THE GSR COMPONENT OF THE ORIENTING RESPONSE IN RELATION TO DURATION OF SCHIZOPHRENIA AND PHENOTHIAZINE LEVEL IN OUTPATIENTS COMPARED TO NORMALS

A Dissertation

Presented to

the Faculty of the Department of Psychology

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

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by

John A. Owens

August, 1969

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ABSTRACT

Two groups each composed of 24 female undifferentiated schizophrenic outpatients equated for phenothiazine medication were compared with a group of 24 normals on GSRs to a variety of repeated auditory stimuli. The time interval since initial hospitalization for the schizophrenics in one of the two groups averaged 2.6 years, and in the other, 11.8 years. Eight different stimulus series were used, each comprising 6 identical stimuli and a test stimulus. Four series involved pure tones, and 4 series involved words, with the 4 series of tones and the 4 series of words presented in counterbalanced order. The 4 series of tones differed in frequency with 2 of the series at a high intensity level and 2 of the series at a low intensity level. Words were similarly different, except that "intensity" was manipulated by differences in meaning.

The three groups did not differ significantly with respect to basal resistance levels, orienting responses, or habituation. The shorter duration schizophrenics did differ from the other groups in that they showed less non-specific reactivity following a word series composed of emotionally loaded words. In general, the shorter duration schizophrenics appeared less similar to the normal group than the longer

duration schizophrenics, whose electrodermal activity closely approximated that of the normals. Schizophrenics with relatively higher drug levels were found significantly less reactive than those with lower levels, irrespective of duration of schizophrenia. The general effect of the drug appeared to be a reduction of electrodermal reactivity toward the normal range. The magnitude of orienting responses varied in relation to the type of stimulus comprising the series. Habituation to repeated stimuli was found consistently.

Based on the experimental data, schizophrenic outpatients receiving phenothiazine medication were concluded to be similar to normals in magnitude of electrodermal orientation, in adaption to novel conditions of moderate intensity, and in general background level of electrodermal activity. The disruptions of orienting responses typically reported for hospitalized patients were not typical of similar medicated outpatients. The absence of group differences between schizophrenic outpatients and normals accentuates the value of current community mental health programs which combine drug therapy with outpatient status in the more socially stimulating environment of the real world. The findings also supplement the contention that prolonged hospitalization may contribute to reduced orienting and the development of

chronicity. It appears promising that with adequate drug therapy outpatients can increasingly approach normal functioning and thereby avoid the passive, vegetative aspects previously associated with chronic schizophrenia.

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CHAPTER I

INTRODUCTION

Recent investigations of the orienting response (OR) in schizophrenics have concentrated on orienting as a function of schizophrenic status. Using the galvanic skin response (GSR) component of the OR to light stimuli Bernstein (1964) demonstrated reliable differences between normals, hospitalized remitted-chronic schizophrenics, and hospitalized regressed-chronic schizophrenics. Remitted schizophrenics were more responsive than regressed but less than normals. Stern, Surphlis, and Koff (1965), using the same component of orienting to tone and word stimuli, found promising results for differentiating good and poor prognosis schizophrenic groups while hospitalized. They found reduced responsiveness in those schizophrenics making progress toward remission while those not recovering demonstrated no change. Juxtaposing the two studies, Bernstein's results indicate reduced orienting is associated with greater severity of schizophrenia while Stern, Surphlis, and Koff suggest reduced orienting is associated with lesser severity of schizophrenia. This research is directed toward clarification of these paradoxical results.

Although existing efforts to explore orienting in schizophrenia are promising, results frequently are divergent. Comparison of studies is difficult because they often differ in important methodological aspects. In addition, schizophrenia is a complex disorder with multiple interacting variables including degree of severity, type, treatment, age, sex, social factors, and course. Many of the confusions associated with GSR differences in schizophrenia arise because subject variables have not been examined systematically variable by variable.

One variable which especially appears important is duration of the schizophrenia, as the onset period and the chronic stage are likely quite different. Certainly a very prominent difference between the samples of Bernstein and of Stern, Surphlis, and Koff was duration of schizophrenia. Bernstein studied chronic, extensively hospitalized patients while Stern, Surphlis, and Koff studied acutely ill patients soon after hospital admittance. Within each study the variable of duration of disorder was confounded. Bernstein's remitted group was not hospitalized as long as his regressed, while in the Stern, Surphlis, and Koff study duration was tied to psychiatric status. More precise examination of duration of schizophrenia could be effected by examining remitted out-

patients differing in duration of time since disorder onset. Efforts to clarify the role of orienting in schizophrenia appear justified, and should better elucidate differences in OR associated with duration of schizophrenia.

CHAPTER II

THEORETICAL BACKGROUND

The Orienting Response and Schizophrenia

The term "orienting reflex" was introduced by Pavlov in 1919 (English translation, 1927). Initially he considered the orienting response (OR) to be a nuisance since it interfered with study of conditioned reactions, but later he came to regard it as one of his more important discoveries. The OR is considered as one of three types of reactions to novel stimuli; the other two are "adaptive responses" and "defensive responses" (Sokolov, 1960; Berlyne, 1960). Orientation reactions typically occur first and then may be replaced by either adaptive or defensive reactions depending upon the intensity and type of the novel stimulus (Berlyne, 1960; Lynn, 1966). The OR is differentiated by the following two properties (Sokolov, 1960; Kintsch, 1965): 1.) It is a nonspecific response initiated by any quantitative or qualitative change of the stimulus independent of the receptor modality of the stimulating agent. 2.) It is subject to habituation with repeated presentations of the same stimulus.

The OR, therefore, is a widespread, multiple component, physiological response elicited by any adequate, novel

stimulus. Its components include increased sense organ sensitivity, changes in the skeletal muscles that direct the sense organs, changes in the general musculature, modifications in EEG toward increased arousal, peripheral vasoconstriction and cerebral vasodilation, occurrence of the galvanic skin response (GSR), delayed respiration followed by decreased frequency and increased amplitude, and slowing of the heart rate (Sokolov, 1960; Lynn, 1966).

OR is believed by Russian researchers (Lynn, 1966) to perform a basic function in maintaining stable relations between the individual and the changing external environment. The Russians have viewed the OR as part of a homeostatic system in which the OR provides positive feedback, increasing sensitivity to subsequent stimulation. The "adaptive reaction" provides negative feedback, counters positive feedback effects, and thereby sets up a homeostatic balance. Sokolov (1963b) suggested the OR occurs whenever a degree of "mis-match" is found between sensory input and a "neuronal model" of expectancies based on previous input. As the novel aspects of sensory input are integrated into the "neuronal model" OR habituation occurs. The OR, therefore, is believed to accelerate integration of environmental changes and contribute to maintaining the homeostatic equilibrium.

The most frequently used parameters of orienting are degree of reactivity and rate of habituation. Orienting reactivity refers to responses associated with presentations of novel stimuli. Habituation, the decrement in reactivity with stimulus repetition, is used best descriptively, according to Sokolov (1960), and should be distinguished from "extinction" (the process by which a learned response is eliminated) and from "inhibition" (the physiological process underlying habituation). Stimuli used to elicit orienting and OR habituation define points in a range of novelty with maximum novelty being present on the initial stimulus presentation and with decreasing degrees of novelty associated with each stimulus repetition. Non-specific responses are physiological reactions unrelated to known, experimental stimuli. When non-specific responses occur in an experimental situation where sources of novel stimuli have been eliminated, the generating stimulus frequently is assumed to be of internal or unknown origin. Non-specific measures provide an indication of background arousal against which arousal changes can be contrasted.

Schizophrenia traditionally has been seen as a disorder in which coping and defense mechanisms deteriorate or collapse under stress precipitating regression toward constant, pre-

dictable, nonthreatening conditions. Accordingly, a major characteristic of the schizophrenic disorder can be viewed as an inability to deal with novel conditions. Therefore, the OR especially should be expected to reflect changes associated with the onset and the course of schizophrenia. Indeed, it would seem likely that disturbances in the OR might be observed in advance of global behavioral disruption since, as Lynn (1966) suggested, the OR is an important aspect of the process of integrating external stimuli.

Disruptions of the OR in schizophrenics were consistently found by early Russian scientists and led in part to Pavlov's neurophysiological theory of schizophrenia (Pavlov, 1941). In response to overstimulation nerve cells supposedly induce a state of "protective inhibition." When in a state of "protective inhibition" nerve cells do not conduct impulses, thereby disrupting higher level integrations of sensory information, consequent responsive behavior (including the OR), and the homeostatic level of balance. Specific types of schizophrenia are believed related to those nerve groupings which are affected and to the amount of spread of the "protective inhibition." For example, in catatonia the "protective inhibition" is assumed to have spread to subcortical and autonomic nerve centers. Excited, active schizo-

phrenic states are attributed to removal of cortical control and "positive induction" where inhibition in one region induces excitement in another.

Other Theories of Schizophrenia

The Pavlovian explanation of schizophrenia is attractive since it provides a well developed, unified theory with a single etiology. In contrast, American theories typically are less parsimonious, more empirical, and more frequently assume multiple causes and types of schizophrenia. Some theories believe the sources of schizophrenia to be external and related to such variables as developmental events (Abraham, 1955; Goldman, 1962), family roles and interaction patterns (Kanner and Eisenberg, 1955; Bateson, Jackson, Haley and Weakland, 1956; Lidz and Fleck, 1960), acquiring an appropriate, independent identity in society (Fenichel, 1945; Wolman, 1965), social interactions (Sullivan, 1953; Arieti, 1955), social class (Lemikau and Grocetti, 1958; Hollingshead and Redlich, 1958), and aversive stimuli (Garmezy, 1952). Other theorists place importance on intraorganismic deficits in learning (Taylor and Spence, 1954; Skinner, 1954; Cohen, 1956; Mednick, 1958), in intellectual functioning (Roe and Shakow, 1942; Rapaport and Webb, 1950; Hall and Crookes, 1951; Binder, 1956), in cognitive processing and generaliza-

tion of sensory input (Piotrowski, 1945), in motivation (Huston and Shakow, 1946), in biochemical make-up (Freedman, 1958; Woolley, 1958; Kety, 1960), in genetics and heredity (Kallmann, 1953; Becker, 1956; Bender, 1956; Altshuler, 1957; Gregory, 1960), and in arousal-inhibition levels (Arieti, 1955; Mednick, 1958).

The multiple theoretical approaches listed above deal with three different conceptual frameworks, as pointed out by Stern and McDonald (1965). The first assumes that behavioral abnormality causes physiological disturbances, the second assumes that physological abnormality causes behavioral disturbances, and the third that physiological and behavioral disturbances simply coexist in time. A fourth framework also might be stated in which the interaction between behavioral and physiological activity is seen as the cause of schizophrenia.

Several of the theories listed above offer supplemental and alternative explanations to the Pavlov-Sokolov formulation of "protective inhibition" and are specified in cursory form below. More detailed research information relating to these formulations can be found in the review of Lang and Buss (1965).

Drive. Theories of schizophrenic deficit concentrating on the construct of drive essentially are of two types, positive and negative. Positive drive theory attributes association disturbances to increases in anxiety and probably was best formulated by Mednick (1958). Intense anxiety was viewed as related to excessive associative generalizations. Elevations in anxiety supposedly produced positive feedback, thereby adding further intensity to situations already anxiety provoking. The transition between acute and chronic schizophrenia occurred when the excessive generalizations in the high anxiety state became so broad as to be remote, irrelevant, and tangential. Remote generalizations were viewed as defenses to avoid anxiety provoking areas and, thereby, decrease anxiety.

Negative drive theories attribute overly reactive inhibitory systems as dominating activation systems. Consequently, schizophrenic behavior is described as sluggish, retarded, and passive. Because of restricted cerebral input learning is slow and associations are tangential and primitive, although preonset knowledge tends to remain intact. This theory is similar to that of Pavlov and Sokolov.

Somatic. The somatic arousal theories generally have attributed schizophrenic deficits to diminished feedback

from the peripheral sense organs to the cortex. Consequently, there are modifications in temperament, in arousal, in control, and in orientation. Some theories, however, propose the opposite, namely, that excessive peripheral feedback disrupts the organization and integration of behavior giving rise to schizophrenia (Land and Buss, 1965).

Attention. Attention theories focus on cortical deficit in the ability of schizophrenics to attend to more than one stimulus, to switch attention in a rapid flexible manner, and to ignore irrelevant inputs. Consequently, due to the attention deficiency, behavior does not achieve adequate integration under conditions of pressure and stress where rapid attention to stimuli is essential. Under minimally stressful or complex conditions the schizophrenic may perform similar to the normal.

Associative Interference. To the extent central nervous system inputs fail to be associated according to the normative standards of a culture an inadequate sense of "reality" will be acquired and the individual will be handicapped in his responses. The more idiosyncratic the association and the more of these associations the greater the disturbance. As inaccurate associations are added to inaccurate associations the thinking of the schizophrenic becomes more fragmented and

bizarre, often to the extent of delusions and hallucinations.

Onset, Duration, and Course of Schizophrenia

Attempts to understand the etiology of schizophrenia are made more complex by age at onset, by manner of onset, by duration of the disorder, and by course. Schizophrenia has been described as a disorder of young adulthood because of the large incidence of onsets during this period. However, schizophrenia is not limited to this age group. Young children may manifest the symptoms of schizophrenia while others may not experience schizophrenic disruptions until late in life. An onset in childhood is held to be most dehabilitating since it disrupts the acquisition and integration of expressive, intellectual, emotional, motivational, and personality assets. When schizophrenia occurs later in life the individual at least has some coping resources in the skills and knowledge already acquired.

