PHYSIOLOGICAL RESPONSIVENESS IN REACTIVE AND PROCESS SCHIZOPHRENIA

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PHYSIOLOGICAL RESPONSIVENESS IN REACTIVE AND PROCESS SCHIZOPHRENIA

By

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ABSTRACT

It has been suggested that the mental diseases commonly diagnosed as schizophrenia (of four classical types) may be distinguished on the lines of two basically different groups. These types, referred to as reactive and process schizophrenia, were differentiated in this study on the basis of case history and clinical data, according to the following criteria: (1) prepsychotic personality; (2) precipitating stress; (3) onset; and (4) clinical picture. The comparison of these two groups on the basis of physiological reactivity to various stimuli was the primary purpose of the study.

Two groups of chronic schizophrenics, eighteen in each group, and a group of eighteen normal control subjects were studied. Four pictures, one of neutral value and the others representing common conflict areas (hostility, dependency, sex) were used as stimuli. A loud bell preceded by a verbal warning was also used. The responses measured included base levels and amplitude of heart rate and GSR changes and arousal and recovery time of GSR.

The reactive group of schizophrenics showed a significantly higher base level heart rate than either the normals or the process

group. There were no significant differences between the groups in base GSR.

The reactives responded like the normals in amplitude of GSR and heart rate change, except after the warning where their response was lower. They tended to make a slower recovery than the process or normal groups.

Amplitude of GSR for the process group was lower than for the other groups. The mean heart rate changes of this group were all negative and significantly different from the changes of the normals and reactives.

These results were interpreted to mean, primarily, that at least two groups, differing in physiological response to certain stimuli, can be distinguished within the classification of schizophrenia. These groups do not seem to be independent of the traditional subtypes, but can be differentiated independently of them. Both groups manifest withdrawal at a social level and in overt activity. They differ, however, in the extent of the withdrawal. The reactives were affected by other stimuli and responded strongly to them, their response reaching or exceeding the normal level. The withdrawal of the process group seemed to go much further, their responsiveness in this study being confined to what seems to be a reflex response to sensory stimuli.

The results thus indicate a more significant basis for classifying schizophrenia than the traditional four subtypes. The reactive-process distinction provides a differentiation meaningful in terms of etiology, treatment, and prognosis, and can discriminate these groups at both physiological and psychological levels.

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INTRODUCTION

The concept of schizophrenia as a disease entity is one of the most confused and controversial in modern psychopathology. There has been a growing awareness of its complexity as a diagnostic group and a great variety of disturbed behavior has often been included in the category. Much of this behavior is not consistent with the traditional view of the disorder as originally developed by Kraepelin (3, 10, 28), and later modified by Bleuler (5).

Kraepelin, confronted with a wide array of poorly classified states of insanity, sought to isolate more definite disease syndromes. One common pattern he described was a disease of early onset, characterized by a progressive withdrawal from reality, hallucinations, delusions, negativism, bizarre thinking and behavior, and blunted or inappropriate affect. These conditions were said to occur in the absence of primary disturbances of perception and memory, with a relatively clear "sensorium." Included in the syndrome were three symptom groups which had earlier been considered as separate entities: the catatonic, hebephrenic, and paranoid groups. Common among them, according to Kraepelin, was a disease course originating early in life and leading to a demented end-state. This course was

emphasized by Kraepelin in his name for the disease, dementia praecox, and served to differentiate the group from others that did not show the tendency toward early dementia, especially the manic-depressive psychosis.

Bleuler, several years later, revised this conception, renaming it schizophrenia, and expanding the syndrome by including another group, the simple type. He described the schizophrenic group as characterized by a dissociation of the functions of the personality and a primary disorder of thinking, and emphasized that emotion is not always absent. In his discussion of the affect of the schizophrenic he states that in the beginning of the disease the oversensitive patient consciously and deliberately isolates himself to avoid emotional arousal, but nevertheless retains the capacity for emotional experience. Later on in the course of the illness there is still emotion present but in an "abnormal basic state," "a different adjustment of the affective zero point" (5, p. 43), with outward indifference and apathy. He also speculated as to the possibility of a later reduction of the group into several entities, according to etiology, and did not entirely accept Kraepelin's belief in the organic basis of the disease. He further disagreed with Kraepelin in not accepting the latter's view of a necessarily bad prognosis, in a progression towards dementia.

Many contradictions to these classical descriptions are found today, both clinically and in the results of experimental studies. We find in practice that almost any patient who presents a picture of blunted affect or hostile attitudes is apt to be labeled schizophrenic, and the use of the diagnosis varies tremendously from one hospital to another, depending on the orientation of the particular diagnostician.

Viewpoints in regard to etiology share in this controversy, and they range from such causes as a constitutional defect or an organic brain disease to psychological trauma. Symptomatology varies similarly: there is often confusion, distortion of perception and memory, and acute outbursts of anxiety and emotion in patients diagnosed schizophrenic. The onset may be early and insidious, as Kraepelin stated, or sudden, acute, and relatively late in life, and a particular case does not necessarily end in dementia; social recoveries do occur (10, 29).

The concept of the four clinical types as all distinct varieties of the same disease has also been criticized (7). Much depends, in this instance, on what is emphasized in order to construct a usable classification and frequently patients are found who have symptoms cutting across several of the traditional subgroups.

This disagreement has led to the lack of any consistent rationale for treatment or any definite standpoint in regard to prognosis, and points to the need for a sounder basis for diagnosing schizophrenia, both as a group and in differentiating subgroups. The situation has been recognized to some extent in the modern term "schizophrenic reaction" (63). This name seems to imply a group having broad similarities in symptoms but possibly being quite heterogeneous in other respects; unfortunately not much more is made specific in the official psychiatric classification.

SCHIZOPHRENIA AS A HETEROGENEOUS GROUP: THE REACTIVE-PROCESS DISTINCTION

While this issue of the heterogeneous nature of schizophrenia has not been explicitly recognized in the official nomenclature, there has been a growing tendency to take account of the problem in the study of the disease. As mentioned above, Bleuler did not consider schizophrenia as necessarily homogeneous and believed that there might be a later reduction of it into several entities, each with a particular etiology and outcome. Since his time several workers, on the basis of clinically formed opinions, have attempted to deal with the question. These people, although using different terms among themselves and forming a minority in psychiatric thinking, have been fairly consistent in pointing to two large divisions within the category of schizophrenia, differentiating them in terms of onset, symptomatology, outcome, and sometimes etiology. Thus Sullivan held that there were two unrelated but often confused syndromes: dementia praecox, an "organic, degenerative disease" with an insidious onset and poor prognosis, and schizophrenia, "primarily a disorder of living" with an acute onset due to situational stress and a good prognosis (58). Hoskins recognized the situation in his comparison of schizophrenia to such entities as "headache" and "hypertension,"

". . . each of which has a common core manifestation but each of which may represent very dissimilar disorders" (28, p. 72). Strecker and Willey gave an outline for differentiating the two groups on the basis of prognosis. They consider good affect as the best index of a good prognosis. A "basic and constitutional seclusive makeup" is a poor sign but an acute, stormy onset with a significant precipitating situation indicates a better prognosis (56).

Langfeldt, in an extensive study of the outcome of schizophrenia, went even further in his view that percentage reports of recovery merely indicated the relative proportion of true of "process" versus acute or "schizophreniform" cases treated. He was the first to use the term "process schizophrenia" for the poor prognostic group (39).

D. E. Cameron has studied the disorder in terms of the type of onset. His findings, supporting the two-entity view, show that there are two main groups of early symptoms, one being characterized by hypoactive behavior and the other by hyperactivity. His evidence indicates that the hypoactive symptoms are usually present for a longer time before hospitalization than the hyperactive ones, corresponding to the "insidious" onset traditionally associated with schizophrenia (9).

Darrah, like Sullivan, used the two terms "dementia praecox" and "schizophrenia" to distinguish the two forms, and agreed with Sullivan in his description of dementia praecox as having an insidious onset, progressing to deterioration, with a schizoid prepsychotic personality. Schizophrenia in Darrah's view has an abrupt onset with a milder, nondeteriorating course, good prognosis, and a usually adequate prepsychotic personality (13).

Wittman and Steinberg, in a study of fifty-nine life histories of schizophrenic patients, found in about 50 percent of their cases a life-long "shut-in" personality picture, present from earliest childhood on. "The true schizophrenic . . . from early childhood on shows the characteristically schizoid type of reaction sometimes even in the face of benign environmental factors, that develops into the regression characteristic of 'process schizophrenia'" (61, p. 815). There is no specific onset, "but rather the progressive development of a type of personality reaction pattern" (61, p. 816). The other cases were considered to be a "schizophreniform" disorder based on environmental factors.

Bellak summarizes this and other work, concluding that schizophrenia is not one disease entity but a syndrome or reaction type associated with a large number of etiological factors. These range from completely psychogenic through a continuum to completely

organic (4). The two polar types can be differentiated on the basis of prognosis, and he argues for considering the two as different disorders; there is "at least a reasonable chance that a common outcome speaks in favor of a more or less common root" (4, p. 404). The favorable group has the characteristics, contrary to the traditional description of schizophrenia, of an acute onset, atypical (not schizoid) prepsychotic personality, a precipitating factor, confusion, and not the classic "clear sensorium." Many of the phenomena can be understood in terms of psychological dynamics, the outcome is relatively good, and affect will be more or less adequate.

