects in this experiment. And it may be noted that in the design of this experiment interactions of order of the various experimental conditions are confounded with individual differences. The question, therefore, arises whether any evidence of the existence of such order interactions is available. Such interactions might take the form of anticipation, based on the experience of previous experimental sessions, of the nature of the new session just beginning. Any systematic effects of this nature, insofar as physiological reactions are concerned, should be revealed by comparison of the fore-period of the null session with the fore-period of the last session. If we consider variance first, starting from the supposition that the variance for the fore-period of the null session (which was the first session for every subject) is due to individual differences alone, while the variance for the fore-periods of the last session is due to both individual differences and anticipation effects, it turns out, as Table 11 (given below) shows,

that the supposed anticipation effect does not exist, unless it produces equal shifts for all subjects in the same direction, notwithstanding six different kinds of bases for anticipation, or equal or nearly equal number of shifts in opposite directions.

TABLE 11

SIGNIFICANCE OF DIFFERENCE BETWEEN THE VARIANCE DUE TO INDIVIDUAL DIFFERENCES ALONE AND VARIANCE DUE TO INDIVIDUAL DIFFERENCES PLUS ORDER-EFFECTS

Variables	F-Ratio	Probability
Conductance	1.442	$>.05$
Respiration Amplitude	1.026	$>.05$
Rate of Respiration	1.652	$>.05$

If we look for anticipation effects as indicated by means, the following comparisons, admittedly of little significance, may be made. For the four subjects whose second session was P the average difference between null session fore period conductances and third session (i.e. the session immediately following P) fore-period conductances may be computed. The same can be computed for the four subjects whose second session was I, and again for the remaining four subjects whose second session was D. Table 12 gives these differences, and also differences similarly computed for respiration amplitude.

Now, if a subject begins his third session with an anticipation based on the experience of the second, then

TABLE 12

MEAN DIFFERENCES BETWEEN THE NULL SESSION FORE-PERIOD AND THE FORE-PERIOD IMMEDIATELY FOLLOWING EACH OF THE THREE EXPERIMENTAL SESSIONS

Variables	Null Session Fore-Period Minus the Fore-Period Immediately Following Periodic Shock Session	Null Session Fore-Period Minus the Fore-Period Immediately Following Immediate Shock Session	Null Session Fore Period minus the Fore-Period Immediately Following Delayed Shock Session
Conductance	-8.6	-13.0	+0.1
Respiration Amplitude	+1.25	- 0.25	+7.25

the differences between third session fore-period values, and null session fore-period values should reveal any effects of such anticipations on physiological reactions. Inspection of Table 12, however, shows that the differences are very irregular as to sign and magnitude. The largest difference for conductance, -13.0, after I, is due mainly to subject 5 who reported greater anxiety for I than for D.

The difference of practically zero for conductance after D might suggest that after D the subjects felt that the worst was over, but the corresponding difference for respiration amplitude does not support such an interpretation. It seems, on the whole, more likely that all of these differences are random ones, and that, therefore, there is no evidence of "carry-over," anticipation effects.

Before stating the conclusions apparently to be drawn from the foregoing analysis, it is necessary to consider the question of the frequency and distribution of

shocks in the various experimental sessions. We had introduced a device by means of which, it was hoped, to maintain the number of errors made by each subject in each session constant. This, however, could not be achieved. In the periodic shock session, each subject received 13 shocks. But in the immediate and the delayed shock sessions, the number of shocks varied a great deal. The complete data for the number of shocks during these sessions are shown in Table 13.

It will be seen, in Table 13, that the means for the immediate and the delayed shock sessions were 16.7 and 30.5 respectively as against the mean of 13 for the periodic shock session. This fact might make one suspect that possibly the markedly large physiological reactions in the immediate and the delayed shock sessions could be due to the larger number of shocks administered to the subjects in those sessions. That such was, however, not the fact will be evident from the following considerations. Since the mean for the immediate shock session was fairly close to the mean for the periodic shock session, we are mostly concerned with the delayed shock session in which the subjects received the largest number of shocks.

