1980

Type of Schizophrenic Thought Disorder as a Function of Level and Duration of Cortical Arousal Abnormality

Bruce Pfau
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TYPE OF SCHIZOPHRENIC THOUGHT DISORDER AS A FUNCTION OF
LEVEL AND DURATION OF CORTICAL AROUSAL ABNORMALITY

by

Bruce Pfau

A Dissertation Submitted to the Faculty of the Graduate
School of Loyola University of Chicago in Partial
Fulfillment of the Requirements for the Degree
of Doctor of Philosophy

April
1980
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VITA

The author, born October 3, 1953, is the son of Harvey Pfau and Renee (Horowitz) Pfau of Bethpage, New York.

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INTRODUCTION AND STATEMENT OF THE PROBLEM

Since the beginning of this century textbooks of psychopathology have cited "disturbances in thinking" as the hallmark feature of schizophrenia. As early as 1911, Bleuler observed that the "associative threads" of the schizophrenic's thought seemed to be broken. Kraepelin (1919) devoted extended passages of his seminal work, *Dementia Praecox and Paraphrenia*, to elegant descriptions of schizophrenic cognition, noting the patients' disturbance in attention, train of thought and constraint of thought. Today, the *Diagnostic and Statistical Manual* of the American Psychiatric Association (1968) defines schizophrenia as "a group of disorders manifested by characteristic disturbances in thinking, mood and behavior." But as Meehl (1962) succinctly pointed out, while disturbances in mood and behavior are symptoms of schizophrenia, thought disorder remains the true "diagnostic bell ringer."

Owing to the tremendous influence of psychoanalysis, a number of theorists (e.g., Fenichel, 1945; Sullivan, 1944) writing in the 1930's and 1940's argued that schizophrenic thought disorder represented a secondary, cognitive response to a primary emotional problem. However, as Chapman and Chapman (1973) pointed out, while emotionally laden
situations have been shown to affect schizophrenic thinking, there is little evidence to support the notion that thought disorders originate from intrapsychic emotional problems.

Over the last twenty years, a growing number of theorists (e.g., Broadbent, 1958; Chapman and McGhie, 1962; Lang and Buss, 1965; Payne, Mattusek & George, 1959; Venables, 1964) have invoked information processing models of thought disorder. In general, these theorists propose that schizophrenic thought disorder arises from primary defects in the patients' selective attention apparatus. As a result of this defect, they argue, schizophrenics have difficulty focusing their attention on relevant stimuli and disregarding, or "filtering", irrelevant stimuli.

Many experimental studies of schizophrenic information processing have employed measures of distractability and conceptual breadth as indices of selective attention disturbance. Measures of distractability often involve tasks where subjects must disregard irrelevant stimuli in order to perform efficiently. Measures of conceptual breadth usually make use of categorization tasks where subjects have the potential of making errors of commission, that is, including irrelevant items in a category, or, making errors of omission, that is, excluding relevant items from a category. Findings from these studies (e.g., Broen, 1966; Chapman, 1961; Tutko and Spence, 1962; Venables, 1964) suggest that two distinct attentional disturbances may exist
in schizophrenia; one in which too many stimuli are attended to, and one in which too few stimuli are attended to. In other words, the attentional focus of some schizophrenics is broadened to the point where they fail to filter irrelevant information, while the attentional focus of others is narrowed to the point where they inappropriately filter relevant information. For example, Chapman (1961) found that while some schizophrenics were overinclusive, making errors of commission on categorization tasks, others were overexclusive making errors of omission. McGhie (1970), noting the results of several studies conducted by him and his colleagues, reported that while some schizophrenics were highly distracted by irrelevant stimuli, others were less distracted than normals.

Another group of investigators, stimulated by information processing models of thought disorder have examined the neurophysiological underpinnings of selective attention. A number of studies have demonstrated, for example, that central nervous system (CNS) excitability or arousal is associated with the resolution of attentional focus (Callaway, 1959; Venables, 1964) and the rate of central information processing (Harter, 1967). In general terms, heightened CNS arousal has been associated with an alert organism, one who is ready to scan the environment, focus on relevant stimuli, and encode information rapidly. Lowered CNS arousal has been associated with a relatively
relaxed organism who scans less frequently, focuses in a more diffuse fashion, and processes information more slowly. Heightened CNS arousal is usually elicited by informationally relevant cues, while lowered CNS arousal is elicited when stimuli are less informationally relevant.