Some experimental work has been done in an effort to differentiate these groups more clearly. Kantor, Wallner, and Winder compared two groups of schizophrenics, classified as reactive or process cases on the basis of history, as to whether they were diagnosed psychotic or nonpsychotic from the Rorschach (32). Their reactive group corresponds to the good prognostic group, their process cases to the poor prognostic group. They obtained these results: the cases could be reliably differentiated into process and reactive groups from history criteria, the reactive cases tending to be called nonpsychotic from the Rorschach and the process cases psychotic with this test. They consider these results "evidence that process and reactive cases differ in their psychological-function characteristics"

(32, p. 162), and further evidence for the existence of these two distinct groups within the traditional category of schizophrenia.

Funkenstein and his associates have differentiated several prognostic groups of schizophrenics on the basis of blood pressure, psychological, and clinical reactions to epiniphrine and mecholyl, these drugs acting as autonomic nervous system stimulants (23-26). They describe seven reaction patterns to these drugs and state that no diagnostic group falls entirely into any one pattern, with schizophrenia being included in more of the patterns than any other, providing further evidence for the heterogeneous character of this group. They found that the patients' prognoses with electric shock treatment were more in accord with their autonomic patterns than with their clinical diagnoses.

Funkenstein, Meadow, and others, in a further series of studies of schizophrenics, found a positive relationship between prognosis, autonomic patterns, and the capacity for abstract thinking (45-47). They delineate three main types of patients on the basis of these studies. Type A, with very poor prognosis, shows a marked impairment of abstract thinking. This group was most deteriorated, with inappropriate affect, poorly organized delusions, and low physiological reactivity following mecholyl. They consider this type to

be the group originally defined by Kraepelin as dementia praecox, the true "process" schizophrenia.

Type B, an intermediate group, is characterized by a slightly better but still not good prognosis, with little loss of abstraction. This group includes the majority of psychotics in remission and represents also the autonomic pattern of normals. Schizophrenics of this type have highly organized delusional systems, less visible anxiety than patients of the other groups, and are well preserved in appearance.

Type C, the other polar type, has very good prognosis and corresponds to the "reactive" schizophrenia category. This type has a relatively intact capacity for abstraction and a strong physiological reaction following mecholyl. Anxiety and turmoil are prominent and there is a large emotional component, with often a depressive coloring. Affect is usually appropriate, and the group shows neither organized delusions nor deterioration.

These two polar types and the intermediate group correspond to the three types of reaction described by Boisen (6). These include those patients who drift into the psychosis through a gradual withdrawal, with no struggle; those who form delusional misinterpretations (the well-systematized paranoids) enabling them to maintain

some integration; and those who react with panic and acute disturbance, facing their problems and often recovering.

These studies give extensive evidence for at least two polar types, with possible intermediate mixtures. Whether these groups are completely different entities in terms of etiology and dynamics, or are end-points on a continuum running from organic to psychological etiology, as Bellak suggests, the findings are important and should be considered in the study of schizophrenia.

THE PROBLEM OF EMOTIONAL RESPONSIVENESS

One of the many problems in the study of schizophrenia and one that seems to have been particularly influenced by the lack of recognition of the division behind the process-reactive distinction, is the question of emotional withdrawal. In the classical description of the disease the patient withdrew progressively from the world until he lost all contact with reality. This withdrawal was accompanied by a change in affect which consisted of blunting and disharmony of the emotions. The condition was further displayed in the lack of interest, the indifference and apathy of the schizophrenic, and especially in his marked lack of rapport with the social environment.

This concept has been criticized in regard to both the extent and nature of the withdrawal. Thus, Sullivan believed that the schizophrenic, being extremely sensitive to rejection and trauma, concealed his true feelings by a suppression of interest and overt signs of emotion: "the alleged indifference, apathy and emotional disharmony of the schizophrenic patient are more a matter of impression than a correct evaluation . . . of the patient" (57, p. 153).

Similarly, Lang, reporting his own experience as a schizophrenic, attests to the presence of interests and feelings as strong as before the onset of the psychosis, and gives a clue to the fate of these responses: "While the capacity for affective discharge has continued with little abatement, there has been an increasing tendency for affective discharges to be centered around ideation" (38, p. 193).

Confronted with this contradiction, it seems well to look at some of the experimental evidence on both sides of the question. This evidence, besides illustrating the difference in opinion in regard to the emotional responsiveness of the schizophrenic, also demonstrates certain of the difficulties involved in work with this group.

The Low Reactivity View

This line of thinking has been that the apathy is pervasive and deep throughout the whole organism, a withdrawal at every level possibly based on low physiological reactivity. This low reactivity reduces the capacity for emotional response and effector action, the patient no longer responding to stimuli that normally would evoke a reaction. Angyal, Freeman, and Hoskins, basing their conclusions on several physiological studies, take this view and state that withdrawal

is the one common symptom among all the variety of schizophrenias (2). They claim that this withdrawal is shown psychologically in the indifference and apathy seen clinically; physiologically in such characteristics as lower basal levels of the oxygen consumption rate, blood pressure, and circulation time.

Other evidence in support of a low reactivity hypothesis is provided by Angyal and Blackman in their finding of a reduced nystagmic response in schizophrenics (1). Vestibular reactivity was low, part of the general decreased responsiveness of their group of patients. Similarly May found diminished pupillary responsiveness to pain and light (44), and Pincus and Hoagland (51) found that schizophrenics as a group showed adrenal cortices typically unresponsive to stress and unable to alter action to meet changing environmental demands. Freeman and Rodnick (21) reported blood pressure, heart rate, and respiratory volume in response to the breathing of hot moist air considerably less in schizophrenic patients than in normal subjects; and in another study these same investigators found less postrotational sway in schizophrenics than in normals (22). Thus there is considerable evidence for a profound withdrawal, affecting even physiological processes, in schizophrenia.

The Normal or Excess Reactivity View

There has, however, been evidence contrary to the above findings. Experimental results from other physiological studies support the view that a good deal of responsiveness remains, even in chronic patients. The results vary somewhat from study to study but in general heightened physiological activity is found under stress, with poor discrimination and a tendency to reach a high level of arousal, or to overreact.

Thus Williams studied the psychogalvanic, respiratory, and pulse rate responses of "early chronic" schizophrenics to several psychological stress situations (60). His subjects showed a heightened level of physiological activity (as compared to normals) during both rest and stress periods. There was less arousal to the specific stress situations, the high basal levels of response apparently masking more specific responses, and the group was further characterized by less recovery following stress.

Malmo and Shagass compared "early" schizophrenics with neurotics, anxiety states, and normals, on several measurements of physiological response. They found that the early schizophrenics most resembled the anxiety patients in their greater responsiveness and lower threshold of reaction, but showed a lack of discrimination

among the various stimulus intensities in their responses, a pattern of poor discrimination and overresponse (41, 42).

In a similar study, Malmo, Shagass, and Smith found normal and greater than normal background physiological activity under stress in chronic schizophrenics. "Purposive" overt acts were less frequent in this group but tension levels were high. The authors hypothesize that those aspects of responsiveness associated with emotional arousal are intact in chronic schizophrenics, but the mechanisms underlying overt acts are inoperative (43).

Other data showing normal or greater than normal reactivity on a physiological level include the results of D. E. Cameron (8) and H. Freeman (20) on temperature regulation, and the study of Cohen and Patterson (11) in which schizophrenics showed an abnormally elevated pulse rate under painful stimulation. Similarly, Landis, Hunt, and Page found a greater than normal startle response in schizophrenics (37), and Freeman and Pathman found no difference between normals and psychotics in the basal physiological activity levels (19). These results lead to the view that at least normal physiological responsiveness is present in schizophrenics, if not always manifested overtly. Hunt and Cofer, in their review, come to this same conclusion, stating that "although no reduction of emotional behavior at the reflex or autonomic level appears in

schizophrenics, they show marked deviations from the normal . . . in overt behavior related to emotion'' (29, p. 1002).

Summary of Studies of Responsiveness

While the variety of results summarized here may not all be comparable, it still can be seen that there is a great deal of disagreement and even flat contradiction. In general most investigators agree that the chronic schizophrenic shows less overt responsiveness than the normal or neurotic. This cannot, however, be generalized to include all schizophrenics since several investigators report heightened overt reactions in the acute stage. In terms of internal or physiological response there is evidence for both lower and higher reactivity than in the normal, and some studies have shown a normal response. Commonly it is found that schizophrenics show poorer discrimination and less tendency to react to specific experimental stimuli, and less ability to vary response appropriately in terms of the strength of the stimulus.

Shortcomings of These Studies

When the varying psychological and physiological features of the two groups (reactive and process) discussed earlier are considered, it is apparent that experimental studies can be expected to

give contradictory results unless this factor is taken into account. The diverse natures of these groups, as indicated in the studies of Funkenstein (23-26) and Kantor, Wallner, and Winder (32), are such that they could almost alone account for the inconsistency of the findings on emotional responsiveness just reviewed. This factor has, unfortunately, been almost entirely neglected in most of the work done in the area, and deserves much closer attention in future work of this kind.