Now, if the fact of too many shocks administered was instrumental in increasing the various physiological reactions in the delayed shock session, then the records of those subjects who were in the upper half in order of

TABLE 13

FREQUENCY OF SHOCKS IN THE IMMEDIATE AND THE DELAYED SHOCK SESSIONS

Subject Number	Immediate Shock Session — Frequency of Shocks							Delayed Shock Session — Frequency of Shocks						
	1st 2½min	2nd 2½min	3rd 2½min	4th 2½min	5th 2½min	6th 2½min	Total	1st 2½min	2nd 2½min	3rd 2½min	4th 2½min	5th 2½min	6th 2½min	Total
6	3	3	4	2	2	1	15	9	7	6	5	1	7	35
12	3	2	1	6	1	4	17	0	7	7	7	1	8	30
1	5	0	2	2	2	4	15	0	6	6	4	6	10	32
2	2	7	3	4	3	4	23	1	7	4	2	2	1	17
7	1	0	2	3	7	4	17	2	10	5	1	7	2	27
8	3	2	3	2	1	2	13	2	13	4	2	7	1	29
9	1	4	2	2	4	5	18	19	21	32	11	4	3	90
10	4	0	5	1	1	3	14	0	4	1	2	4	3	14
3	1	1	1	1	5	4	13	2	10	3	8	4	3	30
11	0	0	3	6	4	5	18	5	2	1	0	5	4	17
4	5	7	4	3	2	2	23	3	7	6	1	4	6	27
5	0	2	1	3	6	3	15	1	3	5	1	3	5	18
						Total	201						Total	366
						Mean	16.7						Mean	30.5

those subjects who were in the upper half in order of the number of shocks received should reveal marked differences between their records for the first five-minute sub-period (before many shocks had been received) and the last five-minute sub-period (after receiving the excessive number of shocks) of the main experimental period.

Table 13 shows that subject nos. 1, 3, 6, 8, 9, and 12 received more shocks in the delayed shock session than the rest. But when we refer to Appendix C and compare the data of these subjects for the first five-minute period with those of the last five-minute period, we do not notice any significant change. There is an absolute increase of two thousand ohms in the level of resistance at the end of the fifteenth minute over what it was at the beginning of the first minute of the main experimental period.. The rate of respiration shows an absolute decrease of 2.5 cycles and likewise the amplitude of respiration shows an absolute decrease of 6 units. The pulse rate, however, shows an absolute increase of 10 beats. It will be further interesting to note that the resistance level of subject no. 9 went on gradually increasing during the entire period, although he received the largest number of shocks.

Let us now compare the means of the entire group for the different variables during the first five-minute period with their means during the last five-minute period at different sessions. The means for the different variables are given below.

	Resistance Level[1]		Pulse Rate	
	Beginning of the 1st min.	End of the 15th min.	1st Five mins.	Last Five mins.
P	29.9	30.9	85.5	88.0
I	22.2	20.2	89.0	90.2
D	16.5	14.8	94.2	96.2

	Rate of Respiration		Amplitude of Respiration	
	1st Five mins.	Last Five mins.	1st Five mins.	Last Five mins.
P	19.0	18.0	25.9	28.1
I	21.2	20.8	27.9	30.8
D	21.5	20.6	34.6	34.4

If there are cumulative effects in the various physiological reactions as additional shocks are given, then the difference between the beginning and end of the delayed shock session should be greater than the corresponding differences for the periodic and immediate. All of the differences are not only small in comparison with the differences between different kinds of sessions, and insignificant, but taken at face value, contradict any interpretation based on total numbers of shocks, since the data for level of resistance, and amplitude of respiration reveal larger difference

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[1]For the levels of resistance, we compared the level at the beginning of the first minute with the level at the end of the 15th minute, because we thought that the level at the beginning of the first minute was mostly the result of the announcement of the conditions for any session and as such would provide more sensitive measure.

in the immediate shock session than the delayed shock session. Likewise, the data for pulse rate and rate of respiration exhibit greater differences in the periodic shock session than the delayed shock session. Obviously, the number of shocks was not an important determinant of the differences in the physiological reactions between the various sessions.