The manner of onset has been given importance in many theories. A rapid, or acute, onset associated with stress is believed to carry a more favorable prognosis than an insidious onset in the presence of no identifiable stress (Stephens and Astrup, 1963). The acute phase is characterized in the Diagnostic and Statistical Manual (1952) by confusion, emotional turmoil, ideas of reference, fear, and disassociation.

Arieti (1955) explained the acute episode as a precarious struggle with intense anxiety. Inability to sustain the struggle was seen as producing excitation, agitation, and possible panic. Further developments included gross confusion in mental status, unintelligible speech, and hallucinations.

Although "acute" schizophrenia has frequently been contrasted with a "chronic" schizophrenia, based on type of onset, the comparison causes an unfortunate mixture of ideas. Acute and chronic should be reserved to describe active, uncontrolled schizophrenia and long duration, stabilized schizophrenia respectively. A slow, progressive development is better expressed as an "insidious" onset rather than in terms of its probable chronic outcome. Certainly it would not be logical to call intensely disturbed schizophrenics as "remitted" because this was their probable prognosis. The use of the word "chronic" is best restricted to description of persons who have manifest schizophrenia over an extended period of time and stands in contrast to "early" schizophrenia. Pairs of words directed toward expressing similar onset distinctions have included rapid-insidious, malignant-benign, typical-atypical, and process-reactive.

Schizophrenia with an insidious onset is described in the Diagnostic and Statistical Manual (1952) as having mixed symptomatology with disturbances in thought, affect, and motor behavior which typically deteriorate slowly and progressively. Arieti (1955) suggested schizophrenia with an insidious onset was associated with reduced motor activity and increased withdrawal.

The next distinction, course, is probably the most inadequately controlled and potentially critical variable in schizophrenia research. Theories of schizophrenia typically project a course and outcome for the disorder. Rapid onset is believed to follow the course of heightened activity and an intense disruption of short duration, frequently followed by remission. Insidious onset is held to be associated with progressive reductions in motor activity and restrictions in reality involvements. The prognosis is felt to be good with a rapid onset and poor with an insidious onset. Accordingly, schizophrenia symptomatology, and underlying physiological components, should differ with manner of onset and duration. Additional differences would be likely with repeated observations during the course of schizophrenia. Rapid onset schizophrenics who recover should differ from those who do not. The insidious onsets should show progressive

deterioration, thereby also differing from their own previous observations as well as from the acute onset persons.

There are multiple possibilities for coping with the problems of onset, course, and duration in research efforts. The best approach is probably that of doing a longitudinal study with repeated measures at preselected intervals. Unfortunately, in longitudinal research the length of time required to carry out the research may extend to the lifetime of the patients, which frequently exceeds that of the researcher. Most efforts have stressed cross-sectional approaches. Several course classification options are available when making a cross-sectional study. Among these groupings are:

1. Age at onset or at initial hospitalization.
2. Duration since onset or since initial hospitalization.
3. Duration while hospitalized.
4. Duration following final hospitalization.
5. Ratio of duration hospitalized to duration remitted.

If the complicated factors of the schizophrenic disorder are to be understood it seems likely the variables of onset, course, and duration will need to be better controlled and better evaluated.

Neurological Basis of GSR

Classifications of the nervous system can be made either by neurological structure or by function. Neurological divisions by structure include the central and peripheral nervous systems, in which autonomic innervations are included as peripheral. Neurological classification by function include the somatic system (central nervous system and peripheral fibers to and from the sense organs and striated muscles) and the vegetative, or autonomic, system (visceral innervations and their centers in the brain and brain stem). In either classification the autonomic nervous system (ANS) is involved with regulation and maintenance of the homeostatic balance between the glands, smooth muscles, heart, lungs, and other visceral organs. The ANS can be subclassified, based on structure, into the sympathetic nervous system (SNS), composed of nerve fibers originating in the thoracic and lumbar regions of the spinal cord, and the parasympathetic nervous system (PNS), composed of fibers originating in the cranial and sacral regions of the spinal cord. The SNS fibers generally stimulate the organs they service with an adrenaline like substance and, hence, based on function, the SNS has been described as an "adrenergic" system. The PNS fibers stimulate end organs with acetylcholine and functionally

comprise the "cholinergic" system (Sternbach, 1966).

Most autonomically innervated organs receive both SNS and PNS fibers with antagonistic functions. A few, however, receive only SNS fibers. Among these are the sweat glands, which further are unique in responding to the postganglionic, synaptic transmitter substance acetylcholine and in not responding to adrenaline secretions. Because of the absence of PNS fibers, which are typically antagonistic to SNS functions, there is not the often observed neurological feedback system of excitation-inhibition. Sweat activity is a simple continuous response involving degrees of response to excitation.

Sweat glands over most of the body are thermoregulatory. The palms of hands, soles of feet, armpits, groin, and parts of the face, however, produce sweat concomitant with emotional reactions. Since a salty solution is an excellent conductor of electricity, a continuous measure of sweat activity can be made by passing a known current through the skin, by recording voltage, and by determining resistance from Ohm's law (Voltage = Current X Resistance). Accordingly, sweating and resistance (measured in ohms) are inverse functions. By determining the reciprocals of resistance values the relationship between sweat and the new measures becomes direct. The new measures are "conductance" values

(measured in ohms). The above measure commonly is called the galvanic skin response (GSR).

The GSR component of the OR is particularly attractive to study. GSR is related only to the SNS system and is not complicated by the effects of PNS feedback, as are most SNS responses. Because certain areas of the body produce perspiration following emotional stimuli GSR measurements from these areas yield a quantitative index related to emotional experience. It is not surprising that a long history of efforts to examine emotionally disturbed behavior via the GSR has developed, although it is surprising that the results have been so divergent (Landis, 1932; Land and Buss, 1965). These divergencies, as pointed out by Stern and McDonald (1965), are more likely associated with inadequacies of diagnosis than with inadequacies of the GSR measure. Dykman, Reese, Galbrecht, and Thomasson (1959), suggested the GSR more adequately reflected attention and integration of external events than heart rate or respiration, both of which appeared more dependent upon intraorganismic factors. In addition they found it the easiest to evaluate and the most reliable of their indices. Measurement techniques are well established for GSR, making more tenable the basic research assumption that experimental differences are not related to

unreliability of the response measure.

The behavior disturbance labeled "schizophrenia" is a complex disorder. The disorder, and consequently the response measure, is likely affected by the multiple, intertwined and interacting variables already mentioned, namely, age at onset, duration, age when observed, sex, social factors, and course. However, efforts to isolate critical variables is complicated further by treatment effects, and particularly, by new phenothiazine psychopharmacologies.

Phenothiazine Medication

The rapidly expanding family of phenothiazine derivatives currently is composed of seventeen drugs (Friend, 1968): acetophenazine (Tindal), carphenazine (Proketazine), chlorpromazine (Thorazine), fluphenazine (Permitil, Prolixin), mepazine (Pacatal), methdilazine (Tacaryl), methoxypromazine (Tentone), perphenazine (Trilafon), prochlorperazine (Compazine), promazine (Sparine), promethazine (Phenergan), thiethylperazine (Torecan), thiopropazate (Dartal), thioridazine (Mellaril), trifluoperazine (Stelazine), triflupromazine (Vesprin), and trimeprazine (Temaril). All tend to cause sedation in varying degrees and most have a minor antihistaminic effect.

Phenothiazine derivatives generally have similar actions although there are so many specific actions they have yet to be spelled out (Friend, 1968). As Gordon (1967) noted, "...there are many thousands of papers on the clinical applications of the phenothiazines" (p. 150). Accordingly, in his review, he selected chlorpromazine, which has qualitative properties largely shared by most other tranquilizing phenothiazines, as a prototype for the family of phenothiazine agents. The most central effect of chlorpromazine is its impact in sedating motor behavior without inducing coma. Organisms receiving chlorpromazine are capable of being aroused and of responding to stimulation, except at extremely high doses where sleep or anesthesia may occur. Besides decreasing motor activity chlorpromazine dosage is related to loss of aggressiveness (Gordon, 1967).

The sites and mechanisms of chlorpromazine action have been objects of much research but definitive decisions are not yet available (Gordon, 1967; Friend, 1968). Among the tentative conclusions made by Gordon (1967) is that chlorpromazine influences the hypothalamus and the limbic system. The reticular formation appears to be depressed with average doses of chlorpromazine but is stimulated by large doses. Reticular stimulation via chlorpromazine may produce extra-

pyramidal symptoms resembling Parkinson tremors. According to Chin (1964) chlorpromazine can inhibit the "arousal" reaction as recorded in the electroencephalogram.

In addition to the above CNS effects Herman and Barnes (1964), using decerebrate cats, showed chlorpromazine to have direct action on the spinal cord. The tentative findings suggest a likely generalized, multiple site effect of chlorpromazine.

If the complexities of the disorders currently labeled schizophrenia are to be determined, then increasingly efforts will need to be directed toward better isolation of subject variables and toward more utilization of a normal control group. This study proposes to examine duration of disorder while controlling diagnosis, sex, age, race, effective drug level, and hospital-outpatient status. The response measure will be the GSR component of the OR. Literature relating to these variables will be reviewed below.

CHAPTER III

REVIEW OF THE LITERATURE

Early Studies Relating GSR and Psychopathology

Long before the OR was formally conceptualized, the hope of uniquely characterizing "emotional disturbance" in terms of the GSR led to considerable research. Landis (1932), in his review of such research, listed two studies as early as 1888 and indicated "some forty or fifty deal with use of one or another variety of the electrical changes of the skin, considered as diagnostic signs which may be of value for the psychiatrist or neurologist" (p. 264). The early efforts typically found differences between normals and psychiatric patients but the results were frequently inconsistent. A picture of the conflicting results can be seen in Table I constructed by Landis (1932) and reproduced below. Landis pointed to the conflicting results of the early studies as indicating an absence of relation between the GSR and emotional disorder. He concluded that GSR was such a general response it could not be relied upon as an indicator of any particular pathological state. Following the Landis review, little research was conducted on GSR in "emotional disturbance" until after World War II.

TABLE 1

Early Studies Relating Emotional Disturbance and GSR, Reproduced from Landis (1932), p. 265.

	Dementia praecox	Catatonia	Hysteria	Hysterical anaesthesia	Neurasthenia	Manic-depressive insanity	Amentia	Alcoholic insanity
Increased psychogalvanic activity	Gregor 1913 Gregor and Gorn 1913 McCowan 1926 Syz 1928			Prince and Peterson 1908	McCowan 1926			Ricksher and Jung 1907
Decreased psychogalvanic activity	Prideaux 1921 Westburg 1929 ödegaard 1930 Syz and Kinder 1931	Peterson 1907 Peterson and Jung 1907 Ricksher and Jung 1907 Wells and Forbes 1911 Gregor 1913 Gregor and Gorn 1913 Wiersma 1916 Syz 1928 Westburgh 1929 ödegaard 1930 Syz and Kinder 1931	Prideaux 1921 McCowan 1926	Litwer 1920	ödegaard 1930	Gregor 1913 Gregor and Gorn 1913 Abbot and Wells 1919 Prideaux 1921 Syz 1928 Westburgh 1929 Syz and Kinder 1931	Claparède 1911 Prideaux 1921	Brün 1923
Psychogalvanic activity same as normal	Peterson 1907 Peterson and Jung 1907 Ricksher and Jung 1907		Wiersma 1916 Albrecht 1917 ödegaard 1930	Veraguth 1909 Myasischchev 1929	Golla 1921		Gregor 1913 Gregor and Gorn 1913	

	Dementia praecox	Catatonia	Hysteria	Hysterical anaesthesia	Neurasthenia	Manic-depressive insanity	Amentia	Alcoholic insanity
Increased variability of psychogalvanic activity	Brün 1923		Sticker 1897	Goebel 1918	Grünbaum 1920	ödegaard 1930	Sticker 1897	
Increased electrical resistance of body		Richter 1926 Syz 1926 Richter 1928 Syz 1928 Syz and Kinder 1928 Westburgh 1929 Syz and Kinder 1931		Vigouroux 1888		Syz 1926 Syz 1928 Syz and Kinder 1928 Syz and Kinder 1931		
Decreased electrical resistance of body	Syz 1926 Syz 1928 Richter 1928 Syz and Kinder 1928 Westburgh 1929 Syz and Kinder 1931		Féré 1888 Féré 1892	Féré 1888	Müller 1904			Müller 1904
Resistance of body same as normal			Richter 1928			Richter 1928		

Hoch, Kubis, and Rouke (1944) reviewed investigations of GSR in abnormal mental states and concluded there was "no apparent uniformity of opinion concerning the basic phenomena associated with the response ..." (p. 237). However, they did not accept Landis' conclusion, but rather stressed the necessity of resolving the obtained experimental differences:

> Conceding the fact of the insecurity of differential diagnosis in psychiatry, it is difficult to appreciate how completely contradictory results are obtained by different investigators working on the same problem. Differences in methodology, measurement, recording, as well as the stimuli applied may help to explain the various opposing and contradictory views. But these are disturbing facts despite attempted explanations, and as such should engender a spirit of caution among investigators as well as impelling further research towards the clarification of the difficulties (p. 238).

One impetus that seemed to revive interest was the review of McCurdy (1950) which surveyed the early literature relating GSR and emotionality. When studies reported sufficient information, McCurdy applied statistical techniques to previously unanalyzed studies, many included the Landis table. Based on his survey and evaluation, McCurdy concluded the relationship between the GSR and rated emotionality was unusually high and should be more fully evaluated.