Three other factors that could possibly contribute to the confusion in this research on responsiveness are also due some attention. These factors are concerned with certain methodological features of the experimental work, as well as the selection of subjects, and will be discussed in this order:

1. The disorder has been studied at different stages of its development.

2. The stimuli used have varied widely, and cannot always be specified because of the effect of the illness itself on the subjects' perceptions.

3. Many different types of measures of response have been used.

Stage of schizophrenia. The importance of the stage at which the disorder is studied has been demonstrated by several investigators. Noted previously were the results of Malmo and his co-workers who found increased reactivity at both overt and covert levels in early schizophrenia but decreased overt response to the same stimuli in chronic schizophrenics (41-43). Pfister, on the basis of studies of pulse, blood pressure, body temperature, and skin irritability, describes three stages from "morbid hyperexcitability" to a stage of "partial damage" to a final hypoactive state with a "complete loss of autonomic regulation." In this process "the very refined regulating mechanism shows first a weakening and finally a complete loss of function" (50, p. 116). Collins makes the same sort of observation with regard to emotion, finding the affect of cases with a shorter duration much stronger than the affect of chronic cases (12). It is apparent that different investigators would be likely to arrive at inconsistent results if they studied these different stages in the course of schizophrenia.

Experimental stimuli. The experimental stimuli have varied widely, from the interpersonal stress of Williams (60) to pain produced by heat (41), loud noises (37), word association tests (12), and others. This heterogeneity of stimuli limits the comparability of

one study with another, and the diversity of the results that have been obtained attests to the danger of generalizing from a specific situation. Uniformity of procedure among different investigators and the use of several stimuli in any one study are needed, especially stimuli that will arouse different levels of response.

In addition it is difficult to really specify and control the stimulus to which the schizophrenic is reacting, even when great effort is made to do so. Sullivan mentions this problem and states that the schizophrenic often reacts to his own rather than the experimenter's interpretation of the situation, because of his delusions and intensely personal frame of reference (57). Hunt and Cofer draw the same conclusion from their review of the literature: arousal and response operate in the schizophrenic but to his own preoccupations and interpretations (29). Syz's (59) finding of many spontaneous responses and Williams' (60) and Malmo's (41) results showing a high general level of tension with a dearth of responses to specific stimuli give more experimental support to this point of view.

This type of misinterpretation can be considered a defect in the set to respond, or a lack of ability to take the anticipatory set demanded by the situation. If the prestress set of patients and controls differs one can expect different results, and if the difference

lies in the fact that the situation has no meaning for the schizophrenic then one would expect no response. "The problem is expanded from the mere question of 'responsivity' to 'responsivity to what and how'" (54, p. 676).

The studies of Rodnick (53) and Paintal (49) illustrate this point. Both found that schizophrenics gave responses approximately equal to those of normals to actual stress stimuli, but that the preparatory responses to a "ready" signal of the schizophrenic groups were only about one-half that of the normal groups. Both studies used the psycho-galvanic technique, demonstrated by Furer and Hardy (27) to be more a response to the threat content of a stimulus than to the stimulus itself. This would indicate that results such as Rodnick's and Paintal's are due to the failure of schizophrenics to perceive certain stimuli as threatening, these stimuli ordinarily being quite effective in producing a response in normals. Thus the definition of the stimulus in these studies is difficult since it may have no meaning, or an entirely different meaning, for the schizophrenic.

Measures of response. The measures of responsiveness have also varied a great deal. A few of those used, as reported in the studies mentioned above, include GSR, the pupillary reflex, oxygen consumption rate, nystagmus, adrenal cortical hormone output, heart

rate, respiratory volume, and word association time. It can be seen that there will be difficulties in interpreting the presence or absence of all these different activities as representative of the same phenomenon, withdrawal or responsiveness.

The mathematical expression of the measurements has also been subject to much variation; included among them have been level, latency and frequency of response, amount of change, and percentage of the maximum response. Dunbar (15) stresses the importance of the stability rather than the level or amplitude of a process to show the presence of emotion. She states that it is not the level of the equilibrium itself, but the change and the time required to return to equilibrium that is significant. G. L. Freeman and his co-workers have used this suggestion in their work and have found that the differences in arousal and recovery time were an important differentiating characteristic between psychotic, neurotic, and normal groups (17-18).

STATEMENT OF THE PROBLEM

The present problem concerns physiological responsiveness in reactive and in process schizophrenia, with an emphasis on the control of the factors just reviewed. These two groups of schizophrenics, all in the chronic stage of the disorder, and a control group of normals were studied.

Criteria for Reactive and Process Schizophrenia

The schizophrenic subjects were selected on the basis of case history and clinical data to meet the criteria of reactive or process schizophrenia. The original list of criteria used in differentiating the reactive and process groups was taken from several of the studies and reviews found in the literature. A list of these criteria appears in Appendix I. For our purposes these criteria were reduced to the following four:

1. Prepsychotic personality: In the process group this meant a prepsychotic personality of a schizoid type, characterized by seclusiveness, withdrawal, apathy, and indifference. The reactive group includes those with a normal or neurotic, not schizoid, personality. They had been more outgoing than the process cases, with some degree of active social success.

2. Precipitating stress: Among the reactive cases there was in each a significant precipitating stress or situation present, one that logically could have precipitated the psychosis. The patients in the process group had no particularly severe stress that could have precipitated a psychotic break.

3. Onset: For the process group this was a continuous, insidious, gradual development and exaggeration of the traits of the prepsychotic personality, with no specific point at which a break could have been said to occur. The reactive group had an abrupt, acute, sudden, and stormy break with distinct changes in personality and habits, leading into an acute episode.

4. Clinical picture: The acute episode of the reactive group was marked by an exacerbation of the psychotic symptomatology, especially the affective features, severe confusion, and hallucinations. These patients had strong emotional outbursts with anxiety, turmoil, and sometimes depression, and they were disoriented and clouded in sensorium. The process group did not undergo this acute episode, their affect appearing flat, inadequate, or absent, with little severe disturbance. They were relatively well oriented, with a clear sensorium.

Several of these criteria overlap to some extent; however, they highlight the most important differentiating characteristics of

the two groups, and each points to some aspect of the history or clinical record that could be judged with a certain degree of clearness. The cases were judged, according to the criteria, as clearly fitting one or the other category. A difficulty arose in that because of their better prognosis, one would not expect to find many chronic cases of the reactive type, and the differences both in responsiveness and clinical appearance at this stage may be smaller than in the earlier stages, where the reactive schizophrenic is more likely to undergo an acute episode. Enough cases were found, however, to make a sample and the differences in responsiveness were left to the study.

Because of the results of Funkenstein (23-26) and Boisen's description (6), it appeared that "well-organized" paranoids, those that are stabilized with a relative lack of deterioration, could represent an intermediate[1] group that might obscure the differences of the extremes. For this reason an effort was made to exclude these cases.

The symptoms (prepsychotic and onset) of the process group were in all cases present before the age of twenty years. The symptoms of the reactives did not appear until after this age, near the time of the acute break and hospitalization.

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[1] Intermediate in terms of physiological reactivity and disturbance, as well as prognosis.

Stimuli

The reactions of these groups (process, reactive, and control) to three different stimuli were measured. These three stimuli were chosen to be quite different in nature, in order to tap different levels of responsiveness: response to psychodynamic conflict or anxiety; response to a present reality threat; and response on a startle level.

The first of these stimuli consisted of a set of four pictures, one of neutral value and three which were selected because they represent common sources of anxiety: hostility, dependency, and sex.

These pictures were identical with the ones employed by Sines (55), and were used because of their success in his study in arousing autonomic responses of the same type that were measured here, and especially because of their apparent value in tapping psychological conflict in an experimental situation. The presentation used by Sines was held to in this study, each card being placed in front of the subject for a period of forty seconds. At the beginning of this time a structuring statement was made in order to control as much as possible the subject's interpretation of the picture. These statements were also taken from Sines' procedure.

The first picture, a print of card 12BG of the TAT series (48), was used as a neutral picture, one that would not in itself probably be

associated with any particular conflict. It was used because of the likelihood of any stimulus giving a large response after the initial rest period of the experimental session. The structuring statement made was "Imagine yourself in a situation like this--it's a nice summer day when you can relax and really take it easy."

The hostility picture, a drawing made especially for Sines' study, was structured by "Put yourself in this fellow's position--your feelings are breaking loose and you're going to do something that you've wanted to do for a long time." The sexual card, a print of a picture taken from Esquire magazine (16), was given this structuring statement: "Put yourself in this man's position--you have yourself all set up and whatever you do now is entirely up to you." The dependency picture, card 6BM of the TAT, was presented with the statement "Think of yourself as this kind of a fellow--always depending on your mother for help."

Copies of the pictures will be found in Appendix II.