It seems clear, then, that the levels for the various physiological reactions were established before the subject received many, or even any, shocks. Thus, we are led to the conclusion that announcement of the conditions for each session was sufficient to define the uncertainty level for each subject, and the concrete experiences of such uncertainty added little or nothing.

A further point may be suggested: the greater number of errors in these sessions, with consequently more frequent shocks could also be taken as an indication of greater anxiety on the part of the subjects. Further investigation might well take this aspect of the matter into account explicitly.

CHAPTER VI

CONCLUSIONS

The conclusion now seems justifies that the hypotheses stated in Chapter III have been confirmed with rather remarkable exactness. A few deviations from the expected results in individual cases have been noted, but on the whole the twelve subjects have reacted to the various experimental conditions with surprising uniformity. This fact might even be considered as further support of the view that the uncertainty-anxiety relationship is a primary one, and that the uncertainties introduced into this experiment, viz., of expectation and perception, are fundamental dimensions of the primary anxiety inducing configuration. It seems justifiable to emphasize in this connection that this experiment has shown that not <u>expectation</u> of pain ("danger," "threat of injury") but degree of <u>uncertainty</u> of expectation of pain (shock) is the factor which differentiates the various experimental conditions.

Finally, the results indicate the desirability of further investigation such as, to mention only two of many possible extensions, a parallel experiment in which the subject strives for some "reward" instead of trying to

avoid shock, and if the main importance of individual differences in an experiment of this type is confirmed, a search for those anxiety inducing conditions which are definitely functions of individuality.

A P P E N D I C E S

APPENDIX A

Instructions for the Null Session

You are required to keep, as best as you can, the wandering spot of light inside the ring by moving the lever.

Instructions for Periodic Shock Session

You are required to keep, as best as you can, the wandering spot of light inside the ring by moving the lever. You will, however, receive shock every time lamp No. 15 (red light) is on.

Instructions for Immediate Shock Session

You are required to keep, as best as you can, the wandering spot of light inside the ring by moving the lever. You will receive shock immediately every time after the spot of light will move out of the area bounded by the ring.

Instructions for Delayed Shock Session

You are required to keep, as best as you can, the wandering spot of light at the center within the area indicated by a ring in the previous sessions, although the ring will not be there in this session. You will receive shock every time 30 seconds after the spot of light will move out of that area.

APPENDIX B

Check-List I[1]

Please check this list on the basis of what you felt or experienced during the experimental session.

	Yes	No	Doubtful
1. Did you feel uneasy?	___	___	_____
2. Did you feel as if your head was warm?	___	___	_____
3. Did you feel your face was burning?	___	___	_____
4. Did you feel rapid pounding of theheart?	___	___	_____
5. Did you feel weakness of any kind in any part of your body?	___	___	_____
6. Did you experience disturbed or tense feeling in the stomach?	___	___	_____
7. Did you feel anxious?	___	___	_____
8. Did you feel muscular tremors?	___	___	_____
9. Did you feel as if you were "on edge"?	___	___	_____
10. Did you feel dryness of throat?	___	___	_____
11. Did you experience rapid breathing?	___	___	_____
12. Was your heart palpitating?	___	___	_____
13. Were you perspiring?	___	___	_____
14. Did you feel an unusual tickling or itching anywhere?	___	___	_____
15. Were you worried about the possibility of harm from shock?	___	___	_____
16. Were you nervous?	___	___	_____

Any other experience, not covered by the above questions.

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[1]Some questions conveying identical meanings were included in the list in order to make it possible for the subject to express his feelings in those terms which he fully understood.

CHECK-LIST II

(a)

Please rank the under-mentioned experimental sessions in order of the degree of anxiety produced by each. Assign No. 1 to that session which produced the maximum anxiety and so on.