The relationship between attention and arousal, takes on greater significance in light of the work of Gruzelier (1978) who reviewed a number of studies conducted over the last 20 years and concluded that schizophrenics are bimodally distributed on measures of central and autonomic arousal. One group of patients appears to have heightened levels of arousal while another appears to have lowered levels. Some of the work reviewed by Gruzelier led Venables (1964) to propose a theory of thought disorder that attempted to relate the apparent bipolarity of schizophrenic arousal (i.e., high-low) and selective attention (i.e., hyper-attentive - hypo-attentive). Chronic schizophrenics, Venables argues, are overaroused to the point where almost no stimulus could be expected to elicit enough additional cortical excitation to induce attentional focus. Chronic patients, therefore, tend to be withdrawn, hypo-distractable and narrow in attentional focus. Acute patients, on the other hand, are underaroused to the point where even a comparatively minor stimulus elicits sufficient cortical excitation to induce attentional focus. Acutes, therefore, tend to be agitated, hyperdistractable and broad in
attentional focus. In essence, Venables argues according to the "law of initial value" (Wilder, 1958), viewing the organism's response to stimuli as inversely proportional to its tonic or resting level of arousal. He and his associates have offered considerable evidence to support these formulations (Venables and Wing, 1962; Venables, 1963a; Venables, 1964), finding chronics to be more aroused and narrower in attention than acutes.

In contrast, a number of other findings fail to confirm, or directly contradict those of Venables. For example, some investigators have found no differences in the arousal levels of acute and chronic patients (Thetford, Spohn and Everds, 1972; Spohn, Thetford and Woodham, 1970), while others (Magro, 1972) have reported some acutes to be more aroused than chronics. In terms of psychological functioning, Chapman (1956) found, in direct contrast to Venables, that chronics were more distractable and, thus, assumedly broader in attentional focus than acutes.

The present thesis proposes that these inconsistent findings may be explained by the failure of the above studies to examine the interaction between type of arousal deviance, that is, over or under arousal, and duration of arousal deviance, short or long. One reflection of the duration of a patient's arousal deviance is assumed to be provided by his chronicity, another by his premorbid adjustment status. A number of studies (Whittman, 1941;
Becker, 1955; Chapman, Day and Bernstein, 1961) have shown that while some schizophrenics (good premorbids) have relatively normal pre-psychotic histories, others (poor premorbids) evidence signs of abnormal functioning for most or all of their lives. In addition, because good-premorbids tend to have better prognoses than poor premorbids, premorbid adjustment status often overlaps with chronicity (acute-chronic) status. The present thesis proposes that the type of selective attention disturbance exhibited by a schizophrenic patient will be a function of the level of his central nervous system arousal (high vs low) and the duration of his arousal disturbance (long vs short) in accordance with the following theoretical model.

Good premorbid and acute schizophrenics, it is proposed, experience periods of normal brain functioning prior to the onset or in between periods of disturbance in CNS arousal. One group of good premorbids and acutes undergoes a heightening of arousal, while another group undergoes a lowering. During the periods of normal brain functioning these groups learn, as normals do, to associate informationally relevant environmental stimuli with high CNS arousal and informationally non-relevant stimuli with low CNS arousal. Disturbances in CNS arousal, it is argued, produce internal cues, independent of external stimuli, which are interpreted by the patient in the context of his previously learned associations. These factors lead good
premorbids and acutes to attribute (or misattribute) to environmental stimuli degrees of informational relevance normally associated with heightened or lowered states of arousal. Hence, overaroused good premorbids and acutes, it is hypothesized, will tend to attribute informational relevance to a greater proportion of stimuli than normals, while underaroused good premorbids and acutes will attribute such relevance to a relatively smaller proportion of stimuli. Categorization tasks should find overaroused-good premorbids and acutes to be overinclusive and underaroused-good premorbids and acutes to be overexclusive. The overaroused group should be hyperdistractable on tasks which call for disregarding irrelevant stimuli, whereas the underaroused group should be hypodistractable.