A second stimulus, a startle stimulus, was made up of three doorbells mounted on a piece of sheet metal. This gave a loud harsh noise, the bells being rung simultaneously for the time of three seconds. This device was used to elicit a response at a reflex level, giving less chance for distortion by the schizophrenics and being almost certain to draw a response from all subjects.

The third stimulus, a verbal warning, was given at least thirty seconds before the presentation of the bell. The warning was: "In a moment I am going to ring a loud bell. Relax and listen for the bell." This warning was used for two reasons: because of the possibility of differences in the preparation to respond to threat between the three groups, and because it did not seem wise to subject psychotic patients to such a jarring stimulus as the bell with no warning beforehand.

Responses

Two related but different reactions, GSR and heart rate, were used as indexes of physiological response. These reactions were recorded by means of a polygraph. The instrument used in this study was the Multi-Channel Recorder No. 603, constructed by the Lafayette Instrument Company. This polygraph records the three indexes of autonomic activity, change in heart rate, respiration, and the galvanic skin response (GSR) commonly obtained with this type of device.

GSR was taken by means of finger electrodes attached to the index and third fingers of the right hand of the subject. Contact was aided by means of a standard electrode paste. Heart rate was recorded with a standard blood-pressure cuff, which in this study was

placed just below the knee on the subject's left leg. The leg was used because the blood-pressure cuff, when placed on the arm and inflated, produces considerable discomfort after a very short time. The cuff can, however, be kept on the leg for periods of at least twenty to thirty minutes with no more than a very slight sensation of numbness in the foot. Respiration was also recorded, by means of a pneumograph placed around the subject's chest. This measure, however, was discarded before analysis of the data because on inspection of the records as obtained, it appeared rather unreliable and erratic, due to mechanical difficulties in the recording apparatus.

The question arises as to what kind of state is actually being measured by this instrument. The activity recorded was considered primarily an index of "responsiveness" or "reactivity," rather than "apprehension," "alertness," "preparedness to react," or "anxiety." The term "responsiveness" seemed to give a simpler and less suggestible label for the condition involved.

Hypotheses

Reactive and process schizophrenia, as discussed in the literature, present differences in development which lead to contrasting clinical patterns after the patients have definitely become psychotic. These contrasts are found especially in levels of activity: the process

schizophrenics are hypoactive with symptoms of apathy and lack of strong emotional response, and the reactives tend more towards hyperactivity and rather extreme manifestations of emotion. These varying patterns suggest possible basic differences in terms of physiological response, the assumption being made here that autonomically activated physiological responses can be used as valid indexes of emotional states. The two groups would then differ in physiological response, with the reactive group more likely to show a higher level of activation than the process group. The first three hypotheses were made on this basis, each with regard to a different measurable aspect of response. These hypotheses are:

1. Base levels. The background levels of physiological activity were recorded, with the subject at rest, as free as possible from any external stimulation. It was expected that the reactive group would show higher levels of basal activity than the process group.

2. Amplitude of response. It was hypothesized that the amplitude of specific responses to the experimental stimuli of the reactives would be larger than those of the process patients.

3. Arousal and recovery times. The expectation was that the reactive group would take longer to reach a peak of response, and longer to recover, than the process group.

The last hypothesis was based on the studies of Rodnick (53) and Paintal (49), and was intended as a check on differences among the groups in the set to respond to a threatening stimulus.

4. Reaction to a preparatory stimulus, the verbal warning. The response of the normals to the warning was predicted greater than the response of the schizophrenics, and it was expected that the reactives would produce a larger response here than the process group.

METHODOLOGY

Subjects

The subjects included two groups of hospitalized male veterans, eighteen in each group, and also a group of eighteen normal control subjects, all veterans. The two groups of schizophrenic subjects were matched individually for age and length of hospitalization and the control subjects were matched with the schizophrenics for age. The ranges and means of age and hospitalization appear in Table I.

All the schizophrenics had been hospitalized for at least six years, placing them in the late chronic stage of the disorder. All of them had been diagnosed schizophrenic on admission to the hospital and at least once thereafter, at a routine periodic review by a board of three psychiatrists.

Only those cases were selected where there was no question of mental deficiency by the examining psychiatrists. It would have been desirable to have an estimate of I.Q. on all the patient group, but their clinical condition made the administration of tests difficult if not impossible. Since the reactions studied were physiological and no verbal or other voluntary responses were required, it was

TABLE I

AGE AND LENGTH OF HOSPITALIZATION

Item	Reactive	Process	Control
Age range	28-47	27-48	26-49
Mean age	37.1	36.7	36.7
Range of hospitalization	6-11	6-12	
Mean years of hospitalization	8.7	8.8	

assumed that the psychiatrists' judgment would be adequate to control this variable.

The subcategories of the patients' diagnoses are shown in Table II. As will be seen in the table, there were no cases of schizophrenia, simple type, in the reactive group, and no paranoids or catatonics in the process group. These subdiagnoses were not included in the criteria differentiating the two groups; the cases, after being placed in their respective groups, were then found to show this characteristic.

The control subjects were all selected from hospital personnel. None had ever had a history of neuropsychiatric disorder of any kind. The sample included office workers, physical therapists, and several social workers and psychologists.

TABLE II

PATIENTS' SUBDIAGNOSES

Subtype	Reactive	Process
Simple	0	2
Catatonic	3	0
Paranoid	5	0
Hebephrenic	5	7
Mixed	2	3
Unclassified	3	6

Because of the procedural problems involved in subjecting schizophrenic patients with this degree of disturbance to extensive measurements and stimuli, preliminary interviews were made with all prospective patient subjects (after they had been separated into the two groups). These interviews were done to ascertain whether or not the patient was accessible enough to cooperate in the study itself. All subjects were taken from one ward in the hospital, in order to keep the degree of disturbance as constant as possible.

Measures

The two measures used, heart rate and GSR, were recorded both at rest and during stimulation. Heart rate was taken as simply the frequency per minute, basal heart rate levels being obtained from the mean frequency during five minutes of rest preceding the presentation of the first stimulus.

Basal GSR was taken just before presentation of the first stimulus, following the rest period during which the skin resistance was allowed to stabilize. This rest period was kept at least five minutes in length, to obtain the base heart rate; when GSR failed to reach a stable level during this time the period was continued as long as necessary. In most cases this was within ten minutes; with two subjects the period had to be extended as long as twenty minutes. In any case, the basal heart rate was measured from the last five minutes of the rest period.

GSR deflections after stimulation were recorded on the kymograph chart. In order to give a reading in ohms for each deflection, the galvanometer was calibrated by means of a standard decade resistance box. The galvanometer, in this procedure, was set at the level of sensitivity used for all subjects, and curves were graphed using base resistances from 5,000 to 150,000 ohms in 5,000-ohm steps.

Deflections of 100 ohms, to the limit of the chart, were recorded at each base level, and the graphed reactions of the subjects were measured against these deflections.

The final unit used for GSR was conductance, the resistance readings in ohms (R) being converted into conductance units in microhms (C) by means of the formula

$$C = \frac{1}{R}(10^6).$$

It has been demonstrated (35, 36) that only conductance and log conductance units of GSR are independent of the base level of skin resistance, and give scores which do not deviate significantly from normality. For this reason one of these two measures seemed best suited for use in this study; conductance was chosen because of its greater arithmetical convenience.

In addition to this measure of amplitude of response, the length of time after stimulation for the GSR to reach a peak (arousal) and the time to return to the base level (recovery) were also recorded. This was done to give an indication of the stability of response.

Procedure

Each subject, before being brought into the experimental situation, was told that measurements would be made of his pulse rate,

breathing, and how much he perspired. The patients were also told that the measurements were part of a routine checkup, to determine the general condition of their health. Any questions of the subject were answered at this time.

The subject was then brought into the room and seated in an armchair, his right arm placed on a table with the hand on a sponge-rubber pad to reduce movement, and the finger electrodes were attached. The left leg with the blood pressure cuff attached was placed on another sponge-rubber pad, lying on a chair and supporting the thigh and foot of the subject, thus keeping his leg in a comfortable position. The subject was requested to relax and to try to move as little as possible, and not to speak. During the preliminary rest period he was asked to close his eyes.

Each subject was seen for two sessions: in the first session he was placed in the apparatus, which was then turned on for a few minutes. This was done to familiarize him with the situation and to alleviate any anxiety produced by the rather complicated and strange-appearing equipment.

The actual experimental work was done in the second session. The procedure in this session began with the usual instructions and adjustments of the equipment, after which recordings were made with the subject at rest, in order to obtain base level records. At the

end of at least five minutes, or longer if needed for the skin resistance to reach a stable level, the subject was told: "I am going to show you some pictures. You don't have to do or say anything, just look at the pictures when I show them to you and try to remain as quiet as possible." These instructions generally were followed by a change in the skin resistance; after the resistance had returned to the base level, the Neutral card was presented, with the structuring statement made at the beginning of the presentation. The picture was held in front of the subject for a period of forty seconds and then removed. The skin resistance was again allowed to stabilize. After this had occurred, and never before three minutes had elapsed, the next card was presented, the same procedure being used.