Immediate shock session (i.e. the session in which shock was given immediately every time after you made an error).

Delayed shock session (i.e. the session in which shock was given 30 seconds after you made an error).

(b)

Please rank the under-mentioned experimental sessions in order of the degree of anxiety produced by each. Assign No. 1 to that session which produced the maximum anxiety and so on.

Periodic shock session (i.e. the session in which shock was given every time lamp No. 15 was on).

Immediate shock session (i.e. the session in which shock was given immediately every time after you made an error).

(c)

Please rank the under-mentioned experimental sessions in order of the degree of anxiety produced by each. Assign No. 1 to that session which produced the maximum anxiety and so on.

CHECK-LIST II (Continued)

Periodic shock session (i.e. the session in which shock was given every time lamp No. 15 was on).

Delayed shock session (i.e. the session in which shock was given 30 seconds after you made an error).

CHECK-LIST III

Please rank the under-mentioned experimental sessions in order of the degree of anxiety produced by each. Assign No. 1 to that session which produced the maximum anxiety and so on.

Periodic shock session (i.e. the session in which shock was given every time lamp No. 15 was on).

Immediate shock session (i.e. the session in which shock was given immediately every time after you made an error).

Delayed shock session (i.e. the session in which shock was given 30 seconds after you made an error).

APPENDIX C

I

Resistance Data

Sub-ject nos.	Fore Period Average of 2 mins	Main Exp. Period 1st min	5th min	10th min	15th min	Final Period At the end of 2nd min
		Null Session				
1	31.7	31.0	31.0	28.0	30.0	31.0
2	43.0	40.0	41.0	38.0	38.0	39.0
3	34.7	30.0	33.0	32.0	31.0	32.0
4	42.5	42.0	38.0	40.0	44.0	46.0
5	25.0	24.0	25.0	26.0	24.0	26.0
6	47.7	44.0	53.0	46.0	50.0	50.0
7	56.0	60.0	70.0	65.0	69.0	75.0
8	33.7	34.0	32.0	32.0	27.0	25.0
9	14.0	14.0	14.5	15.0	14.0	15.0
10	17.0	16.0	17.0	16.0	17.0	17.5
11	38.0	40.0	40.0	55.0	62.0	73.0
12	17.8	18.0	21.0	20.0	21.5	21.5
Total	401.1	393.0	415.5	413.0	427.5	451.0
Mean	33.4	32.7	34.6	34.4	35.6	37.6
		Periodic Shock Session				
1	30.0	27.0	29.0	30.0	26.0	28.0
2	62.5	45.0	35.0	54.0	44.0	54.0
3	33.0	34.0	24.0	21.0	26.0	27.0
4	40.8	41.0	39.0	34.0	41.0	46.0
5	12.5	10.0	12.0	11.0	12.0	13.0
6	30.0	26.0	27.0	31.0	26.0	33.0
7	98.7	62.0	63.0	69.0	58.0	80.0
8	24.3	20.0	21.0	22.0	22.0	23.0
9	17.0	18.0	18.0	18.5	17.5	21.5
10	23.3	19.5	21.0	23.0	26.0	29.0
11	61.7	40.0	38.0	50.0	54.0	63.0
12	18.0	16.0	19.0	18.0	19.0	21.0
Total	451.8	358.5	346.0	381.5	371.5	438.5
Mean	37.6	29.9	28.8	31.8	30.9	36.5

Each figure stands for so many thousands of ohms.