Studies of GSR and Schizophrenia

Since 1953, a number of studies have been carried out

which, although not conceptualized as OR studies, measured GSR activity in schizophrenics. Some studies were directed toward assessment of the GSR in relation to stressful stimuli. Others attempted to measure treatment effects with the GSR. Assessment of these studies focuses on whether the schizophrenic population was in an acute, active phase or in a chronic, stable phase, on comparison of GSR in schizophrenics with normals, and on the direction of GSR change associated with improvement. Attempts to interpret these studies in an OR framework must consider the effect of threat and stress as stimuli in many of the studies.

Williams (1953) observed GSR in 18 normals and 18 "early chronic schizophrenics." The schizophrenics were aged 20 to 35 years and had been hospitalized 1 to 3 years with little or no improvement after treatment, as judged by three qualified psychiatrists or psychologists. The schizophrenic group was subdivided into equal groups diagnosed as paranoid, hebephrenic, and catatonic. Normal and schizophrenic subjects were matched for age and sex. Non-specific GSR was significantly higher in schizophrenics than in normals. GSRs, recorded under a series of three stress conditions, did "not appear to distinguish differences in activity between groups during stress" (p. 460).

Bassett and Ashby (1954) compared normals and schizophrenics and found that GSR amplitude "tends to go up in those who are about to recover" (p. 642). The authors used a normal group (N = 7; 5 women, 2 men; ages 19-50), an electroconvulsive therapy (ECT) inpatient group (N = 16; 10 women, 6 men; ages 17-62), and a non-ECT inpatient group (N = 16; 13 women, 3 men; ages 17-60). Neither duration of hospitalization nor length of illness was specified. ECT was not introduced until one week after initial testing. Five test periods were run at approximately one week intervals. Stimuli were four "fairly strong" peripheral stimulations (pinch to ear lobe, smell of 2% ammonia, flash of light 15 inches from eyes, touch of cotton on conjuctiva). Habituation of the GSR over successive sessions was marked in all groups. The effect of ECT on GSR was concluded to be small. More important was the finding that patients about to "recover" showed an increase in GSR whether the recovery followed ECT or was spontaneous, suggesting that greater GSR was associated with good prognosis.

Stern and Sila (1959) measured the GSR of two groups of patients (diagnosis unspecified). One group (N = 14; $\bar{X}$ age = 39) was subjected to an average of 15 ECT treatments and received from 150-600 mg. of Thorazine daily. The

patient "control" group (N = 7; $\bar{X}$ age = 35) received no ECT but were administered therapeutic doses of Thorazine ranging from 400-1600 mg., daily. The controls were "matched to the ECT group on such variables as sex, education, and pharmacotherapy" (p. 101). Separate test sessions were conducted during which a word association test was administered. The first was before ECT, the second after 6 ECT sessions, the third after completion of all 15 ECT sessions, and the fourth 30 days after the final ECT. Significant GSR increases were found for the ECT group between the first and third testing and between the second and third testing. No significant changes occurred between the third and fourth sessions. With the non-shocked group no significant differences were observed. The authors concluded that the therapeutic outcome of ECT is an increase in GSR.

Crooks and McNulty (1966) measured changes in skin resistance (as well as heart rate and muscle tension) under three stress conditions (letter association, verbal threat, shock-threat of shock) using both normals and schizophrenics. The normal group (N = 30; male) and the schizophrenic group (N = 30; male) were of the "same age range" (p. 281). Hospital records indicated the schizophrenics were all "early" rather than "chronic" schizophrenics (minimum hospitalization

1.5 years). Medication was withdrawn 3 days prior to testing. As in Williams (1953) the basal resting levels of most response indices were much higher for schizophrenics than normals; high basal level of skin resistance in the schizophrenic group denoting a lower level of "arousal." Schizophrenics also showed a significantly greater change in skin resistance to stress than the normal control group. The largest increment of change (a decrease in resistance) occurred under the shock-threat of shock condition. Interpreting their findings the authors suggested that basically normal situations acquire abnormal arousal value in schizophrenics, thereby generating a "high over-all level of somatic activity" (p. 293).

Notwithstanding some evidence relating psychiatric status and autonomic reactivity, these studies highlight problems of research in schizophrenia. A primary issue concerns the distinctive effects of stimulus characteristics, particularly between simple stimulus change and more complex stimulus dimensions involving threat, or demand. Another issue concerns complexities involving patient's age and duration of illness. Interpretation of these results is fraught with uncertainty.

Russian Research Results Relating Orienting to Schizophrenia

Toward the end of the 1950's American psychologists took note of work in the Soviet Union on psychopathology and the OR. Reports of Russian findings currently are to be found in books by Voronin, Leontiev, Luria, Sokolov, and Vinogradova (1958), Sokolov (1963a; 1963b), and Lynn (1966). The presentation of Russian findings which follows is based upon the above sources. Details of the actual experiments are at a minimum in the available reports, as are statistical evaluations of the results. From the reports available, these studies would appear to contain weaknesses similar to the pre-1930 American studies. Nevertheless, they are of value since they have focused specifically on the OR in relation to psychiatric diagnosis. In addition, Russian studies have attempted to relate psychiatrically linked differences in orienting to the Pavlovian inhibition theory of abnormal behavior. In this respect, Russian work differs from American investigations, which are largely empirical.

Vinogradova (Lynn, 1966) indicated that three kinds of orienting response abnormality have been reported in Russian findings: 1.) Unusually strong reactions resistant to habituation "found in early, acute schizophrenics as well as infectious psychosis, neuroses, and cerebral cortex damage" (p. 91).

2.) Weakness or absence of orienting "found in a large proportion of schizophrenics" (unspecified) and in some mental defectives (p. 92). 3.) Impairment of the relationship between the orientation and defensive reaction found in "infectious psychosis" and in schizophrenics with paranoid delusions (p. 92).

Gamburg (1958) recorded autonomic and motor orienting to sounds and to electrical shocks in schizophrenics. Simple schizophrenics tended to give no response at all. Paranoiacs tended to give over reactions of a defensive nature. Eighty percent of the catatonics gave an initial OR but subsequent stimulus presentations elicited no reaction at all. When autonomic reactions occurred in the schizophrenics they were of longer duration than in the normals.

Traugett, Balonov, Kauffman, and Luchko (Lynn, 1963) found that in chronic, deteriorated schizophrenics the OR often did not occur. When a response was present the autonomic reactions tended to be weaker than the motor reactions. In "hallucinated-paranoid" patients the size of the orientation reaction (and its habituation) was highly variable, sometimes being stronger and sometimes weaker than in normal subjects. Some showed a defensive reaction and others showed a poor orientation reaction. During the initial stages of a program

of insulin therapy, patients became overactive and gave defensive reactions to the stimuli. Later, with remission, the stimuli elicited generally normal orientation reactions.

Titaeva (Lynn, 1963) found that those catatonic schizophrenics demonstrating slow orienting habituation were more often in an acute phase of disturbance, while catatonics who tended to habituate rapidly were more chronically ill.

Kostandov (Lynn, 1963) examined orienting of schizophrenics to auditory and visual stimuli. Upon achieving habituation of the OR to neutral stimulus words, he found the OR could be revived by presentation of critical conflict words. Most of his patients lacked the electrical-cortical component of the OR when conflict words were presented. In other instances, a decrease in size of the motor conditioned response was noticed following the presentation of a critical word.

Lynn (1963) commented that, "The Russian evidence as a whole indicates that there are two types of schizophrenics: a majority group characterized by low sympathetic tone and reactivity; and a minority group in which sympathetic tone and reactivity are unusually high" (p. 495). Soviet researchers, however, do not appear to have evaluated adequately reactivity changes as a function of schizophrenic duration and of age; for example, Streltsova (Lynn, 1963) included

patients ranging from 14-55 years in age and from 2 months to 25 years in length of illness. The Russian theory of "two types" of schizophrenia is compatible with, and perhaps better explained by, a formulation in which early, acute schizophrenics are initially highly responsive, with reactivity falling to low levels in the chronic state.

American Research Results Relating Orienting to Schizophrenia

A final group of studies, conducted in the United States, is characterized by being in the orienting framework and by having experimental design, execution, statistical analysis, and report commensurate with conventional standards.

Stern, Surphlis, and Koff (1965) examined the GSR in 63 acutely ill schizophrenics 1-3 days after admission and retested 44 after 5 weeks of hospitalization and phenothiazine treatment. After 5 weeks of hospitalization, a subgroup, subsequently discharged within 2 weeks of the second session, gave fewer tone and word association OR's than previously. This "good prognosis" group demonstrated a reduced level of responsiveness and more habituation during second testing, when compared to both their first testing and to both testings of the "poor prognosis" group. This finding is congruent with a formulation that acutely ill subjects respond at elevated electrodermal levels which fall toward lower, more

optimal levels with progress toward remission.

The authors also looked at the role of stimulus meaningfulness and orienting. Simple tone stimuli and more complex word stimuli (neutral and emotional) in a demand situation (word association test) were compared. While neither tones nor words differentiated between groups initially, the second test permitted prognostic discrimination based on responses to either.

In addition, the possibility of relating responsiveness to diagnosis was pursued. Because of inadequate numbers of patients in certain categories, several were combined for statistical analysis. The "catatonic-chronic" group was found least responsive, the "affective-acute-other" group was the most responsive, and the "paranoid" group differed significantly from the "catatonic-chronic" group but not from the "affective-acute-other" group. The variables of age, race, sex, and intelligence were not found to be of differential value with schizophrenic subjects.

The Stern, Surphlis, and Koff study was creative in the way that it combined the multiple observations of recent onset schizophrenics, used orienting stimuli of varied complexity, and required a degree of active experimental participation. The study, however, failed to include a normal control

group to permit determination of whether recent onset schizophrenics were more or less active in orienting than normals. Further, only 44 of the original 63 patients were available for retesting making retest differences suspect.

Bernstein (1964) compared normals (N = 48) with chronic, remitted schizophrenics (N = 60). Schizophrenic groups were subdivided so that half were receiving a phenothiazine drug and half were drug free for 30 days. Two intensities of lights (5 and 25 ft. candles) were presented 10 times in series (1 sec. duration; interval range 15-60 sec.). Regressed schizophrenics showed significant reduction in both OR frequency and amplitude in relation to both the remitted and the controls. All chronic schizophrenics were found to habituate more rapidly than control subjects. This was true initially and held up in the retesting two months later, as did all other findings. Within the schizophrenic population, the regressed gave a lower frequency of response than the remitted at the low intensity. At the more intense condition, the difference was not significant. Drug effects were not found to be significant.

Of particular interest was the Bernstein finding that longer hospitalization was associated with more rapid habituation. While there is temptation to speculate that hospital-

ization contributes to reduced GSR orienting, one should recognize the likely high correlation between duration of schizophrenia and length of hospitalization. That is to say, long term schizophrenics may be less responsive because schizophrenia tends to follow a course leading to reduced orienting regardless of extent of hospitalization. Bernstein's findings, nevertheless, clearly suggest chronic, hospitalized schizophrenics are less responsive than normals and that within the chronic category, the more intact schizophrenic can be differentiated from the deteriorated on the basis of more orienting activity.

Statement of the Primary Problem

The task of finding a unified explanation for the discrepant OR results in schizophrenic samples is difficult. Attempts to synthesize results require consideration of duration of schizophrenia, frequency and duration of hospitalization, diagnosis, and age. Although orienting in short- and long-duration schizophrenics has not been evaluated simultaneously, it appears that early schizophrenics are quite reactive in their OR and become less so with improvement, indicated by hospital release. Extended hospitalization in the early, acute phase is associated with unchanged responding. Chronic, long hospitalized schizophrenics, in contrast, show less OR

than normals. Chronic schizophrenic patients, regressed and hospitalized longer, are less reactive than remitted patients, whose hospitalization is less extended. Deteriorated schizophrenics often give no OR at all.

General Formulation. Extrapolating a general formulation from the available findings, it appears that with the onset of acute schizophrenia OR increases to an elevated level, falls toward more optimal and normal levels with progress toward recovery, and with chronicity falls below normal levels, continuing to fall in deteriorating patients, frequently to the point of no detectable OR. In remitted chronic patients, the OR is less deviant from normal levels. This formulation recapitulates results of the studies reviewed above and little, if any, evidence stands in contradiction to it. Course of schizophrenia appears to be reflected in OR, a likelihood that has broad implications with regard to both diagnosis and treatment. For example, depressant drugs may be appropriate during the onset stage, but possibly should be replaced by stimulants as the chronic stage develops, as Russian research suggests (Lynn, 1963).

Related Issues. The central problem of this study is to examine parameters of electrodermal activity in normals and then contrast these with the responses of two undifferentiated

schizophrenic groups differing in duration since onset, matching each other in drug level, and matching closely the normals in age.

If an experiment could be conducted in which all extraneous variables were controlled and the variable of duration of schizophrenia independently examined, the expectancy would be that the shorter duration schizophrenics would show elevated electrodermal activity, the normals would be intermediate, and the longer duration schizophrenics would show reduced electrodermal activity. Experimental opportunities and realities, however, impose certain restrictions and problems. For example, before short-duration schizophrenic subjects can be examined the diagnosis of "schizophrenia" must be made, an event which may lag considerably behind actual onset. After the diagnosis some patients are hospitalized and others treated as outpatients; it is logical to expect both that hospitalized patients are disturbed more acutely than those not hospitalized and that they are receiving a different course of treatment than those not hospitalized. While some schizophrenics are released following a hospitalization, others may fail to benefit from treatment and remain hospitalized thereby complicating sampling problems. Further, persons in the onset stage are more likely to be hospitalized than

those in a chronic state who have had the disorder longer and are probably somewhat more stable. In addition, chronic schizophrenics are likely older than recent onset schizophrenics. Finally, there is the uncertainty related to schizophrenia and subtypes of schizophrenia. For example, perhaps insidious onset schizophrenics progress toward a chronic undifferential state without any truly acute episode, or perhaps only paranoid schizophrenics experience acute activation during onset, or perhaps all onsets are characterized by heightened reactivity on the physiological level.