At the conclusion of the presentation of the pictures, the blood pressure cuff was deflated and the subject allowed to relax and talk for a few minutes. The cuff was then reinflated, and when the base skin resistance had been established the verbal warning was given. At the end of thirty seconds, or longer if necessary to stabilize the GSR curve, the bell was rung for three seconds. The subject was then allowed to relax for a period of at least five minutes, with the recordings being continuously made, before being taken out of the apparatus.

All but a few of the subjects were very cooperative and made every effort to remain quiet throughout the session. The exceptions were several schizophrenics who began to hallucinate during the period, with subsequent verbalization in response to the hallucinations. When this occurred, the presentation of stimuli was stopped and the patient was asked to try to relax and be as quiet as possible for a few minutes. Eventually all of these subjects were able to stop their overt response to the hallucinations, and the session was then continued.

RESULTS

The results are presented in the same order as the four hypotheses, which were discussed in the "Statement of the Problem."

1. Base levels. Base or resting levels of heart rate were taken as the mean frequency per minute of the five minutes prior to the presentation of the first stimuli, the pictures. The mean base heart rate of each group, the differences between group means, and tests of the significance of these differences appear in Table III.

As will be seen in the table, the reactive group had a basal level of heart rate significantly greater than the basal level of either the process or control groups. The difference between the base levels of the latter two groups was small and not significant, their mean rates during the resting period being almost identical.

All of the differences between the three groups in terms of basal GSR were small, and none of these differences was statistically significant.

2. Amplitude of response. The amplitude of response in terms of heart rate was taken as the difference between the mean rate of the five-minute rest period and the mean rate per minute of a two-minute period immediately following the presentation of each

TABLE III

HEART RATE BASE LEVELS, DIFFERENCES BETWEEN GROUPS, AND T-RATIOS[1]

Groups	D	t
Reactive (92.2) - Process (82.1)	10.1	4.81
Reactive (92.2) - Control (81.5)	10.7	5.94
Process (82.1) - Control (81.5)	0.6	0.23

[1] A t-ratio greater than 2.90 is significant at the 0.01 level of confidence.

stimulus. Because there was not always a long enough time following the verbal warning and before the bell to give a reliable estimate of the change in this measure after the warning, these two stimuli were combined to give a single stress measure. The mean change in heart rate was calculated from the average rate of a three-minute period beginning with the warning and continuing in all cases for at least two minutes after the bell. The average response of each group after each stimulus for this measure is shown in Table IV, and the differences between groups and tests of significance of these differences appear in Table V, under the heading "Heart Rate-Amplitude."

TABLE IV

MEANS OF EACH GROUP FOR ALL MEASURES OF REACTIVITY AND STIMULI

Stimuli	Reactive	Process	Control
Heart Rate-Amplitude			
Neutral	1.18	- 3.15	2.34
Hostility	2.52	- 1.91	2.73
Dependency	2.38	- 2.72	2.23
Sex	2.56	- 2.12	0.56
Warning	*	*	*
Bell	0.70	- 2.65	- 0.93
GSR-Amplitude			
Neutral	1.85	0.98	2.28
Hostility	2.01	0.91	2.09
Dependency	1.36	0.57	1.59
Sex	2.21	0.92	3.41
Warning	0.77	0.46	2.03
Bell	2.19	1.08	3.25
GSR-Recovery			
Neutral	66.6	39.0	31.6
Hostility	76.8	39.8	26.4
Dependency	49.3	13.9	16.4
Sex	73.1	42.9	55.9
Warning	36.1	12.2	20.2
Bell	74.4	38.9	44.3

* Mean changes in heart rate during a three-minute period beginning with the warning and continuing for at least two minutes after the bell are presented in this table after "Bell."

TABLE V

DIFFERENCES AND SIGNIFICANT T-RATIOS BETWEEN GROUP MEANS ON MEASURES OF REACTIVITY[1]

Stimuli	Reactive-Process		Reactive-Control		Control-Process	
	D	t	D	t	D	t
Heart Rate-Amplitude						
Neutral	4.33	4.98	- 1.16		5.49	7.04
Hostility	4.43	4.76	- 0.21		4.64	5.10
Dependency	5.10	6.30	0.15		4.95	5.32
Sex	4.68	4.22	2.00		2.68	3.78
Warning						
Bell	3.35	3.72	1.63		1.72	
GSR-Amplitude						
Neutral	0.87	2.18	0.43		1.30	3.28
Hostility	1.10	2.40	0.08		1.18	2.74
Dependency	0.79	2.14	0.23		1.02	2.68
Sex	1.29	2.48	1.20		2.49	4.37
Warning	0.31		1.26	2.68	1.57	3.20
Bell	1.11	2.54	1.06		2.17	4.34
GSR-Recovery						
Neutral	27.6	2.24	35.0	2.50	- 7.4	
Hostility	37.0	2.31	50.4	2.71	-13.4	
Dependency	35.4	2.79	32.9	2.61	2.5	
Sex	30.2	2.12	17.2		13.0	
Warning	23.9		15.9		8.0	
Bell	35.5	3.82	30.1	3.16	5.4	

[1] A t greater than 2.11 is significant at the 0.05 level; a t greater than 2.90 is significant at the 0.01 level; t-ratios not significant at 0.05 or 0.01 levels are not included in this table.

The reactive group of schizophrenics gave a significantly greater positive change to all stimuli than the process group, but there were no significant differences between reactive and control groups. The normal controls showed a significantly larger response, in terms of a positive heart rate change, to the pictures than did the process group, but the difference of the two groups on the warning and bell combination was not large enough to reach statistical significance.

The difference in microhms between the peak of the GSR curve after stimulation and the base GSR before stimulation was used as the amplitude of this response. The means of the three groups for this measure are shown in Table IV, under "GSR-Amplitude." The differences between groups and tests of significance will be found in Table V under the same heading. An examination of the group means reveals that the process group gave a smaller, and the normal controls a larger GSR than the reactives on all stimuli. The reactive group gave a significantly greater GSR than the process group on all stimuli except the warning; the difference here was not large enough to reach significance. There were, in turn, no significant differences between the controls and the reactives except at the verbal warning, where the normal control group responded with a significantly larger GSR than the reactives.

The controls gave significantly larger responses than the process schizophrenics after all stimuli.

3. Arousal and recovery time. There were no consistent significant differences between any of the groups in time of arousal of the GSR to a peak. The group means for recovery time are given in Table IV, and the differences between the groups and the tests of significance in Table V, both under the heading "GSR-Recovery."

The reactive group showed significantly longer times to recover from the peak GSR than the process group after all stimuli except the warning. The differences after the stimuli between the reactives and normals were also all significant with the exception of the warning and sex card stimuli, the reactives taking longer to recover. There were no significant differences between the recovery times of the normal and process groups.

4. Reaction to a preparatory stimulus, the verbal warning. The response of the normals, in terms of amplitude of GSR, to the verbal warning was significantly greater than the response of the reactives or the process group. The difference between the two schizophrenic groups was not large enough to reach statistical significance. There were no significant differences between any of the groups in either arousal or recovery time after the preparatory stimulus.

DISCUSSION

These results give evidence for the hypothesis that within the older classification of schizophrenia there are at least two main groups, distinct from the traditional subtypes of the disorder. These groups, in this study called reactive and process, were originally differentiated on the basis of prepsychotic personality and the clinical picture. Each was characterized by its own pattern of physiological reaction. Neither group gave a pattern of response similar to that of a normal control group.

The reactive schizophrenics on the one measure, heart rate, showed a much higher base level than the other groups. The reactives responded at about a normal level in amplitude of response to both the pictures and the bell, but gave a response well below the normal, on GSR, to a verbal warning. Their recovery time on GSR was slower than that of the other groups.

The process schizophrenics were characterized by a basal heart rate similar to the normal. In amplitude of the heart rate response the mean changes of this group were all negative and significantly different from the changes of the other groups, which were all positive with the exception of a slowing of the rate for the

normals after the warning and bell. The process schizophrenics consistently gave a smaller GSR than the other groups to all stimuli, and showed a recovery time similar to the normal recovery time.

Interpretation of the Response Pattern: Reactive Group

The high base level of heart rate in the reactive group is similar to the resting rates of the "early chronic schizophrenics" found by Williams (60) and the levels of response of the "early schizophrenics" found by Malmo and Shagass (42). This leads one to suspect a sort of chronic overresponsiveness still present in the reactive group after years of hospitalization which could be a residual of the original psychological disturbance and intense anxiety that led into the acute stage of the psychosis.

The reactives in spite of this higher base level also evidenced an increase in heart rate as large as the increase of the normals after the pictures. To further support the supposition of overresponsiveness the reactives, while giving a response in amplitude of GSR at about a normal level, took on the whole a significantly longer time to recover on this measure than the normal group. This seems to be an indication of tension levels as high or higher than those of the normals with probably more difficulty in dissipating

the tension than normal. Certainly the capacity to be aroused is still intact in the reactive group, and in some respects this arousal to respond is considerably greater than normal.