APPENDIX C

Resistance Data

Subject nos.	Fore Period Average of 2 mins	Main Exp. Period 1st min	5th min	10th min	15th min	Final Period At the End of 2nd min
Immediate Shock Session						
1	25.0	24.0	21.0	19.0	18.0	20.0
2	43.0	41.0	35.0	33.0	28.0	34.0
3	23.0	16.0	16.0	17.0	15.0	20.0
4	30.5	23.0	24.0	26.0	22.0	30.0
5	18.0	17.0	15.0	14.0	14.0	16.0
6	71.7	26.0	29.0	40.0	36.0	50.0
7	52.3	31.0	34.0	33.5	29.5	40.0
8	20.5	17.0	18.0	17.0	18.0	20.0
9	16.0	17.0	14.0	15.0	13.0	16.0
10	15.7	14.0	13.0	13.0	12.5	14.5
11	40.2	31.0	37.0	22.0	24.0	30.0
12	15.0	10.0	14.0	12.0	12.5	12.5
Total	370.9	267.0	270.0	261.5	242.5	303.0
Mean	30.9	22.2	22.5	21.8	20.2	25.2
Delayed Shock Session						
1	20.5	15.0	16.0	17.0	13.0	18.0
2	58.7	40.0	37.0	33.0	32.0	36.0
3	22.7	17.0	13.0	10.0	16.0	20.0
4	30.5	27.0	18.0	22.0	16.0	21.0
5	19.3	13.0	15.0	12.5	14.5	15.0
6	15.0	11.0	9.0	12.0	13.0	15.0
7	41.7	22.0	19.0	22.0	16.0	27.0
8	21.2	12.0	11.0	12.0	13.0	15.0
9	14.7	10.0	11.5	12.0	13.0	15.0
10	19.8	9.0	8.5	8.5	9.5	12.0
11	23.0	15.0	16.0	21.0	15.0	26.0
12	11.5	7.5	7.0	6.5	6.5	9.0
Total	298.6	198.5	181.0	188.5	177.5	229.0
Mean	24.9	16.5	15.1	15.7	14.8	19.1

Each figure stands for so many thousands of ohms.

II

RESPIRATION DATA

Null Session

Subject Nos.	Rate of Respiration: Fore Period 2 min	Rate of Respiration: Main Exp. Period 1st 5 min	Rate of Respiration: Main Exp. Period 2nd 5 min	Rate of Respiration: Main Exp. Period 3rd 5 min	Rate of Respiration: Final Period 2 min	Amplitude of Respiration: Fore Period 2 min	Amplitude of Respiration: Main Exp. Period 1st 5 min	Amplitude of Respiration: Main Exp. Period 2nd 5 min	Amplitude of Respiration: Main Exp. Period 3rd 5 min	Amplitude of Respiration: Final Period 2 min
1	14.0	13.0	14.0	13.0	13.5	27.0	25.0	24.0	22.0	22.0
2	20.0	20.5	19.0	17.0	13.0	28.0	29.0	28.0	27.0	27.0
3	18.0	16.0	14.0	15.0	16.0	21.0	22.0	26.0	23.0	26.0
4.	26.0	26.0	27.5	26.5	26.0	27.0	26.0	28.0	28.0	27.0
5	19.0	19.0	20.0	21.0	18.0	25.0	23.0	23.0	32.0	27.0
6	19.0	19.0	19.5	19.0	18.0	20.0	24.0	22.0	22.0	24.0
7	16.0	17.0	17.0	17.0	17.0	20.0	20.0	21.0	23.0	21.0
8	18.0	19.0	18.0	18.0	18.0	22.0	20.0	20.0	21.0	21.0
9	24.0	24.0	23.5	24.5	23.0	28.0	29.0	28.0	27.0	30.0
10	15.0	16.0	15.0	16.0	16.0	33.0	36.0	36.0	36.0	35.0
11	20.0	21.0	21.0	21.0	20.0	22.0	22.0	20.0	19.0	21.0
12	21.0	20.0	21.0	21.0	20.0	22.0	21.0	21.0	20.0	22.0
Total	230.0	230.5	229.5	229.0	218.5	295.0	297.0	297.0	300.0	303.0
Mean	19.17	19.2	19.12	19.1	18.2	24.6	24.7	24.7	25.0	25.2

The unit for the amplitude of respiration is arbitrary.