All these problems cannot be unravelled in a single study. Rather it is necessary to isolate certain, hopefully, key variables for examination and to control the remainder. Consequently, this study has chosen to examine only female schizophrenics with a diagnosis of "undifferentiated schizophrenia," with outpatient status, with histories of at least one episode sufficiently severe to require hospitalization, and without other known problems, such as alcoholism, neurological damage, etc.

If schizophrenia is a disorder with persistent behavioral effects following onset, then outpatients, even though less acute than when hospitalized, should reflect the disorder. On the other hand, if schizophrenia is one acute episode, or

a series of acute episodes, which subsides and leaves the individual essentially normal, then outpatients should not differ from normals. Similarly, a long-duration since onset in outpatients may be associated either with chronicity, or with control of the disorder, or with return to normalcy depending on whether the schizophrenic disorder is progressive, is active but controlled by treatment, or is subject to complete remission and recovery.

Experimental examination of these possibilities and their implications on the general formulation probably are masked further by treatment effects, including hospitalization, electroshock, psychotherapy, and chemotherapy. The latter particularly is important to, is not instrumental in, permitting outpatient status.

All the above issues potentially confound the direct relating of research results to the general formulation. Variable by variable they need to be systematically examined if the underlying disorder is to be described and understood.

Supplementary Problems

Order. One important research question is whether intra-organism changes occurred in the course of the experiment which systematically biased the results. A check for such a bias can be made if identical experimental stimuli are

counterbalanced for order of presentation. For example, half the experimental subjects receive the tones followed by words and the other half receive words followed by tones.

Medication. The welfare of the patient precludes withdrawing medication so as to examine directly the schizophrenic disorder. However, the effect of phenothiazine medication can be inferred by comparing for response differences at different drug levels. The predicted effect is that higher drug levels will be associated with lower levels of electrodermal reactivity.

Stimuli. The experiment offers an opportunity to examine multiple stimulus-response relationships. Comparisons can be made for simple tones and meaningful words, for high and low intensity stimuli, and for serial presentations of stimuli. The research relating ORs and stimuli is sufficiently developed to permit several predictions:

1. Orientation responses will be observed with the introduction of each new stimulus or the change in any characteristic of the stimulus such that:
    a. OR magnitudes will be greater for the first stimulus presentation of a given category (tones or words) than for subsequent presentations within the category.

b. More intense stimuli will be associated with greater OR.

c. Response to a new stimulus following a rest period will be greater than for a new stimulus of similar intensity within a series.

2. Habituation of the OR will occur with repeated stimulus presentations.

a. Successive responses to repeated stimuli will be progressively smaller.

b. Greatest OR decrease will occur following the initial presentation in a repeated series.

3. Disinhibition will occur with a change in any dimension of the repeated stimulus.

a. Response to the disinhibition stimulus will be larger than to the stimulus immediately preceding.

b. Response to the disinhibition stimulus will be smaller than to the stimulus introducing the series.

4. Representation of the repeated stimulus following the disinhibition stimulus will produce a response which is:

a. Larger than that observed to the stimulus preceding the disinhibition stimulus.

b. Smaller than that observed to the disinhibition stimulus.

CHAPTER IV

METHOD

Subjects

Subject samples consisted of 48 schizophrenic outpatients being seen for chemotherapy at the Texas Research Institute for the Mental Sciences and 24 normals selected at random. The schizophrenic group had two subgroups of 24 patients differing in duration of schizophrenia as determined from their initial hospitalization. All the schizophrenics had experienced an episode sufficiently severe as to require at least one major hospitalization of two or more months. The shorter duration group had a total of 33 verified, separate hospitalizations with a mean of 1.4 per subject, while the chronic group had 93 hospitalizations with a mean of 3.9 per subject. The spread of years from initial hospitalization to the present ranged from 1-5 years in the recent group and 6-27 years in the chronic group; the mean number of years elapsed from initial hospitalization was 2.6 and 11.8 respectively. Drug dosage for each schizophrenic was identified by means of a biochemical assay, and subjects were matched on assay results.

The ages of the normal subjects were matched to those of the total schizophrenic group. Matching was achieved by ranking each schizophrenic subgroup by age, determining a mean age for each successive pair of ages within both groups, and obtaining a normal subject close to the mean age of each pair. This procedure insured that ages in the normal group adequately represented both the recent schizophrenics, who tend to be younger, and the chronic schizophrenics, who tend to be older. Recent outpatient schizophrenics ranged in age from 20-58 years with a mean age of 32.7, chronics ranged from 23-63 with a mean age of 42.3, and the normals ranged from 16 to 65 with a mean age of 37.1. Subjects in the normal group were required never to have been hospitalized for a psychological disorder and not to be on phenothiazine medication. To eliminate confounding of the results by additional variables, all subjects were female, Caucasian, and diagnosed as acute or chronic undifferentiated schizophrenics.

Procedure and Stimulus Material

Subjects were seated in a sound and light attenuated room separated from the adjoining instrument room. The sensing devices were secured, the earphones positioned, the room darkened, and the door closed. While the equipment was calibrated, time was allowed for hydration. An initial 2 min.

basal resting level reading was taken and then followed by the recorded instructions:

> You are about to participate in a test related to the perception of tones and words. The test will last about 30 min. During that time please remain seated and try to avoid excessive movements. The test material will be presented through the earphones. Your responses will be picked up by the sensing devices you are wearing. At no time should there be any physical discomfort beyond that normally experienced while sitting quietly for 30 min. The test will begin immediately.

Following the instructions subjects received a 1 min. rest period (no specific stimuli) and then the first series of experimental stimuli. Each of the eight series was followed by a 1 min. rest period and the last rest period by a final 2 min. basal period. An identical timing sequence was used for the stimuli in each series. This sequence utilized variable intervals to prevent stimulus anticipation or temporal conditioning. The interval pattern is given below:

60 sec. resting level terminated by OS_1

15 sec. period terminated by OS_2

25 sec. period terminated by OS_3

20 sec. period terminated by OS_4

24 sec. period terminated by OS_5

21 sec. period terminated by TS_6

15 sec. period terminated by OS_7

60 sec. resting level

The experimental stimuli were series of paired tones and words. Each series consisted of an orienting stimulus (OS) presented five times, a test stimulus (TS) presented once and the OS repeated a final time. Stimuli were selected which represented low and high intensities and were presented so that under both tone and word conditions subjects received a low OS followed by a low TS, a low OS followed by a high TS, a high OS followed by a low TS, and a high OS followed by a high TS.

Eight pure tones were used. Each had a one second duration. They were presented in the following order and had the stated physical characteristics:

Pair 1:	OS	1300 cps.	64 db.
	TS	1500 cps.	64 db.
Pair 2:	OS	500 cps.	60 db.
	TS	300 cps.	76 db.
Pair 3:	OS	1800 cps.	77 db.
	TS	2000 cps.	62 db.
Pair 4:	OS	1000 cps.	80 db.
	TS	800 cps.	79 db.

The tone frequencies were selected so that paired stimuli could be readily discriminated but so that they were more similar to each other in frequency than to any other tone used. The intensities selected correspond to the 65 and 80 phon levels of perceived equal loudness as determined by

Robinson and Dadson and reported in Peterson and Gross (1963).

Eight words were used. As with the tones, half were of low intensity and half were of high intensity, with intensity being defined by the magnitude of GSR response evoked by each word. The words were selected from the lists of Smith (1922), Walker and Tarte (1963), and Laffal (1955) according to the following criteria:

1. The magnitude of GSR evoked by the word in previous studies; one-half of the words selected were from the lowest 5 percent of lists ranked according to magnitude of GSR (low intensity, neutral words) and the other one-half from the highest 5 percent (high intensity, emotional words).
2. Equal number of letters and syllables for both words in a series.
3. Relatively high frequency of occurrence in the English language according to Thorndike and Lorge (1944).
4. Similar evaluative meaning for each pair of words; that is, whether the word was considered generally pleasant, unpleasant, mixed, or indifferent (Lanier, 1941; Eriksen, Azuma and Hicks, 1959).
5. Same grammatical part of speech for each pair.

The words, their pairing, and their order of presentation were as follows:

Pair 1:	OS	flower
	TS	pencil
Pair 2:	OS	swim
	TS	kiss
Pair 3:	OS	love
	TS	give
Pair 4:	OS	spit
	TS	rape

In both the tone and word conditions the more intense stimuli were concentrated toward the end of the series. This was done in order to offset the anticipated effect of response habituation. In addition the conditions were counterbalanced (50 percent of the subjects received the tones followed by the words and the rest the words followed by the tones) to allow evaluation of a possible order effect.

Apparatus

All stimuli were tape recorded on a Wollensak 1580 stereophonic tape recorder. Reproductive characteristics of the Koss stereophonic earphones were determined by the method of equivalence at the earphone level. Tone intensities were recorded to give the stated earphone intensity at a single loudness setting of the recorder. In addition all stimuli were continuously monitored and maintained throughout the ex-

periment by a voltmeter in parallel with the recorder output.

Exosomatic basal skin resistance and skin conductance changes (GSR) were recorded with a constant voltage (0.4v) system in conjunction with an Offner Type R Dynograph. Basal resistance was measured in ohms and GSR in micromhos. Two Ag-AgCl electrodes were used. The active site was the palmar surface of the second phalanx of the right middle finger and the reference site was on the ventral surface of the right forearm. Both sites were initially cleansed with an acetone-ether solution. The 6 mm. diameter active site was demarcated by a piece of pre-punched masking tape. The active site, the reference site, and the electrodes were coated with a neutral, saline gel which was isotonic with sweat. The active electrode was held by masking tape, while the reference electrode (3 by 4 in.) was secured with an elastic bandage.

Data Reduction and Analysis

A GSR was considered to have occurred when a detectable deflection was observed to begin 1-4 sec. after stimulus onset. Each GSR was measured in millimeters from its onset to its peak, and the magnitude expressed as the square root of the conductance change. A 21 sec. rest period reading was made midway between successive stimulus series to indicate

spontaneous GSR activity. The 21 sec. period was identical to the total number of seconds evaluated within each series of stimuli, allowing direct comparison. A 60 sec. reading was made during the basal periods.

The experiment was designed so that from each factor there were an equal number of observations for each treatment. Accordingly, the experiment was a complete factorial design with equal replications. Analyses of variance were performed to test for experimental differences. These analyses, as well as the square root of the conductance change transformation, were performed by an IBM 7094 computer.

CHAPTER V

RESULTS

Resistance Levels

Basal skin resistance levels, recorded in K-ohm units during pre- and post-test rest periods, were evaluated in two analyses. In the first (Tables 2 and 3) short- and long-duration schizophrenics of high- and low-manifest drug levels were compared. Neither groups, drug levels, nor their interactions were significant. However, a significant decline in resistance was observed from the pre- to the post-test period.

The second evaluation compared both schizophrenic groups and normals (Tables 3 and 4). No statistically significant group differences or interactions were found. Once again a significant decrease in resistance level occurred from the pre- to the post-test period.

Initial Stimuli

Orienting theory predicts the likelihood of greater reactivity immediately following a change in stimulation. Terminating each rest period with a different auditory stimulus constituted one of the prime changes in experimental stimulation. To evaluate responses associated with these changes an

TABLE 2

Analysis of Variance: Pre- and Post-Test Basal Skin Resistance Levels for Short- and Long-Duration Schizophrenics with High- and Low-Drug Levels.

Source	df	MS	F
Between Subjects	47		
Groups (A)	1	14,950	
Drug (B)	1	196,566	2.46
A X B	1	4,593	
Error	44	79,827	
Within Subjects	48		
Period (C)	1	122,265	12.36**
A X C	1	3,775	
B X C	1	434	
A X B X C	1	9,126	
Error	44	9,892	
Total	95		

* p = .05

** p = .01

TABLE 3

Mean Pre- and Post-Test Basal Skin Resistance Levels in K-ohm Units for Short- and Long-Duration Schizophrenics Manifesting High- and Low-Drug Levels and Normals.

	Pre-Test	Post-Test	Combined
Short-Duration Schizophrenics			
Low-Drug	362	318	339
High-Drug	481	407	444
Combined	422	363	392
Long-Duration Schizophrenics			
Low-Drug	433	325	379
High-Drug	486	425	455
Combined	459	375	417
Schizophrenic Groups Combined			
Low-Drug	397	322	359
High-Drug	483	416	450
Combined	440	369	405
Normals	365	322	344
Schizophrenic and Normal Groups Combined	415	353	384

TABLE 4

Analysis of Variance: Pre- and Post-Test Basal Resistance Levels for Short- and Long-Duration Schizophrenics and Normals.

Source	df	MS	F
Between Subjects	71		
Groups (A)	2	67,092	
Error	69	72,940	
Within Subjects	72		
Periods (B)	1	138,570	18.22**
A X B	2	5,024	
Error	69	7,607	
Total	143		

* p = .05

** p = .01

analysis of variance was computed for response magnitudes (includes zero responses) elicited by the first stimulus of each new series (Tables 5 and 6). Additional evaluations were made by comparing mean differences with a "critical difference" according to Lindquist's (1956) technique. Values are reported in micromhos.

Order. To insure that reactivity was not systematically affected by whether tones or words were presented first the stimuli were presented in a counterbalanced order so that half the subjects in each group experienced tones first and half words first. The order of receiving tones followed by words, or words by tones, failed to produce significant OR differences or interactions (Tables 5 and 6). Groups which had received tones first did not differ from those receiving words first. Additional comparisons of mean differences showed no significant differences between tones presented first and tones presented second or between words presented first and words presented second. Since significant effects were not associated with "order" this distinction was dropped and the data pooled.