Darrow, in a review of studies concerned with physiological reaction to sensory and ideational stimuli (14), concludes that the reflex response to momentary sensory stimulation is quite different from the response to ideas aroused by the stimulus. The sensory stimulus itself is more apt to excite peripheral responses, the ideas more effective in increasing the activity of the heart. His review, and the evidence of more recent studies (30, 31) indicate that the sensory stimulus is likely to slow the heart rate, although Darrow qualifies this by adding that fright or startle after sensory stimuli may momentarily increase the pulse, preceding the characteristic slowing.

If one accepts Darrow's generalizations, the positive change in pulse rate of the reactive group to the bell, where ordinarily a negative change (a decrease in heart rate) would occur could indicate considerable internal activity aroused by the bell, this stimulus having a more ideational value for the reactives than for the other two groups. Part of this ideation could be due to the verbal warning, but this would still indicate a lower threshold to respond in terms of ideation, for the reactive schizophrenics, since the other groups

also had the warning and still responded to the combination of warning and bell with a decrease in pulse. The increase of the reactives on this measure could also have been due to their being more startled or frightened by the bell, again assuming Darrow's conclusions. In any case there is evidence here for a greater responsiveness, in some ways, possibly because of overideation or a lower threshold for anxiety or fright, in the reactive group of schizophrenics.

Nevertheless, the small GSR given by this group to the verbal warning indicates a lack of responsiveness in other respects. This particular instance of underreactivity (when compared to the normal GSR to the warning) may have been a result of distorted perception, a lack of contact with or realistic appraisal of the situation. The pattern of poor reality discrimination combined with sizable reactions and a low threshold of response is similar to that found by Malmo and his co-workers (41-43), and their suggestion that part of the high general responsiveness of the schizophrenic may be due to determinants not related to the external situation is substantiated to some extent by the previously discussed heart rate response of the reactive group to the warning and bell.

Interpretation of the Response Pattern: Process Group

The process schizophrenics, on the other hand, gave no indication of a general level of responsiveness or tension greater than the normal. Their base level heart rate was almost the same as that of the normal group, and significantly below the rate of the reactives. Their GSR recovery times were also about normal, and again, smaller than those of the reactives, although the shorter recovery times in this group could be due in part to the smaller amplitude of their GSR: they had less to recover from in re-establishing an equilibrium. The amplitude of their average GSR, much smaller than that of the normal or reactive groups, also indicates a lower responsiveness, and it would appear that this group might be the hyporeactive group, with a possibly defective capacity to respond.

The hyporeactivity was not complete, however. The process schizophrenics did respond, but in a different way than the normals or reactives, with a negative change in heart rate after all the stimuli. This response, according to Darrow usually found after sensory stimuli, was often as large or larger than the positive changes in heart rate given by the normals and reactives. In one instance, the warning and bell combination, where a negative change might have

been expected and was found to occur in the normal group, the negative change of the process group was significantly larger than that of the normals, giving an indication of a stronger than normal response on this occasion.

From this it would appear that there was perhaps less tendency to react with ideation, or possibly a higher threshold for fright or anxiety, in the process group. Their GSR after the warning was, like that of the reactive group, significantly smaller than normal, showing a similar poor capacity to judge or respond to a reality situation; but their lower GSR after other stimuli and their negative heart rate changes evidence a lack of responsiveness of a type that the reactives still have.

The responsiveness still present in the process group could be interpreted as occurring only at a reflex level, stimuli having little value in producing ideation or as social stimuli. The basis of this condition is problematical. The evidence only suggests a restricted reactivity with a still adequate response at some levels and to certain stimuli.

General Considerations Concerning Responsiveness

In any event there is responsiveness left in certain types of chronic schizophrenics, even those that are sometimes considered

"burned-out" or "vegetative." It is also evident that there is a withdrawal, possibly varying in depth and quality, but nevertheless there. The problem seems to be what kind of withdrawal, at what level, and by what mechanisms?

Both of the schizophrenic groups studied very obviously manifest withdrawal at an overt level of activity. The majority of the patients in both groups are so-called "sitters." They eat and sleep and little else. The two groups also showed a similar withdrawal in this study, in their low response to the verbal warning. This type of unresponsiveness seems to be at a deeper level than the lack of overt activity mentioned above, being of an involuntary activity, and can probably best be explained by the distorted relationship to reality, or the loss of contact with reality, apparently found in both groups of schizophrenics. Thus both groups show a lack of response at these levels.

The reactive schizophrenics, however, responded to most of the other stimuli and were in fact quite strongly affected by them. This could be due to a higher level of tension produced by still-remaining psychological conflict, the reactives being preoccupied in certain areas of dynamic importance and so responding to stimuli that touch on these areas, to the exclusion of other stimuli. A new

realistic threat would not be effective in arousing them, but something touching on the old threat would be.

The withdrawal of the process group seems to go much further than this, their responsiveness being confined to the typical reaction to sensory stimuli. This was given even at the presentation of normally ideation-producing stimuli.

Thus it can be seen that withdrawal, and the capacity to respond, are not simple variables. The control of the stimulus and the definition of the response are of primary importance in these questions. The consideration of subjects having superficial similarities but deeper differences as one homogeneous group can especially cloud the picture, and it has been the essential purpose of this research to show that at least two such groups can be differentiated in the traditional classification of schizophrenia. These two groups, in spite of their similarities at some levels of symptomatology, can be distinguished by history, early clinical appearance, physiological response, and perhaps prognosis, and would appear to provide a more meaningful basis for classifying schizophrenia than the original four subtypes.

IMPLICATIONS FOR FURTHER RESEARCH

The problem of defining the stimulus was again brought out in the results of this research, and it was by no means settled here. This difficulty was evident in the unexpected responses of the schizophrenics, especially the slowing-up of heart rate of the process group after the pictures and the increase in heart rate by the reactives after the bell, indicating a much different value of these stimuli for these groups than for the normals. Studies of perception, to determine the type of distortion and the effectiveness of different stimuli in well-defined clinical groups, could do much to clear up this confusion.

The need for a precise answer to the question "Responsivity to what, and how?" is shown not only in this difficulty with the stimulus, but also on the response level. That a difference in stimulus meaning for different groups will produce a different type of response is evident, but there are further unanswered questions about the nature and meaning of a particular reaction itself. One can apparently not find a reaction that will serve as a general index of responsiveness or tension or anxiety; study with more measures, both of overt activity and physiological response, their interrelationships

and their significance at different levels will be necessary. Included in this type of research should be the study of differences in individual physiological patterning. The work of Lacey (33, 34) indicates the probability of a consistently varying emphasis on different response systems for different individuals, some reacting for example more with GSR, others with heart rate or another system. This would seem to be an important variable in itself and its neglect could well be an obscuring factor in research with clinical groups.

In regard to the particular groups studied in this research, one question that can be raised concerns the adequacy of the criteria used in their selection. Are all of these criteria relevant, which are not important, and are there others which could better differentiate the groups? The subtypes of schizophrenia might give a clue here. As shown in Table II, there was some degree of difference between the reactive and process groups, the former including patients diagnosed catatonic and paranoid, the latter with no catatonics or paranoids but two patients with a diagnosis of schizophrenia, simple type. Thus these two larger groups might also provide a more comprehensive differentiation than the older subtypes.

The physiological differences could possibly be brought out more clearly in studies with patients having a shorter length of hospitalization, and especially with patients in an acute stage or

episode. The Rorschach findings of Kantor, Wallner, and Winder (32) indicate that differences could be elaborated by means of psychodiagnostic work, and perhaps differences on other tests than the Rorschach would be found.

There is also the possibility of other groups, especially the "well-preserved" paranoids, giving significantly different patterns of response than the two groups used here, and studies of prognosis would be an important practical application of the differentiation.

The schizophrenics in this study were chosen to represent extremes in terms of development of the psychosis, and it would seem possible that with these different developments there could be basically different etiologies, one group perhaps psychogenic and the other organic. These results give no evidence in regard to such a difference in etiology, but the added clarity in definition of groups should make the study of this question more rewarding.

SUMMARY

The nature of schizophrenia as a disease entity has been very controversial, there being considerable disagreement in regard to both diagnosis and symptomatology. The question of emotional response and withdrawal has been especially subject to disagreement and contradiction, theoretically and in the results obtained from investigation of the problem. Most investigators have reported less overt responsiveness in the schizophrenic than in the normal or neurotic, although heightened overt reactions have been found in some cases. There has been evidence for physiological responsiveness less than, equal to, and greater than that of the normal. In general deficiencies in discrimination among specific stimuli and less ability to respond appropriately have been noted.

The inconsistency of these results may be due to methodological features of the experimental work and also to the selection of subjects and the definition of the groups used. Four main factors are evident here:

1. The possibility of the heterogeneous character of schizophrenia itself.

2. The stage at which the disorder is studied.

3. The type of stimulus used and the change in value of the stimulus resulting from the effects of the disorder itself on the subjects' perceptions.

4. The measure of response.

The first variable was taken as the focus of this research, although an attempt was made to control the others as much as possible.

Two groups of chronic schizophrenics, eighteen in each group, and a group of eighteen normal subjects, were studied. The schizophrenics were differentiated into the two groups on the basis of case history and clinical criteria, these groups being named "process" and "reactive." The criteria included: (1) prepsychotic personality; (2) precipitating stress; (3) onset; and (4) clinical picture.