Periodic Shock Session

Subject	Rate of Respiration					Amplitude				
	Fore Period 2 min	Main Exp. Period 1st 5 min	2nd 5 min	3rd 5 min	Final Period 2 min	Fore Period 2 min	Main Exp. Period 1st 5 min	2nd 5 min	3rd 5 min	Final Period 2 min
1	14.0	11.0	12.0	13.0	13.5	22.0	25.0	25.0	33.0	24.0
2	12.0	15.0	15.0	15.0	14.0	27.0	31.0	36.0	36.0	34.0
3	16.0	17.0	16.0	12.0	12.0	26.0	29.0	28.0	34.0	28.0
4	25.5	27.0	24.5	26.5	25.5	27.0	30.0	36.0	36.0	32.0
5	23.0	25.0	25.0	26.0	24.0	32.0	38.0	40.0	42.0	36.0
6	20.0	18.0	19.0	20.0	20.0	23.0	23.0	23.0	22.0	23.0
7	17.0	18.5	18.5	18.0	18.0	16.0	22.5	20.0	24.0	21.0
8	18.0	19.0	12.0	14.0	17.0	18.0	21.0	25.0	22.0	21.0
9	23.0	22.0	21.0	23.0	19.0	21.0	25.0	22.0	24.0	22.0
10	13.0	14.0	14.0	14.0	12.0	19.0	19.0	18.0	21.5	18.0
11	20.0	21.0	22.0	18.0	20.0	21.0	22.0	22.0	24.0	19.0
12	15.0	20.0	17.0	17.0	16.0	19.0	26.0	20.0	19.0	17.0
Total	216.5	227.5	216.0	216.5	211.0	271.0	311.5	315.0	337.5	295.0
Mean	18.0	19.0	18.0	18.0	17.6	22.6	25.9	26.2	28.1	24.6

The unit for the amplitude of respiration is arbitrary.

Immediate Shock Session

Subject Nos.	Rate of Respiration: Fore Period 2 min	Main Exp. Period: 1st 5 min	2nd 5 min	3rd 5 min	Final Period 2 min	Amplitude: Fore Period 2 min	Main Exp. Period: 1st 5 min	2nd 5 min	3rd 5 min	Final Period 2 min
1	11.0	12.0	13.0	14.5	11.5	22.0	29.0	28.0	31.0	22.0
2	19.0	19.0	17.0	20.0	18.0	22.0	26.0	30.0	33.0	25.0
3	23.0	23.0	20.0	18.0	19.0	26.0	36.0	36.0	38.0	32.0
4	25.5	27.0	27.5	26.0	25.0	27.0	38.0	32.0	38.0	32.0
5	23.0	26.0	25.0	26.0	24.0	30.0	40.0	42.0	57.0	44.0
6	16.0	19.0	18.0	19.0	18.0	18.0	24.0	24.0	24.0	18.0
7	17.0	18.5	19.0	18.0	18.0	20.0	23.5	20.0	24.0	21.0
8	16.0	20.0	20.0	18.0	16.0	21.0	28.0	26.0	25.0	25.0
9	24.0	24.0	24.0	23.0	22.0	21.0	23.0	24.0	30.0	21.0
10	15.0	17.0	19.0	19.0	18.0	19.0	23.0	19.0	21.0	18.0
11	21.0	22.0	23.0	21.0	18.0	21.0	23.0	24.0	30.0	21.0
12	23.0	27.0	26.0	27.0	22.0	16.0	22.0	24.0	19.0	16.0
Total	233.5	254.5	251.5	249.5	229.5	263.0	335.5	329.0	370.0	295.0
Mean	19.4	21.2	20.9	20.8	19.1	21.9	27.9	27.4	30.8	24.6