Groups. A central issue of the study focused on group comparisons. The statistical analysis revealed neither the normals, the long-duration schizophrenics, nor the short-

TABLE 5

Analysis of Variance: OR Magnitudes for Short- and Long-Duration Schizophrenics and Normals to the Initial Stimulus of Each Series Where Half of Each Group Initially Received Tones and Half Words.

Source	df	MS	F
Between Subjects	71		
Groups (A)	2	.384	
Order (B)	1	.001	
A X B	2	.172	
Error	66	.561	
Within Subjects	504		
Stimuli (C)	7	1.185	25.21**
A X C	14	.056	1.19
B X C	7	.037	
A X B X C	14	.024	
Error	462	.047	
Total	575		

* p = .05

** p = .01

TABLE 6

Mean OR Magnitudes in the Form of Square Root of Conductance Change for Short- and Long-Duration Schizophrenics and Normals to the Initial Stimulus of Each Series Where Half of Each Group Initially Received Tones and Half Words.

	Stimuli										
	1300	500	1800	1000	flower	swim	love	spit	Mean Tones	Mean Words	Mean Combined
Short-Duration Schizophrenics											
Tones First	.270	.077	.292	.197	.507	.095	.107	.065	.209	.194	.201
Words First	.323	.135	.298	.347	.507	.220	.173	.113	.275	.253	.264
Combined	.296	.106	.295	.272	.507	.158	.140	.089	.242	.224	.233
Long-Duration Schizophrenics											
Tones First	.423	.211	.501	.515	.504	.119	.156	.153	.412	.233	.323
Words First	.390	.185	.405	.340	.386	.221	.117	.117	.330	.211	.270
Combined	.407	.198	.453	.427	.445	.170	.137	.135	.371	.222	.297
Normals											
Tones First	.483	.190	.474	.366	.489	.193	.245	.193	.378	.280	.329
Words First	.347	.206	.388	.370	.437	.169	.284	.270	.328	.290	.309
Combined	.415	.198	.431	.368	.463	.181	.264	.232	.353	.285	.319
All Groups											
Tones First	.392	.159	.422	.359	.500	.136	.169	.137	.333	.235	.284
Words First	.353	.175	.364	.352	.443	.204	.191	.167	.311	.251	.281
Combined	.373	.167	.393	.356	.472	.170	.180	.152	.322	.243	.283

duration schizophrenics were significantly different from one another (Tables 5 and 6). There were no interaction effects.

Comparison of ORs of short- and long-duration schizophrenics also failed to produce a significant main effect, consistent with the analysis involving all three experimental groups (Tables 7 and 8).

Drug Levels. In order to assess possible relationships between OR and medication level each outpatient group was divided at its median into low- and high-drug subgroups. A urine specimen, taken just before or after the testing and evaluated by the Forrest, Forrest, and Mason (1961) rapid urine test for phenothiazines, provided the measure of effective drug level. When so divided subjects manifesting low-drug levels gave significantly greater ORs than high-drug subjects (Tables 7 and 8).

In addition to the significant main effect a significant interaction occurred between drug groups and stimuli. This interaction was accounted for by the greater differential responsiveness of the low-drug group (Table 9). The scores of the high-drug group were less variable than the low-drug group.

Stimuli. In designing the experiment an effort was made to obtain a broad range of stimuli representing different

TABLE 7

Analysis of Variance: OR Magnitudes for Short- and Long-Duration Schizophrenics With High- and Low-Drug Levels to the Initial Stimulus of Each Series.

Source	df	MS	F
Between Subjects	47		
Groups (A)	1	.389	1.01
Drug Levels (B)	1	2.938	7.61**
A X B	1	1.455	3.77
Error	44	.386	
Within Subjects	336		
Series (C)	7	.916	22.90**
A X C	7	.074	1.85
B X C	7	.096	2.40*
A X B X C	7	.064	1.60
Error	308	.040	
Total	383		

* p = .05

** p = .01

TABLE 8

Mean OR Magnitudes in the Form of Square Root of Conductance Change for Short- and Long-Duration Schizophrenics With High- and Low-Drug Levels to the Initial Stimulus of Each Series.

	Stimuli										
	1300	500	1800	1000	flower	swim	love	spit	Mean Tones	Mean Words	Mean Combined
Short-Duration Schizophrenics											
Low-Drug	.355	.115	.334	.276	.556	.195	.131	.108	.270	.248	.259
High-Drug	.238	.096	.257	.268	.458	.120	.149	.070	.215	.199	.207
Combined	.296	.106	.295	.272	.507	.158	.140	.089	.242	.224	.233
Long-Duration Schizophrenics											
Low-Drug	.589	.343	.728	.648	.613	.256	.196	.193	.577	.315	.446
High-Drug	.225	.053	.179	.206	.277	.085	.078	.077	.166	.129	.148
Combined	.407	.198	.453	.427	.445	.170	.137	.135	.371	.222	.297
Schizophrenic Groups Combined											
Low-Drug	.472	.229	.531	.462	.585	.226	.164	.151	.423	.282	.353
High-Drug	.232	.075	.218	.237	.368	.103	.114	.074	.192	.164	.178
Combined	.352	.152	.374	.350	.476	.164	.139	.112	.307	.223	.265

TABLE 9

Mean Differences Between ORs in the Form of Square Root of Conductance Change for Combined Schizophrenic Groups With Low- and High-Drug Levels to the Initial Stimulus of Each Series.

		Stimuli						
		500	1800	1000	flower	swim	love	spit
Low-Drug								
$\bar{X}$								
.472	1300	.243**	.059	.010	.113	.246**	.308**	.321**
.229	500		.302**	.233*	.356**	.003	.065	.078
.531	1800			.069	.054	.305**	.367**	.380**
.462	1000				.123	.236**	.298**	.311**
.585	flower					.359**	.421**	.434**
.226	swim						.062	.075
.164	love							.013
.151	(spit)							
High-Drug								
$\bar{X}$								
.232	1300	.157	.014	.005	.136	.129	.118	.158
.075	500		.143	.162	.293**	.028	.039	.001
.218	1800			.019	.150	.115	.104	.144
.237	1000				.131	.134	.123	.163
.368	flower					.265**	.254**	.294**
.103	swim						.011	.029
.114	love							.040
.074	(spit)							

Critical Difference:

* .05 = .181

** .01 = .241

categories (tone or word) and intensities (high or low). When all groups were combined a highly significant main effect was found between responses to the initial stimulus of series; certain stimuli evoked greater orienting than others (Tables 5 and 6). No significant interaction effects of groups with stimuli were found. Mean differences, determined for each of the eight responses across subjects, revealed significantly greater responding associated with the first occurrence of a tone or word and with the tones of high intensity (Table 10). For both tones and words there was a significant decrease from the first series to the second even though stimuli were equated for low intensity. The higher intensity tones significantly reinstated responding in the third series and maintained it with only slight loss in fourth. Although the third series of words was of higher intensity value only a slight, non-significant response increase was noted over the second. The lowest initial value in the eight series occurred to the fourth series of words which were of high intensity.

The evaluation of drug levels offered an opportunity to examine more closely stimulus related response differences for the schizophrenic groups. Again significant OR differences were found among the experimental stimuli as well as a

TABLE 10

Mean Differences Between ORs in the Form of Square Root of Conductance Change for Combined Groups to the Initial Stimulus of Each Series.

$\bar{X}$	Series	500	1800	1000	flower	swim	love	spit
.373	1300	.206*	.020	.017	.099	.203*	.193*	.221*
.167	500		.226*	.189*	.305**	.003	.013	.015
.393	1800			.037	.079	.223*	.213*	.241**
.356	1000				.116	.186*	.176*	.204*
.472	flower					.302**	.292**	.320**
.170	swim						.010	.018
.180	love							.028
.152	(spit)							

Critical Difference:

* .05 = .176

** .01 = .235

significant interaction of stimuli and drug levels (Tables 7 and 8). In Table 11 the combined schizophrenic group means and mean differences for ORs to the initial stimulus of each series are given. For low intensity stimuli the introduction of either category (tones or words) produced significantly greater responses than introduction of a new stimulus matched for category and intensity. High intensity tones produced ORs not statistically different from those of low intensity stimuli introducing a new category. In contrast ORs to words decreased progressively.

Repeated Stimuli

Although groups did not differ in ORs to the initial stimulus of series, differences could have developed with stimulus repetition within series. An analysis of variance was performed to evaluate responses to the first five presentations of the initial stimulus of each series (Tables 12 and 13).

Groups. An order effect was not observed for responses to initial stimuli. To rule out the possibility of an order effect with repeated stimuli, the effect of having presented tones or words first was evaluated for each main group. No significant group differences or interactions were found. Neither short-duration schizophrenics, long-duration schizo-

TABLE 11

Mean Differences Between ORs in the Form of Square Root of Conductance Change for Combined Schizophrenic Groups to the Initial Stimulus of Each Series.

$\bar{X}$	Series	500	1800	1000	flower	swim	love	spit
.352	1300	.200*	.022	.002	.124	.188*	.213*	.240*
.152	500		.222*	.198*	.324**	.012	.013	.040
.374	1800			.024	.102	.210*	.235*	.262**
.350	1000				.126	.186*	.211*	.238*
.476	flower					.312**	.337**	.364**
.164	swim						.025	.052
.139	love							.027
.112	(spit)							

Critical Difference:

* .05 = .181

** .01 = .241

TABLE 12

Analysis of Variance: OR Magnitudes to the First Five Stimulus Presentations in Each Series for Short- and Long-Duration Schizophrenics and Normals.

Source	df	MS	F
Between Subjects	71		
Groups (A)	5	.427	
Error	66	.916	
Within Subjects	2808		
Series (B)	7	1.277	19.95**
Stimulus Repetitions (C)	4	3.583	67.60**
A X B	35	.071	1.11
A X C	20	.029	
B X C	28	.135	7.11**
A X B X C	140	.018	
Error	2574		
Error B, A X B	462	.064	
Error C, A X C	264	.053	
Error B X C, A X B X C	1848	.019	
Total	2879		

* p = .05
** p = .01

TABLE 13

Mean OR Magnitudes to the First Seven Stimulus Presentations of Each Series for Combined Groups.

	1	2	3	4	5	6 (Test Stimulus)	7	Combined
Series								
1300	.373	.148	.136	.082	.082	.178	.102	.158
500	.167	.065	.045	.041	.038	.291	.061	.101
1800	.393	.170	.150	.127	.113	.060	.098	.159
1000	.356	.172	.157	.161	.155	.150	.221	.196
flower	.472	.224	.182	.135	.139	.159	.097	.201
swim	.170	.080	.084	.071	.058	.155	.066	.098
love	.180	.112	.061	.090	.093	.111	.074	.103
spit	.152	.084	.077	.098	.070	.234	.085	.114
Tones	.322	.139	.122	.103	.097	.170	.120	.153
Words	.244	.125	.101	.099	.090	.165	.081	.129
Combined	.283	.132	.112	.101	.093	.167	.101	.141

phrenics nor normals differed from each other in mean reactivity to repeated stimuli.

Series. Highly significant differences were found among the eight series. Table 14 shows the mean differences between series with both groups and stimuli collapsed. Within the category "tones" the introductory series of low intensity and the two series of high intensity did not differ from each other but did differ from the second series of low intensity. Within the "words" category only the introductory low intensity series, "flower," significantly differed from all others.

Stimuli. When the series stimulus was repeated significant OR decreases were found. Examination of Table 13 shows, with only five minor exceptions, that the decreases were consistent and progressive. When all series were combined and examined for changes related to repetition of stimuli, no inconsistencies occurred and clear-cut evidence was seen that each successive stimulus repetition evoked less response. Mean differences (Table 15) indicated the greatest decrease occurred between the first and second stimulus presentations.

A significant interaction was found between series and stimuli. The mean differences for the five repetitions under each series are presented in Tables 16-19. These tables show that different levels of response were associated with

TABLE 14

Mean Differences Between GSR Magnitudes in the Form of Square Root of Conductance Change for Combined Groups to the Combined First Five Stimulus Presentations of Each Series.

$\bar{X}$	Series Total	500	1800	1000	flower	swim	love	spit
.165	1300	.094*	.026	.035	.065	.072	.058	.069
.071	500		.120**	.129**	.159**	.022	.036	.025
.191	1800			.009	.039	.098*	.084*	.095*
.200	1000				.030	.107*	.093*	.104*
.230	flower					.137**	.123**	.134**
.093	swim						.014	.003
.107	love							.011
.096	(spit)							

Critical Difference:

* .05 = .083

** .01 = .109

TABLE 15

Mean Differences Between GSR Magnitudes in the Form of Square Root of Conductance Change for the First Five Stimuli with Groups and Series Collapsed.

$\bar{X}$	Stimulus Presentation	2	3	4	5
.283	1	.151*	.171**	.182**	.190**
.132	2		.020	.031	.039
.112	3			.011	.019
.101	4				.008
.093	(5)				

Critical Difference:

* .05 = .076

** .01 = .100

TABLE 16

Mean Differences Between GSR Magnitudes in the Form of Square Root of Conductance Change for the First Five Stimulus Presentations of Series "1300" and "500" with Groups Collapsed.

$\bar{X}$	1300	2	3	4	5
.373	1	.226**	.235**	.291**	.291**
.147	2		.009	.065	.065
.138	3			.056	.056
.082	4				.000
.082	(5)				

$\bar{X}$	500	2	3	4	5
.167	1	.102**	.117**	.126**	.129**
.065	2		.015	.024	.027
.050	3			.009	.012
.041	4				.003
.038	(5)				

Critical Difference:

* .05 = .076

** .01 = .100

TABLE 17

Mean Differences Between GSR Magnitudes in the Form of Square Root of Conductance Change for the First Five Stimuli of Series "1800" and "1000" with Groups Collapsed.