Two types of stimuli were used. The first was a set of four pictures, one of probably neutral value and three which were selected to represent common areas of psychological conflict: hostility, dependency, and sex. The second stimulus consisted of three doorbells mounted on a piece of sheet metal, employed to give a startle stimulus. A verbal warning was given before the bell.

The responses measured were base levels of heart rate and GSR; heart rate and GSR change to the stimuli; and arousal and recovery time of the GSR to the stimuli.

The specific aspects of these responses considered included: (1) background or resting levels of response; (2) amplitude of the change in response; (3) arousal and recovery time of the GSR; (4) differences in response to the verbal warning, a preparatory stimulus, by the three groups.

The results of the study were as follows. The reactive group of schizophrenics, on one measure, heart rate, showed a significantly higher base or resting level than either the normals or process schizophrenics. There were no significant differences between the groups on resting GSR. The reactives responded at about a normal level in terms of amplitude of response, with both heart rate and GSR, to both the pictures and bell, but gave a response well below the normal to the verbal warning and on GSR showed a definite tendency toward slower recovery than either the process or normal groups.

The process schizophrenics were characterized by a consistently smaller GSR-amplitude to all stimuli than the other groups, including a significantly smaller response than the normals after the verbal warning. In terms of amplitude of the heart rate response, the mean changes of this group were all negative, being significantly different from the changes in heart rate of the other groups which were all positive with the exception of a slowing up of the rate for

the normals after the bell. The process group also took a much shorter time to recover (on GSR) than the reactives, showing usually a recovery time similar to that of the normals.

These results were interpreted to mean, primarily, that at least two groups, defined on the basis of case history and clinical criteria, and differing in physiological response to certain stimuli, can be distinguished within the traditional classification of schizophrenia. These groups do not seem to be independent of the traditional subtypes. Both groups manifest withdrawal at a social level, and in terms of overt activity. Both are apparently relatively unresponsive to a present environmental threat. The groups differ, however, in the extent of the withdrawal. The reactive schizophrenics were affected by most other stimuli and responded quite strongly to them, their response reaching a normal level and in one respect, recovery time, exceeding the normal level. The withdrawal of the process group seemed to go much further, their responsiveness, in this study, being confined to what seems to be a reflex response to sensory stimuli, and in general being on a reduced level.

These results further emphasize the complex nature of such concepts as withdrawal and responsiveness, and point to the need for precise control of the stimulus and response and to careful definition of the subjects for study, in research of this kind. They

especially indicate a more significant basis for classifying schizophrenia than the traditional four subtypes. The reactive-process distinction provides a differentiation meaningful in terms of etiology, treatment, and prognosis.

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APPENDIX I

The criteria for reactive and process schizophrenic groups, drawn from several of the studies in the literature (4, 6, 9, 13, 23-26, 32, 45-47, 56, 58, 61).

Process	Reactive
Prepsychotic personality:	
Basic and constitutional seclusive makeup--schizoid personality. Psychosis more the development and exaggeration of a personality type. Traits present from early childhood, including: withdrawn, seclusive, shy, apathetic, dreamy, listless, indecisive, hazy, reticent, disinterested, poor attention and concentration, oversensitive, lacks initiative, lethargic, few interests, hard to influence, stubborn in a passive way, uncommunicative, lack of outstanding defensive personality traits.	Atypical (not schizoid) personality--adequate, normal, or possibly neurotic. Absence or minimal degree of these traits.
Other criteria:	
Early psychological trauma; physical illness, severe or long; "odd" member of family; difficulties at school; family troubles paralleled with sudden changes in patient's behavior; introverted; history of breakdown of social, physical, mental functioning; pathological siblings; overprotective or	Good psychological history--absence of severe trauma; good physical health; normal member of family; well adjusted at school; domestic troubles unaccompanied by behavior disruptions--patient "had what it took"; extroverted behavior trends and interests; history of adequate social, physical, mental

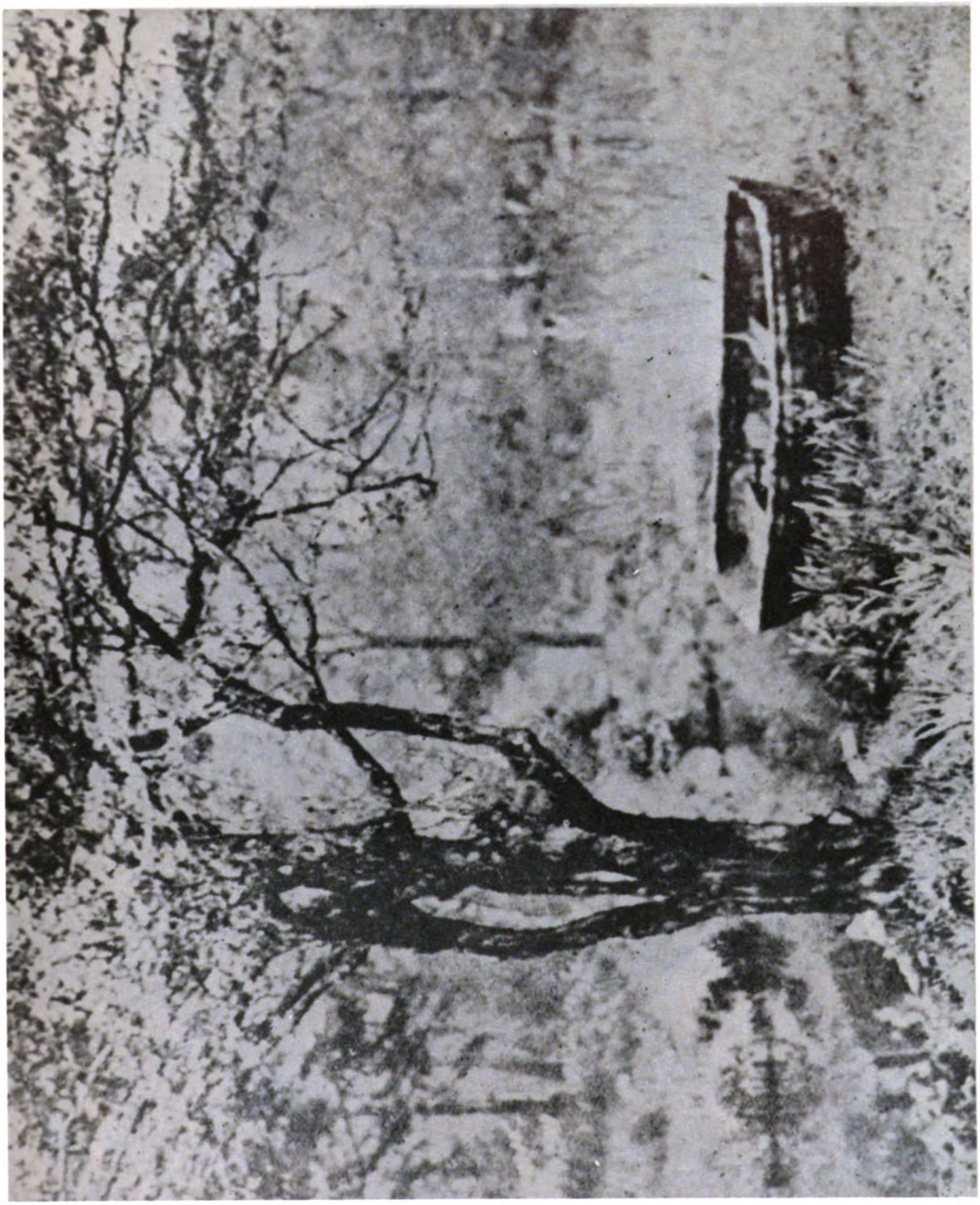
APPENDIX I (Continued)

Process	Reactive
rejecting mother--"momism"; rejecting father; lack of heterosexuality; physical aggression; little capacity for alcohol; failure under adversity; descrepancy between ability and achievement; clash between culture and environment.	functioning; normal siblings; normally protective, accepting mother; accepting father; heterosexual behavior; verbal aggression; much capacity for alcohol; success despite adversity; harmony between ability and achievement; harmony between culture and environment.
Onset and early symptoms:	
Insidious, gradual onset without pertinent stress--or no specific onset. Develops during adolescence. A continuous development and exaggeration of prepsychotic traits.	Acute, abrupt, sudden, stormy onset, with a significant and logical precipitating stress or situation present. Later onset. Abrupt break and change.
Becomes more seclusive; daydreaming; preoccupied; loss of friends; irritability; loss of interest and ambition; depressed; lack of energy and concentration; fatigue; poor appetite.	Nervous; sleepless; worried; nightmares; hypochondriasis; somatic complaints; moody; impatient; tantrums; fault-finding; moralizing.
These symptoms are closely related to the prepsychotic personality; they are usually present much longer before hospitalization than the early symptoms of the reactive group.	These symptoms represent a rather distinct change in personality and habits.
Clinical features:	
Affect is inadequate, at odds with thought, disharmonious--an absence of adequate affect. No manic-depressive component. Massive paranoia; in the chronic stage, delusions are poorly organized.	Prominent affective features, with a possible manic-depressive component. Lots of anxiety, depression, turmoil, disturbance. Minor paranoid trends; neither organized nor systematic delusions. Delusions