The unit for the amplitude of respiration is arbitrary

Delayed Shock Session

Sub-ject Nos.	Rate of Respiration: Fore Period 2 min	Main Exp. Period 1st 5 min	2nd 5 min	3rd 5 min	Final Period 2 min	Amplitude: Fore Period 2 min	Main Exp. Period 1st 5 min	2nd 5 min	3rd 5 min	Final Period 2 min
1	15.0	17.0	16.5	17.5	15.0	22.0	31.0	29.0	28.5	26.0
2	19.0	18.0	15.0	15.0	14.0	27.0	32.0	37.0	36.0	26.0
3	22.0	22.0	18.0	22.0	22.0	26.0	42.0	36.0	34.0	26.0
4	26.0	27.0	28.0	30.0	27.0	27.0	42.0	43.0	42.0	38.0
5	22.0	26.0	24.0	25.0	24.0	32.0	56.0	48.0	52.0	50.0
6	19.0	19.0	19.0	19.0	20.0	24.0	30.0	30.0	33.0	27.0
7	17.5	18.5	18.0	18.0	17.5	21.0	30.0	28.5	35.0	26.0
8	18.0	21.0	20.0	20.0	18.0	21.0	26.0	27.0	28.0	25.0
9	24.0	26.0	27.0	25.0	20.0	28.0	33.0	33.0	37.0	31.0
10	19.0	20.0	19.0	20.0	18.0	24.0	30.0	25.0	30.0	22.0
11	20.0	21.0	15.0	15.0	15.0	20.0	30.0	24.0	30.0	20.0
12	17.5	22.5	21.0	20.5	15.0	18.0	33.0	28.0	27.0	18.0
Total	239.0	258.0	240.5	247.0	225.5	290.0	415.0	388.5	412.5	335.0
Mean	19.9	21.5	20.0	20.6	18.8	24.2	34.6	32.4	34.4	27.9

The unit for the amplitude of respiration is arbitrary.

III

Pulse Rate Data

Subject Nos.	Null Session Main Exp. Period 1st 5 min	Null Session Main Exp. Period 2nd 5 min	Null Session Main Exp. Period 3rd 5 min	P. S. Session Main Exp. Period 1st 5 min	P. S. Session Main Exp. Period 2nd 5 min	P. S. Session Main Exp. Period 3rd 5 min	I.S. Session Main Exp. Period 1st 5 min	I.S. Session Main Exp. Period 2nd 5 min	I.S. Session Main Exp. Period 3rd 5 min	D.S. Session Main Exp. Period 1st 5 min	D.S. Session Main Exp. Period 2nd 5 min	D.S. Session Main Exp. Period 3rd 5 min
1	88.0	88.0	88.0	90.0	92.0	90.0	92.0	92.0	90.0	96.0	94.0	98.0
2	80.0	80.0	82.0	88.0	90.0	88.0	88.0	96.0	90.0	92.0	94.0	90.0
3	82.0	82.0	84.0	84.0	86.0	86.0	90.0	86.0	90.0	94.0	92.0	94.0
4	72.0	72.0	72.0	74.0	76.0	74.0	84.0	78.0	78.0	82.0	86.0	88.0
5	74.0	76.0	74.0	78.0	86.0	82.0	84.0	92.0	100.0	102.0	96.0	100.0
6	84.0	86.0	86.0	86.0	88.0	90.0	96.0	88.0	92.0	88.0	90.0	96.0
7	76.0	82.0	80.0	84.0	90.0	90.0	88.0	90.0	88.0	90.0	98.0	96.0
8	80.0	80.0	82.0	84.0	84.0	88.0	88.0	84.0	90.0	96.0	96.0	100.0
9	88.0	88.0	88.0	90.0	90.0	92.0	92.0	96.0	96.0	98.0	100.0	96.0
10	80.0	82.0	80.0	86.0	88.0	88.0	88.0	84.0	86.0	96.0	92.0	98.0
11	88.0	88.0	90.0	94.0	94.0	92.0	88.0	90.0	96.0	96.0	96.0	98.0
12	88.0	88.0	88.0	90.0	92.0	90.0	96.0	96.0	94.0	100.0	98.0	98.0
Total	980.0	992.0	994.0	1026.0	1056.0	1056.0	1068.0	1080.0	1082.0	1130.0	1130.0	1152.0
Mean	81.7	82.7	82.8	85.5	88.0	88.0	89.0	90.0	90.2	94.2	94.2	96.0

Each figure stands for number of pulse beats per minute.



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