$\bar{X}$	1800	2	3	4	5
.393	1	.223**	.243**	.266**	.280**
.170	2		.020	.043	.057
.150	3			.023	.037
.127	4				.014
.113	(5)				

$\bar{X}$	1000	2	3	4	5
.356	1	.184**	.199**	.195**	.201**
.172	2		.015	.011	.017
.157	3			.004	.002
.161	4				.006
.155	(5)				

Critical Difference:

* .05 = .076

** .01 = .100

TABLE 18

Mean Differences Between GSR Magnitudes in the Form of Square Root of Conductance Change for the First Five Stimuli of Series "Flower" and "Swim" with Groups Collapsed.

$\bar{X}$	flower	2	3	4	5
.472	1	.248**	.290**	.337**	.333**
.224	2		.042	.089*	.085*
.182	3			.047	.043
.135	4				.004
.139	(5)				

$\bar{X}$	swim	2	3	4	5
.170	1	.090*	.086*	.099*	.112**
.080	2		.004	.009	.022
.084	3			.013	.026
.071	4				.013
.058	(5)				

Critical Difference:

* .05 = .076

** .01 = .100

TABLE 19

Mean Differences Between GSR Magnitudes in the Form of Square Root of Conductance Change for the First Five Stimuli of Series "Love" and "Spit" with Groups Collapsed.

$\bar{X}$	love	2	3	4	5
.180	1	.068	.119**	.090*	.087*
.112	2		.051	.022	.019
.061	3			.029	.032
.090	4				.003
.093	(5)				

$\bar{X}$	spit	2			
.152	1	.069	.075	.054	.082*
.083	2		.006	.015	.013
.077	3			.021	.007
.098	4				.028
.070	(5)				

Critical Difference:

* .05 = .076

** .01 = .100

different series. In particular the "500" series of tones and the "swim," "love," and "spit" series of words evoked less orienting than the other series.

Non-Specific GSR

Schizophrenic patients often have been described as having "poor reality contact," or as being more attuned to internal stimulation than other individuals. If so spontaneous GSRs during rest periods might be expected to differ from those of normals. Analyses were made of the sum of GSR amplitudes occurring during the central 21 second period of each 60 second resting period.

Order. Although the order of receiving tones followed by words or words by tones was not associated with OR differences, such differences could have occurred during the rest periods. The analysis of variance indicated, however, that neither order differences nor interactions were significant (Table 20).

Groups. Significant effects were not found either when all three groups were compared (Tables 20 and 22) or when only the two schizophrenic groups were compared (Tables 22 and 23). Significant interactions of groups and rest periods, however, were found in both analyses. Examination of the mean differences between groups and rest periods

TABLE 20

Analysis of Variance: Non-Specific GSR Amplitudes During Rest-Periods Following Stimuli Series for Short- and Long-Duration Schizophrenics and Normals.

Source	df	MS	F
Between Subjects	71		
Groups (A)	2	.104	
Orders (B)	1	.013	
A X B	2	.089	
Error	66	.175	
Within Subjects	504		
Rest Periods (C)	7	.127	3.26**
A X C	14	.068	1.74*
B X C	7	.020	
A X B X C	14	.046	1.18
Error	466	.039	
Total	575		

* p = .05

** p = .01

TABLE 21

Mean Non-Specific GSR Amplitudes in the Form of Square Root of Conductance Change During Rest-Periods for Short- and Long-Duration Schizophrenics and Normals.

	Last Stimulus of Preceding Series										
	1300 cps.	500 cps.	1800 cps.	1000 cps.	flower	swim	love	spit	Mean Tones	Mean Words	Mean Combined
Short-Duration Schizophrenics											
Tones First	.180	.066	.130	.086	.044	.079	.077	.037	.116	.059	.088
Words First	.183	.183	.239	.124	.058	.059	.095	.220	.182	.108	.145
Combined	.182	.125	.185	.105	.051	.069	.086	.129	.149	.084	.116
Long-Duration Schizophrenics											
Tones First	.102	.159	.096	.139	.154	.138	.200	.308	.124	.200	.162
Words First	.138	.166	.150	.103	.242	.130	.094	.230	.139	.174	.157
Combined	.120	.163	.123	.121	.198	.134	.147	.269	.132	.187	.159
Normals											
Tones First	.036	.057	.075	.129	.183	.104	.089	.406	.074	.196	.135
Words First	.134	.071	.072	.088	.075	.078	.165	.201	.091	.130	.111
Combined	.085	.064	.074	.109	.129	.091	.127	.304	.083	.163	.123
Schizophrenic and Normal Groups Combined											
Tones First	.106	.094	.100	.118	.127	.107	.122	.250	.105	.152	.128
Words First	.152	.140	.154	.105	.125	.089	.118	.217	.138	.137	.138
Combined	.129	.117	.127	.112	.126	.098	.120	.234	.121	.145	.133

TABLE 22

Analysis of Variance: Non-Specific GSR Amplitudes During Rest-Periods for Short- and Long-Duration Schizophrenics Manifesting High- and Low-Drug Levels.

Source	df	MS	F
Between Subjects	47		
Groups (A)	1	.178	
Drug Levels (B)	1	.951	5.23*
A X B	1	.232	1.28
Error	44	.182	
Within Subjects	336		
Rest Periods (C)	7	.046	1.35
A X C	7	.075	2.20*
B X C	7	.031	.91
A X B X C	7	.037	1.09
Error	308	.034	
Total	383		

* p = .05

** p = .01

TABLE 23

Mean Non-Specific GSR Amplitudes in the Form of Square Root of Conductance Change During Rest-Periods for Short- and Long-Duration Schizophrenics Manifesting High- and Low-Drug Levels.

	Last Stimulus of Preceding Series										
	1300 cps.	500 cps.	1800 cps.	1000 cps.	flower	swim	love	spit	Mean Tones	Mean Words	Mean Combined
Short-Duration Schizophrenics											
Low-Drug	.185	.103	.256	.146	.042	.071	.127	.201	.173	.110	.142
High-Drug	.178	.147	.113	.064	.060	.066	.045	.056	.126	.057	.092
Combined	.182	.125	.185	.105	.051	.069	.086	.129	.150	.082	.116
Long-Duration Schizophrenics											
Low-Drug	.175	.228	.135	.168	.308	.201	.274	.381	.177	.291	.234
High-Drug	.065	.098	.110	.075	.088	.067	.020	.157	.087	.083	.085
Combined	.120	.163	.123	.122	.198	.134	.147	.269	.132	.187	.160
Schizophrenic Groups Combined											
Low-Drug	.180	.166	.196	.157	.175	.136	.201	.291	.175	.201	.188
High-Drug	.122	.122	.112	.069	.074	.067	.032	.107	.107	.070	.089
Combined	.151	.144	.154	.133	.125	.102	.116	.199	.141	.135	.138

(Tables 24 and 25) indicated the long-duration schizophrenics and the normals responded more than the short-duration schizophrenics following the final word series containing the test stimulus word "rape." In addition the short-duration group appeared to respond somewhat less in periods following words than tones, again differing from the normal and long-duration groups.

Drug levels. As after stimulation periods so too during rest periods the low-drug group was found more active than the high-drug (Tables 22 and 23). High phenothiazine levels were associated with lower non-specific GSR activity.

Rest periods. Significant differences in non-specific GSR activity during the rest periods were found when the combined groups were compared (Tables 20 and 21). From Table 25 it was apparent that the final rest period differed from all others; as already mentioned the test stimulus in the series which preceded the final rest period was "rape."

When rest periods were compared using only the schizophrenic groups no significant differences were found (Tables 22 and 23).

TABLE 24

Mean Differences of Non-Specific GSR Amplitudes in the Form of Square Root of Conductance Change During Rest Periods for Short- and Long-Duration Schizophrenics.

		Last Stimulus of Preceding Series						
Short-Duration Schizophrenics		500	1800	1000	flower	swim	love	spit
$\bar{X}$								
.182	1300	.057	.003	.077	.131**	.113*	.096	.053
.125	500		.060	.020	.074	.056	.039	.004
.185	1800			.080	.134**	.116*	.099*	.056
.105	1000				.054	.036	.019	.024
.051	flower					.018	.035	.078
.069	swim						.017	.060
.086	love							.043
.129	(spit)							
Long-Duration Schizophrenics								
$\bar{X}$								
.120	1300	.043	.003	.001	.078	.014	.027	.149**
.163	500		.040	.042	.035	.029	.016	.106*
.123	1800			.002	.075	.011	.024	.146**
.121	1000				.077	.013	.026	.148**
.198	flower					.064	.051	.071
.134	swim						.013	.135**
.147	love							.122*
.269	(spit)							

Critical Difference:

* .05 = .099

** .01 = .131

TABLE 25

Mean Differences of Non-Specific GSR Amplitudes in the Form of Square Root of Conductance Change During Rest Periods for Normals and for Schizophrenics and Normals Combined.

		Last Stimulus of Preceding Series						
Normals		500	1800	1000	flower	swim	love	spit
$\bar{X}$								
.085	1300	.021	.011	.024	.044	.006	.042	.219**
.064	500		.010	.045	.065	.027	.063	.240**
.074	1800			.035	.055	.017	.053	.230**
.109	1000				.020	.018	.018	.195**
.129	flower					.038	.002	.175**
.091	swim						.036	.213**
.127	love							.177**
.304	(spit)							
Schizophrenic and Normal Groups Combined								
$\bar{X}$								
.129	1300	.012	.002	.017	.003	.031	.009	.105*
.117	500		.010	.005	.009	.019	.003	.117*
.127	1800			.015	.001	.029	.007	.107*
.112	1000				.014	.014	.008	.122*
.126	flower					.028	.006	.108*
.098	swim						.022	.136**
.120	love							.114*
.234	(spit)							

Critical Difference:

* .05 = .099

** .01 = .131

CHAPTER VI

DISCUSSION

The major finding of this study was that neither short-duration schizophrenic outpatients, long-duration schizophrenic outpatients, nor normals differed significantly in magnitude of GSR following stimuli of various types, intensities, and degrees of novelness. Assuming that ORs were elicited adequately, this would mean schizophrenic outpatients orient and habituate to novel stimuli in an essentially normal manner.

Adequacy of the Response Measure

The absence of significant group differences raises the question of whether ORs actually were observed in the response measure. Based on Sokolov's (1960) guidelines, the answer appears to be affirmative. First, GSRs were associated with both qualitative and quantitative changes in stimuli; maximum ORs were associated with the qualitative shift between tones and words, and quantitative changes in stimulus intensity were found to reinstate OR. Second, GSRs were found to habituate with successive stimulus repetitions. The classic nature of the data strongly suggests that orienting behavior

was observed through the GSR component and that the absence of group differences cannot be attributed to limitations of methodology, procedure, or measurement.

General Formulation

The general formulation developed in this study was that the electrodermal component of the OR increases to elevated levels with the onset of acute schizophrenia, decreases toward normal levels with remission, falls below normal levels with chronicity, and continues to fall to the point of no detectable OR with deteriorated patients. The largest group OR mean was produced by the normals, followed closely by the long-duration schizophrenics, and less closely by the short-duration schizophrenics. None of these differences, however, were significant. Short- and long-duration schizophrenics oriented to the experimental stimuli in a manner essentially normal. They were not disrupted more than normals by the introduction of novel stimuli, by changes in novel stimuli, or by changes in stimuli intensity.

As stimulus novelty became less with stimulus repetition all groups showed progressive habituation of the OR and again did not differ significantly from one another. The schizophrenic groups may be regarded not only as responding to novel situations in a manner similar to the normals but also

in inhibiting their responses to redundant stimuli in an essentially normal manner.

Experimental stimuli were the most constant, or least novel, during the stimulus-free rest periods. Spontaneous responses during rest periods did not differ among the experimental groups. Once more schizophrenic outpatients were found to perform similarly to the normals. However, a significant interaction occurred between the experimental groups and the rest periods which, when examined by each group and period, suggested residual aspects of schizophrenia in the shorter duration group. Whereas normals and longer duration schizophrenics tended to respond more after words, the shorter duration group tended to respond more after tones. In the period following the most emotional series of words the normals and the long-duration schizophrenics showed sharp, significant increases in non-specific responses, but short-duration schizophrenics showed only a slight, non-significant difference. Therefore, normal subjects showed increases in spontaneous reactivity following meaningful stimuli, especially emotional stimuli, which were absent in the short-duration group. Such a difference suggests the shorter duration schizophrenics managed meaningful and emotional stimuli in a manner different from normals. If one can jus-

tify an attempt to generalize from these molecular components of physiological behavior to overt, molar behavior, then it would be consistent to infer that the short-duration schizophrenics suppressed or avoided associations to meaningful stimuli while normals coped by becoming more active and by permitting sustained emotional expressions.

Beyond the significant group differences in non-specific reactivity there were no other significant differences among the experimental groups. Nevertheless, the similarity of normals and longer duration schizophrenics and the contrasting gap on multiple observations between these groups and the shorter duration schizophrenics not only add support to the significant non-specific response differences but also contribute to the suspicion that the short-duration group was somewhat more disturbed than the longer duration group. For this experiment, however, statistical analyses require us to conclude that short- and long-duration schizophrenic outpatients and normals did not differ in orientation to novel stimuli or in adaptation to redundant stimuli. The GSR disruptions of ORs typically reported for hospitalized patients are not typical of similar medicated outpatients.