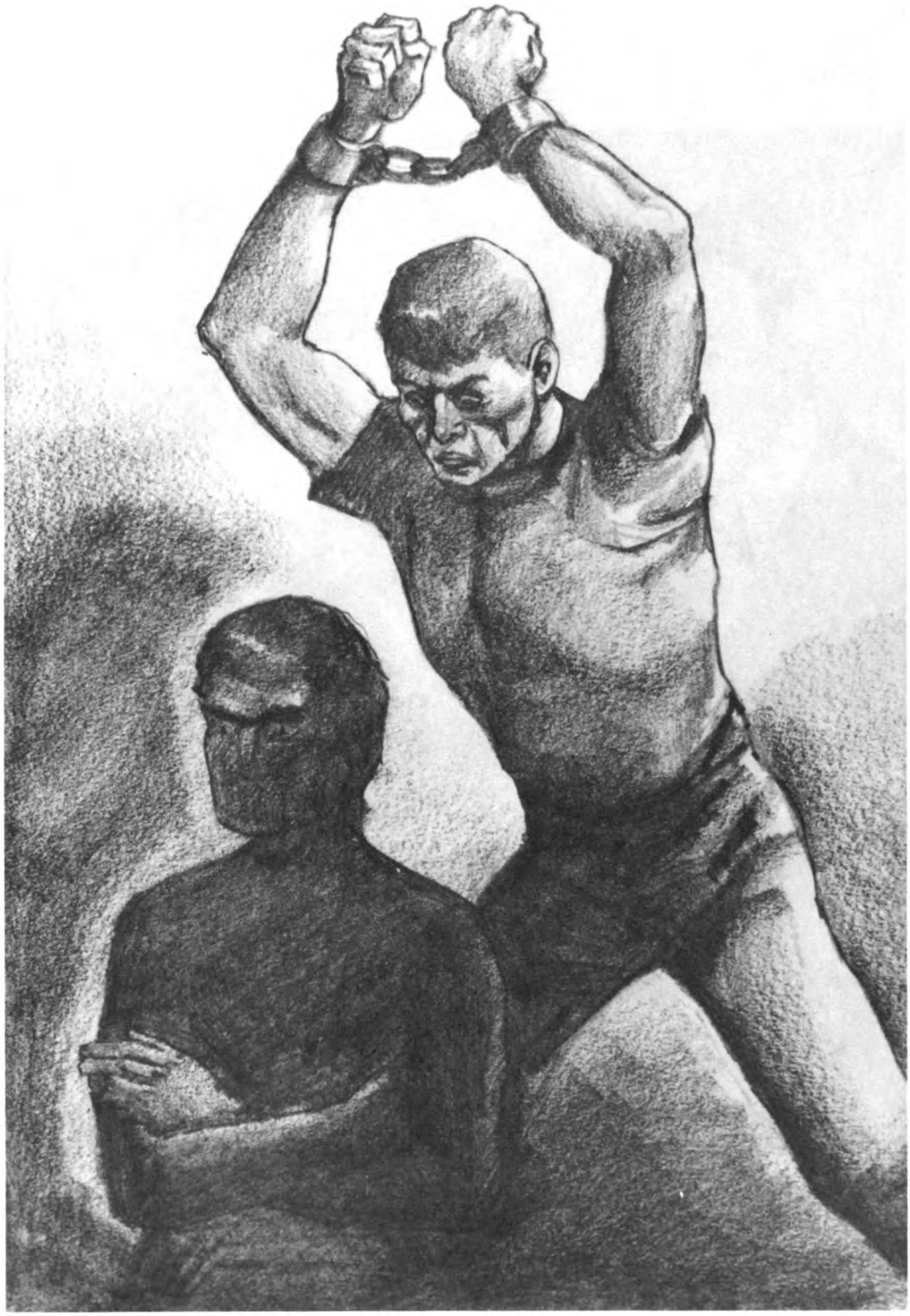
APPENDIX I (Continued)

Process	Reactive
Clear sensorium--relatively well oriented.	are less prominent than the accompanying affective features.
Awareness of change in self.	Confusion--disoriented.
Somatic delusions.	No sensation of change.
Loss of decency--nudity, public masturbation.	Absence of somatic delusions. Retention of decency.
Other clinical and experimental features:	
Loss of capacity to abstract. Presence of thinking disorders on the Rorschach. Poor response to treatment. Lengthy stay in hospital. Anxiety precipitated only by epiniphrine, and a marked blood pressure response to this drug. Low basal blood pressure; small, unsustained drop after mecholyl --short time of homeostasis. Failure of blood pressure to rise under most stresses.	Abstraction intact. Absence or slight degree of thinking disorders on the Rorschach. Good response to treatment. Short stay in hospital. Anxiety precipitated or relaxed only by mecholyl. Moderate blood pressure response to epiniphrine. High basal blood pressure; large, sustained drop of systolic blood pressure after mecholyl--long time of homeostasis (return of systolic blood pressure after injection).

APPENDIX II

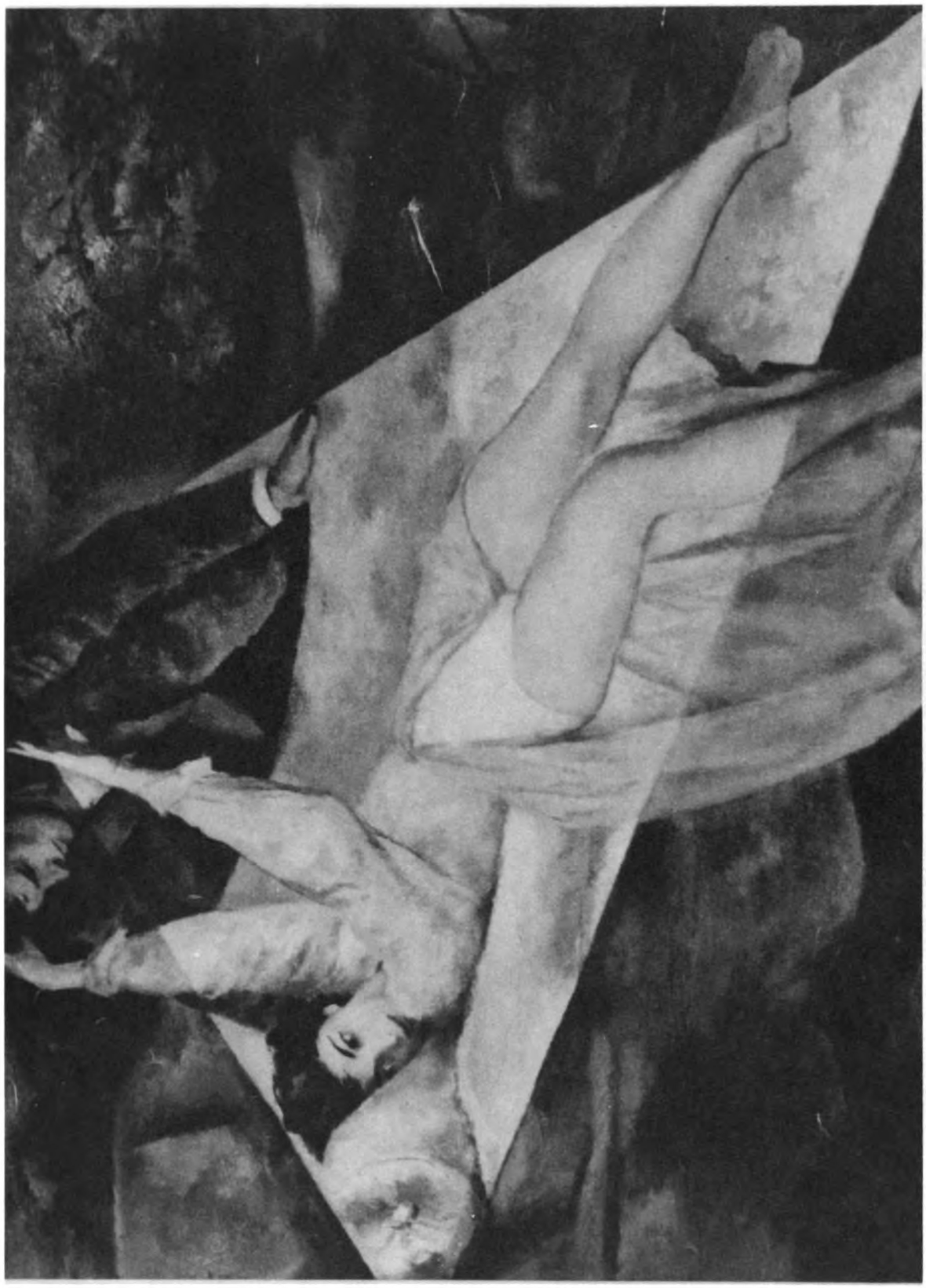


Neutral Stimulus



Hostile Stimulus

Dependency Stimulus



Sexual Stimulus