Basal resistance levels provide an index of underlying, ongoing electrodermal activity. According either to somatic

theories, stressing diminished feedback from peripheral sense organs, or to negative drive theories, where inhibitory systems are believed dominant, one might expect to observe disruption in the basal resistance levels of schizophrenics. Significant differences, however, were found neither among normals, short-duration schizophrenics, and long-duration schizophrenics nor among high- and low-drug schizophrenic groups. One must conclude either that resistance levels are not related to the schizophrenic disorder or that treatment effects have brought baseline indices of electrodermal activity into the normal range.

Related Issues

The central problem of the study was to determine parameters of electrodermal activity in normals and then compare these with the responses of two schizophrenic groups differing in duration since onset. The weight of all major findings was that the three groups did not differ from one another. Multiple interpretations are possible and are discussed below. First, it is possible to conclude that the GSR measure is not influenced by schizophrenia. Evidence reviewed previously is sufficient for us to give this possibility a low probability.

A second direct interpretation is that the electrodermal responses of schizophrenics do not differ from normals. This

possibility, based on available literature, also appears unlikely.

A third possibility is diagnosis. Undifferentiated schizophrenics may not differ from normals in electrodermal activity, but other schizophrenic subgroups may. This possibility has some attraction since paranoid, catatonic, and hebephrenic diagnostic groups frequently demonstrate extreme overt behavioral disruptions. The undifferentiated group is more likely to have had an insidious, undramatic onset and, so, after hospitalization, may show less extreme behaviorial discrepancies when compared to normals. However, an insidious onset is associated with poor prognosis, or a course of deterioration, and the longer duration schizophrenic group paralleled the normals most closely. Diagnosis does not appear to fully handle the findings.

A fourth dimension is hospitalized vs. outpatient status. The point here centers on acuteness. The schizophrenic sample included only outpatients. It is possible, and likely, that when the experiment was conducted the more acute patients of the total population were hospitalized while the less acute were outpatients. Extended duration as an outpatient may be related to progressive recovery rather than to a course of progressive deterioration. Certainly the longer duration out-

patients paralleled the normals most closely. Such a conclusion also would fit in with Bernstein's (1964) findings of longer hospitalization being associated with more rapid habituation.

A fifth variable, phenothiazine medication, would appear critical to making possible sustained outpatient status. It seems likely that the medication modifies physiological functions sufficiently to permit outpatient status, and then, that life in the more stimulating real world interacts with medication effects to enhance adjustment.

The discovered effect of phenothiazine medication in this study, like that reported by Stern, Surphlis, and Koff (1965), was to reduce electrodermal activity. Since reduced electrodermal activity in schizophrenics also was associated with more normal electrodermal activity, we can assume that without phenothiazine medication both schizophrenic groups would manifest electrodermal elevations. This suggests that previously, during acute periods before the introduction of drugs, these patients manifested elevated levels of electrodermal activity. Such an interpretation converges with the Stern, Surphlis, and Koff (1965) finding that electrodermal decrease was found in patients who shortly thereafter were discharged from the hospital. Further, such an interpreta-

tion is congruent with the first part of the general formulation proposed in this study, that ORs increase to elevated levels with onset of acute schizophrenia and decrease toward normal levels with remission.

One of the important issues frequently speculated upon in treatment programs is whether phenothiazine medication merely dampens external behavior, thereby masking a still deviant process, or actually modifies the process. Study results suggest drug effects in conjunction with outpatient status modified the observed GSR parameters of physiological processes into the normal range. Frequent, significant, residual traces of schizophrenic functioning were not found. One cannot, however, rule out the possibility that with additional response measures, or that under more stressful and threatening conditions of stimulation, deviant functioning might not be elicited. The one significant group difference, less non-specific reactivity in short-duration schizophrenics than other groups following the most emotional stimuli, suggests that schizophrenics may still be limited in their capacity to deal with emotional and stressful situations.

The concept of progressive deterioration as the inexorable "course of schizophrenia" is undermined by the absence of group differences. This concept can be traced to Kraepelin

(1919) who described schizophrenia as being a lifelong disease which, once contracted, advanced through progressive stages of deterioration. While the onset of schizophrenia might be either volatile or insidious the outcome was seen as regressive. The assumption of schizophrenia irreversibility remains strong in current theories which typically discuss "remissions" but not "recoveries." Assuming schizophrenia followed a progressive course, by looking at behavior of schizophrenics in similar periods since onset one should be viewing essentially comparable stages of schizophrenia. Certainly no evidence of progressive deterioration was found in either schizophrenic group. If anything the longer duration group was more like the normals than was the shorter duration group, disconfirming any assumption of progressive deterioration being associated routinely with schizophrenia. As a result of modern treatment techniques a new, more optimistic course of schizophrenia is emerging.

Therefore, based on the experimental data, we can conclude that schizophrenic outpatients receiving phenothiazine medication did not differ from normals in magnitude of electrodermal orientation and adaption to novel conditions of moderate intensity or in their general background level of electrodermal activity. The GSR disruptions of ORs typically reported

for hospitalized patients are not typical of similar medicated outpatients. The absence of group differences between schizophrenic outpatients and normals accentuates the value of current community mental health programs which combine drug therapy with outpatient status in the more socially stimulating environment of the real world. They also add support to Bernstein's (1964) contention that hospitalization may contribute to reduced orienting and the development of chronicity. That is to say "course of schizophrenia" may be related to hospitalization as a method of treatment rather than to inherent characteristics of the schizophrenic disorder. It appears promising that with adequate drug therapy patients can reestablish normal functioning and may avoid the passive, vegetative aspects previously associated with chronic schizophrenia.

Supplementary Issues

Order. When designing the experiment it was anticipated that subjects might perform differently at the end of the experiment than at the beginning. Being wired into the apparatus was suspected of provoking increased anxiety and arousal. Then being alone in a dimly lighted, quiet room was suspected as being conducive to relaxation. Finally, not having to give overt responses seemed likely to contribute to reduced

arousal. The order variable, introduced to permit counter-balancing of likely experimental artifacts, however, was not significant. Subjects appeared similarly responsive at the end of the experiment as at the beginning.

Basal Resistance Levels. There is possible evidence that the subjects were aroused slightly more at the end of the experiment than at the beginning. A relatively small, but highly significant, drop in basal resistance was recorded for all groups from the beginning to the end of the experiment. Although subjects were in the electronic circuitry only about 45 minutes, this finding may have been an artifact of the measurement techniques and associated with electrode polarization. If, however, this finding were interpreted it would be seen as being associated with increased arousal at the end of the experiment. It is possible that the varied stimuli and their compact presentation produced a slight arousal increase. At any rate the less desirable finding, increased basal resistance which would be interpreted as increased drowsiness, did not occur. The experimental stimuli appeared adequate to maintain, and possibly increase, arousal levels in passive-participant subjects.

Stimuli. A number of specific predictions were made with regard to expected responses to the orienting stimuli

based on the theory and findings of Sokolov (1960; 1963b) and Zimny and Schwabe (1965). The predicted effects generally were found with only minor exceptions. The results relating to stimuli effects are detailed below:

1. Orientation. Orientation responses were consistently observed with the introduction of a new stimulus. The magnitude of the OR to the initial word was greater than to any other; the magnitude of the OR to the first tone, which was of low intensity, was superceded only by the OR to the initial high intensity tone.

   Intensity effects present in the data tended to be confounded with orienting. Intensity effects were seen most clearly in responses to the test stimulus (sixth stimulus in every series) which was less confounded by the large reaction to the first stimulus in a new category. As predicted the average of the two lower intensity stimuli was less than the average for the higher intensity stimuli in the case of both tones and words. Examination of individual series showed excellent consistency for this finding with tones, where the stimulus changes were most carefully controlled.

With words there were somewhat more discrepancies suggesting the levels of word intensity were not as precisely matched as for tones.

Comparing average responses to high- and low-intensity tone stimuli the prediction was confirmed of greater responsiveness to stimuli introduced following a rest period than to those of similar intensity introduced within a series. A similar finding would have occurred with words except for the disproportionately large response evoked by the test stimulus "rape."

2. Habituation. Habituation of the OR was observed with excellent consistency. Examining the series of combined tones and combined words, responsiveness can be seen to decrease progressively with each of the five stimulus repetitions. Similar results were observed when stimuli were combined according to high- and low-intensity.

The greatest response decrement among the repeated stimuli occurred between the initial presentation and the second presentation, as predicted. The OR can be seen to be highly

sensitive not only to changes in stimulation but also to "identicalness" of stimuli.

3. Disinhibition. Examining the data combined for series of tones and words, disinhibition was found to occur with changes in tone intensity and with presentation of a new word. Responses to the disinhibition stimuli were greater than those to the immediately preceding stimuli, as predicted. Responses to the disinhibition stimuli were less than those to the initial stimuli, again as predicted. Comparisons within series are confounded by the mixing of different stimulus intensities. Combining stimuli of low and of high intensity and then comparing, confirms the specific predictions.
4. Final Stimulus of Series. The prediction was that the final presentation of a repeated stimulus, following the disinhibition stimulus, would produce a response greater than that to the same stimulus preceding the disinhibition stimulus and less than that to the disinhibition stimulus. When observing specific series several cases were noted where the final stimulus presen-

tation was less than the presentation preceding the disinhibition stimulus. However, using combined data the prediction was supported for tones and words and for both conditions combined.

Methodological Considerations

One of the important methodological points of the study was the use of biochemical assays of drug level at the time of testing, as the basis for subject matching, rather than prescribed dosage. Use of prescribed dosage as an indicator of drug effects is inaccurate to the extent patients do not take drugs, differ in absorption rates, vary in amount of drug adaptation, and consume drugs at different schedules and times of day. These inaccuracies are further confounded when working with outpatients who frequently bear responsibility for drug ingestion. More precise relationships between behavior and drug effects can be determined by matching groups on the basis of biochemically determined assay levels, a procedure highly recommended for subsequent investigations.

A second methodological problem was created by the wide-scale application of drugs. Already research populations of schizophrenics not receiving drug treatment are difficult to find. Removal of drugs several days before the experiment need not mean subjects are "drug free." Using only medicated

subjects prevents normal comparisons. This experiment offers one encouraging approach to managing this problem by directly comparing the behavior of schizophrenic groups receiving drugs with matched normals who do not receive drugs. The behavior of schizophrenic groups then can be compared to a normal referent as well as to each other. It is possible we have reached a point in the history of dealing with schizophrenia where manifest behavior mediated by drug medication is more relevant than theoretical behavior assuming no medication. Direct comparison of medicated schizophrenics with non-medicated normals presents an attractive alternative to an otherwise increasingly difficult problem.

The classic patterns of orienting manifested in the data can be attributed directly to the care and attention that went into the selection and control of the stimuli. Stimuli were limited to those of a moderate intensity in order to remain within the range associated with orienting. Tone stimuli were matched on perceived levels of equal loudness at different frequency levels while words were matched on levels of previously elicited GSR. Stimuli were carefully preprogrammed so as to insure each subject heard the identical tone and the identical word. Concerns about drousiness developing in the passive-participant subjects being presented moderate

intensity stimuli did not materialize. Indeed, the levels of experimental stimulation appeared sufficient to sustain, perhaps slightly increase, arousal in the course of the experiment. In OR experimentation it is critical that extensive methodological control be directed both toward the elimination of sources of extraneous stimulation and toward the careful selection and presentation of the experimental stimuli.

Future Research

Drug Effects. One problem needing fuller investigation is drug effects. Despite widescale usage of phenothiazines definitive research is not available regarding their biochemical action and the physiological sites they influence. If the sites of primary drug action can be determined, the theoretical issue of whether disturbed systems of arousal or of inhibition are critical to schizophrenia can perhaps be laid to rest.

Determining the effects of phenothiazines may be a long and tedious process. Although similar in chemical structure and in many of their effects, as Gordon (1964) pointed out, specific types of phenothiazines also seem to have nonsimilar sites of action and different effects. In addition, dose level may be related to changes in behavioral effect at different levels. The continuous introduction of new pheno-

thiazine derivative drugs complicates efforts further. Nevertheless, the general and the specific effects of the multiple phenothiazine drugs need to be clarified. Research so directed may be most enlightening.

Duration and Schizophrenia. The present study looked at two intermediate points of the "duration of disorder" variable. Cases just experiencing schizophrenia onset were not observed. Neither were severe cases of chronicity seen. Exclusion of the very recent schizophrenic and of the very chronic was a choice forced by the decision to examine an outpatient group. Both the most recent and the most chronic schizophrenics tend to be hospitalized, and therefore, were not represented in the outpatient population. Replication of the present study with recently hospitalized and extensively hospitalized schizophrenics would be an attractive study extension. Should the general formulation hold up with groups of the most recent and the most chronic schizophrenics, its documentation would be impressive. Design of such an experiment might be improved by matching diagnostic subgroups for manner of onset along the "rapid-insidious" dimension.

Diagnosis and Schizophrenia. To the extent there is a behavioral basis for the subclassifications of schizophrenia

there is a need for considering the physiological parameters of these subclasses independently. The hebephrenic and paranoid likely orient differently and both likely differ from the catatonic. If the problems and conflicting results associated with GSR in schizophrenics are to be unravelled, then subject variables need to be increasingly limited until the relevant variables can be isolated and until their effects can be predicted. The relationship between OR and schizophrenia needs to be examined under a wider range of subject conditions including subjects hospitalized for various durations, subjects with different diagnoses, as well as normal subjects receiving and not receiving drugs.

Parameters of Normal Orienting. The findings of this study point toward the possibility of establishing a range of normal orienting behavior as a standard against which ORs of deviant populations could be compared. Marked alterations or shifts in orienting might then be usefully applied as a diagnostic and prognostic aid for both the acute and chronic phases of schizophrenia, as well as for assessment of remission. A further consideration may be for treatment since ORs of some schizophrenic patients suggest the use of stimulants rather than tranquillizers. Russian researchers have found that chronic patients frequently benefit from stimulants

which increase ORs rather than tranquillizers which depress ORs (Lynn, 1963).

Multiple Response Components. The current study has examined only the GSR component of the OR. Descriptive uses of the GSR component are limited to stating the direction of discrepancy since more precise scaled values are not available currently. Until greater precision is introduced this component is limited in its descriptive capacity to statements of "greater or lesser than." By using a multiple component approach the number of descriptive combinations can be increased, thereby increasing the possibilities of uniquely describing diagnostic categories via these measures. Since different drug levels and different medications likely effect different neurological centers a multiple component approach may be especially valuable.

CHAPTER VII

SUMMARY

An apparently critical, yet neglected, variable in the available research evaluating OR in schizophrenics has been duration of disorder. In reviewing older studies, conducted under hospitalized conditions and before the widescale usage of phenothiazine drugs, one appeared to find elevated GSR activity in patients with a more recent onset and depressed GSR activity in chronic patients. More recent studies have been complicated by medication advances. Current schizophrenic populations are receiving, almost without exception, phenothiazine medications, which act to reduce electrodermal activity. The effect of widescale phenothiazine medication has been to alter the schizophrenic research populations by producing large, new outpatient populations. Previous conclusions based on hospitalized populations need to be re-examined in light of treatment advances.

This research, in addressing itself to the variable of schizophrenic duration, somewhat surprisingly found that with outpatients receiving phenothiazine medication, disorder duration was not a descriptive variable. This finding in no

way should be taken to indicate the variable is unimportant. Rather, the general formulation proposed in this study, that ORs increase to elevated levels with the onset of acute schizophrenia, decrease toward normal levels with remission, fall below normal levels with chronicity, and continue to fall to the point of no OR in deteriorated patients, appears even more attractive as a result of the study. If anything the general formula predicted the results more accurately than expected: almost no disorder residual was found in the electrodermal responses of the schizophrenic outpatients. Further, the finding that phenothiazine treatment was associated with reduced electrodermal activity suggests previous functioning at higher levels, a finding consistent with the general formulation. Treatment effects appear to have prevented development of the chronic aspects of schizophrenia. Indeed the longer duration schizophrenics appeared more consistently like the normals than the shorter duration schizophrenics. Bernstein (1964), however, has clearly shown that in the chronic regressed and chronic deteriorated stages patients are significantly less responsive than normals, some failing to give ORs at all.

Little, if any, evidence stands in contradiction to the proposed general formulation. Collective evidence indicates

changes in the schizophrenic disorder appear to be reflected in OR. This study has shown that current treatment techniques, coupling psychopharmocological therapy with life as an outpatient, apparently bring electrodermal functioning into the normal range and that those with a longer duration since onset of schizophrenia and longer treatment periods approximate the normals most closely. The parameters of the OR may have exceptional diagnostic potential for advanced warning of impending gross behavioral disruptions. In addition, they offer promise for treatment by better monitoring status and by then addressing treatment toward stabilization within a normal range of functioning.

REFERENCES

Arieti, S. Interpretation of schizophrenia. New York: Brunner, 1955.

Abraham, K. Selected papers on psychoanalysis. New York: Basic Books, 1955.

Altshuler, K. Z. Genetic elements in schizophrenia. Eugenic Quarterly, 1957, 4, 92-98.

Bassett, M., & Ashby, W. R. The effect of electro-convulsive therapy on the psychogalvanic response. Journal of Mental Sciences, 1954, 100, 632-642.

Bateson, G., Jackson, D. D., Haley, J., & Weakland, Jr. Toward a theory of schizophrenia. Behavioral Science, 1956, 1, 251-164.

Becker, W. A. A genetic approach to the interpretation and evaluation of the process reactive distinction in schizophrenia. Journal of Abnormal and Social Psychology, 1956, 53, 229-236.

Bender, Loretta. Schizophrenia in childhood: its recognition, description, and treatment. American Journal of Orthopsychiatry, 1956, 26, 499-506.

Berlyne, D. E. Conflict, arousal, and curiosity. New York: McGraw-Hill, 1960.

Bernstein, A. S. The galvanic skin response orienting reflex among chronic schizophrenics. Psychonomic Science, 1964, 1(12), 391-392.

Binder, A. Schizophrenic intellectual impairment: uniform or differential? Journal of Abnormal and Social Psychology, 1956, 52, 11-18.

Chin, J. H., Bitter, G., & Killam. Comparison of chlorpromazine, trifluoperazine, and pentobarbital on conditional arousal to reticular stimulation in cats. Federation Proceedings, 1964, 23, 248.

Cohen, B. D. Motivation and performance in schizophrenia. Journal of Abnormal and Social Psychology, 1956, 52, 186-190.

Crooks, R. C., & Mcnulty, J. A. Autonomic response specificity in normal and schizophrenic subjects. Canadian Journal of Psychology, 1966, 20(3), 280-295.

Dykman, R. A., Reese, W. G., Galbrecht, C. R., & Thomasson, Peggy J. Psychophysiological reactions to novel stimuli: measurement, adaptation, and relationship of psychological and physiological variables in the normal human. Annual New York Academy of Science, 1959, 79, 45-107.

Eriksen, C. W., Azuma, H., & Hicks, R. B. Verbal discrimination of pleasant and unpleasant stimuli prior to specific identification. Journal of Abnormal and Social Psychology, 1959, 59, 114-119.

Fenichel, O. The psychoanalytic theory of neurosis. New York: Norton, 1945.

Forrest, F. M., Forrest, I. S., & Mason, A. S. Review of rapid urine tests for phenothiazine and related drugs. American Journal of Psychiatry, 1961, 118, 300-307.

Freeman, H. Physiological studies. In L. Bellak (Ed.), Schizophrenia: A Review of the Syndrome. New York: Logos, 1958.

Friend, D. G. Sedatives and tranquillizers in general medical practice. In W. Modell (Ed.), Drugs of choice 1968-1969. St. Louis: C. V. Mosby, 1968.

Gamburg, A. L. Orienting and defensive reactions in simple and paranoid forms of schizophrenia. In Voronin, L. G., Leontiev, A. N., Luria, A. R., Sokolov, E. N., & Vinogradova, O. S. Orienting reflex and exploratory behavior. Moscow, Academy of Pedagogical Sciences of RSFSR, 1958.

Garmezy, N. Stimulus differentiation by schizophrenic and normal subjects under conditions of reward and punishment. Journal of Personality, 1952, 20, 253-276.

Goldman, A. E. A comparative-developmental approach to schizophrenia. Psychological Bulletin, 1962, 59, 57-69.

Gordon, M. Psychopharmacological Agents. Academic Press: New York, 1964-1967. 2 vols.

Gregory, I. Genetic factors in schizophrenia. American Journal of Psychiatry, 1960, 116, 961-972.

Hall, K. R. L., & Crookes, T. G. Studies in learning impairment: I. Schizophrenic and organic patients. Journal of Mental Science, 1951, 97, 725-737.

Herman, E. H. & Barnes, C. D. Evidence for an action of chlorpromazine on the spinal cord. Federation Proceedings, 1964, 23, 456.

Hoch, R., Kubis, J. F., & Rouke, F. L. Psychogalvanometric investigations in psychoses and other abnormal mental states. Psychosomatic Medicine, 1944, 6, 237-243.

Hollingshead, A. B., & Redlich, F. C. Schizophrenia and social structure. American Journal of Psychiatry, 1954, 110, 695-701.

Huston, P. E., & Shakow, D. Studies of motor function in schizophrenia. III. Steadiness. Journal of Genetic Psychology, 1946, 34, 119-126.

Kallman, F. J. Heredity in health and mental disorders. New York: Norton, 1953.

Kanner, L., & Eisenberg, L. Notes on the follow-up studies of autistic children. In P. H. Hoch & J. Zubin (Eds.), Psychopathology of childhood. New York: Grune & Stratton, 1955.

Kety, S. S. Recent biochemical theories of schizophrenia. In D. D. Jackson (Ed.), The etiology of schizophrenia. New York: Basic Books, 1960.

Kintsch, W. Habituation of the GSR component of the orienting reflex during paired-associate learning before and after learning has taken place. Journal of Mathematical Psychology, 1965, 2(2), 330-341.

Kraepelin, E. Dementia praecox and paraphrenia. Chicago: Chicago Medical Book, 1919.

Laffal, J. Response faults in word association as a function of response entropy. Journal of Abnormal and Social Psychology, 1955, 50, 265-270.

Landis, C. Psychiatry and the psychogalvanic reflex. Psychiatric Quarterly, 1932, 6, 262-272.

Lang, P. J., & Buss, A. H. Psychological deficit in schizophrenia. II. Interference and activation. Journal of Abnormal Psychology. 1965, 70, 2, 77-106.

Lanier, L. H. An experimental study of "affective conflict." Journal of Psychology, 1941, 11, 199-217.

Lemkau, P. V., & Crocetti, G. M. Vital statistics of schizophrenia. In L. Bellak (Ed.), Schizophrenia: A Review of the Syndrome. New York: Logos, 1958.

Lidz, T., & Fleck, S. Schizophrenia, human integration, and the role of the family. In D. D. Jackson (Ed.), The Etiology of Schizophrenia. New York: Basic Books, 1960.

Lynn, R. Russian theory and research on schizophrenia. Psychological Bulletin, 1963, 60(5), 486-498.

Lynn, R. Attention, arousal and the orientation reaction. Oxford, England: Pergamon Press, 1966.

McCurdy, H. G. Consciousness and the galavanometer. Psychological Review, 1950, 57, 322-327.

Mednick, S. A learning theory approach to research in schizophrenia. Psychology Bulletin, 1958, 55, 316-327.

Pavlov, I. P. Conditioned reflexes. Oxford: Clarendon Press, 1927.

Pavlov, I. P. Conditioned reflexes and psychiatry. New York: International Publishers, 1941.

Peterson, A. P. G., & Gross, E. E. Handbook of noise measurement. General Radio Co.: West Concord, Massachusetts, 1963.

Piotrowski, Z. A. Experimental psychological diagnosis of mild forms of schizophrenia. Rorschach Research Exchange, 1945, 9, 189-200.

Rapaport, D., & Webb, W. B. An attempt to study intellectual deterioration by premorbid and psychotic testing. Journal of Clinical Psychology, 1950, 14, 95-98.

Roe, Anne, & Shakow, D. Intelligence in mental disorder. Annual New York Academy of Science, 1942, 42, 361-390.

Skinner, B. F. A new method for the experimental analyses of the behavior of psychotic patients. Journal of Nervous and Mental Disorders, 1954, 120, 403-404.

Smith, W. W. The measurement of emotion. New York: Harcourt, Brace, 1922.

Sokolov, Y. N. Neuronal models and the orienting reflex. In Mary A. B. Brazier (Ed.), The central nervous system and behavior. Madison, N. J.: Madison Printing, 1960.

Sokolov, Y. N. Higher nervous functions: the orienting reflex. Annual Review of Physiology, 1963a, 25, 545-580.

Sokolov, Y. N. Perception and the conditioned reflex. Oxford: Pergamon Press, 1963b.

Stephens, J. H., & Astrup, C. Prognosis in "process" and "non-process" schizophrenia. American Journal of Psychiatry, 1963, 119, 945-953.

Stern, J. A., & McDonald, D. G. Physiological correlates of mental disease. Annual Review of Psychology, 1965, 16, 225-264.

Stern, J. A., & Sila, B. Autonomic responsivity and electroconvulsive therapy. Journal of Neurological Psychiatry, 1959, 1, 100-103.

Stern, J. A., Surphlis, W., & Koff, E. Electrodermal responsiveness as related to psychiatric diagnosis and prognosis. Psychophysiology, 1965, 2(1), 51-61.

Sternbach, R. A. Principles of psychophysiology. New York: Academic Press, 1966.

Sullivan, H. S. The interpersonal theory of psychiatry. New York: Norton, 1953.

Taylor, J. A., & Spence, K. W. Conditioning level in the behavior disorders. Journal of Abnormal and Social Psychology, 1954, 49, 497-503.

Thorndike, E. L., & Lorge, I. The teachers word book of 30,000 words. New York: Teachers College, Columbia University, 1944.

Unger, S. M. Habituation of the vasoconstrictive orienting reaction. Journal of Experimental Psychology, 1964, 67(1), 11-18.

Voronin, L. G., Leontiev, A. N., Luria, A. R., Sokolov, E. N., & Vinogradova, O. S. Orienting reflex and exploratory behavior. Moscow: Academy of Pedagogical Sciences of RSFSR, 1958.

Walker, E. L., & Tarte, R. D. Memory storage as a function of arousal and time with homogeneous and heterogeneous lists. Journal of Verbal Learning and Verbal Behavior, 1963, 2, 113-119.

Williams, M. Psychophysiological responsiveness to psychological stress in early chronic schizophrenic reactions. Psychosomatic Medicine, 1953, 15, 456-462.

Wolman, B. B. Schizophrenia and related disorders. In B. B. Wolman (Ed.), Handbook of Clinical Psychology. New York: McGraw-Hill, 1965.

Woolley, D. W. Serotonin in mental disorders. Research Publication: Association of Nervous and Mental Disorders, 1958, 36, 381-400.

Zahn, T. P. Autonomic reactivity and behavior in schizophrenia. Psychiatric Research Reports, 1964, 19, 156-177.

Zimny, G. H., & Schwabe, L. W. Stimulus change and habituation of the orienting response. Psychophysiology, 1965, 2(2), 103-115.