Poor premorbid and chronic schizophrenics, it is proposed, have experienced abnormal levels of CNS arousal for most or all of their lives. For this group, it is not misattribution arising from faulty internal cues that leads to deviant attentional control, but adaptation to chronically abnormal levels of arousal, in much the way Venables (1964) proposes. Chronically high tonic levels of arousal will decrease the likelihood that a stimulus will elicit enough additional cortical excitation to induce attentional focus, whereas chronically low tonic levels of arousal will increase the likelihood that even a comparatively minor stimulus will elicit sufficient cortical excitation to
induce attentional focus. Thus, in terms of psychological functioning the predictions for poor premorbids and chronic schizophrenics are opposite those of good premorbids and acutes. Over aroused-poor premorbids and chronics should be overexclusive and hypodistractable, whereas underaroused poor premorbids and chronics should be overinclusive and hyperdistractable.

If the above formulations are correct, inconsistent research results among investigations that attempt to relate arousal to selective attention dysfunction may be viewed as stemming from subject selection differences. For example a study heavily loaded with bad premorbid or chronic patients would be expected to find a very different relationship between arousal and attentional disturbance than a study loaded with good premorbids or acutes. Studies reporting no differences in cognition between schizophrenics dichotomized on the basis of chronicity, premorbid adjustment status, or arousal alone are also explainable in that each criterion group would contain two sub-sets of patients with qualitatively opposite modes of cognitive functioning. Studies finding no differences in arousal between patient groups dichotomized in terms of chronicity or premorbid status would, likewise, be the result of bimodal arousal states existing within each criterion group.

While a wealth of indirect evidence may be adduced to
support the above formulations, more direct evidence is lacking. The present thesis will attempt to provide direct evidence by assessing premorbid adjustment status, chronicity, central nervous system arousal, overinclusive-overexclusive thinking and distractability for a sample of schizophrenic subjects. Premorbid adjustment status will be measured using the Bromet-Harrow (1973) modification of the Phillips (1953) Scale. Chronicity will be taken to be the percent of a patient's life spent in the hospital. Cortical arousal will be measured using a two-flash threshold procedure. Overinclusive-overexclusive thinking will be measured using the Chapman (1961) card sorting task. And distractability will be measured using the Stroop (1935) test.
Selective Attention and Schizophrenic Thought.

Historical Perspective. As early as 1890, William James pointed out the importance of selective attention to adequate cognitive functioning. James noted that at any given moment, the human organism is exposed to an enormous array of internal and external stimuli, some of which are relevant to the adaptive demands of the environment, others of which are not. To perform efficiently, it is therefore necessary for the organism to selectively attend to those stimuli which are relevant and to disregard those which are irrelevant. Not to engage in selective focusing, according to James, would result in behavior being as scattered as the stimuli that impinge on the senses and reduce the organism's experience to "utter chaos."

Kraepelin (1919) was one of the first psychopathologists to relate the "chaos" of schizophrenic thought and behavior to disturbances in attentional control. The passage below illustrates that Kraepelin, like many modern investigators, was struck by the fact that schizophrenics often demonstrated qualitatively opposite attentional styles.

The patients digress, do not stick to the point, let their thoughts wander without voluntary control in the most varied directions. On the other hand, the attention is often rigidly fixed for a long period of time so that the patients stare at the same object, continue the same line of thought or
do not let themselves be interrupted in some definite piece of work. (p. 6)...Further it happens that they deliberately turn their attention away from those things to which it is desired to attract it...there is occasionally noticed a kind of irresistible attraction of the attention to casual external impressions. (p. 19).

Without actually employing the term "attention," Cameron (1938, 1939) and Goldstein and Scheerer (1941) attempted to explain schizophrenic cognition by invoking constructs and mechanisms that later writers would argue are subsumed by the concept of selective attention. Cameron, for example, noted that schizophrenics make faulty generalizations because they are inordinantly responsive to distracting stimuli, both internal and external. Goldstein and Scheerer proposed that schizophrenics' difficulty in abstract thinking resulted from their inability to maintain a mental set to respond to designated stimuli. It would appear that Cameron's notion that schizophrenics are inappropriately responsive to distracting stimuli implies that they are first inappropriately attentive to such stimuli. Goldstein and Scheerer's concept of "mental set", likewise, implies a readiness to attend to some stimuli and not to others.

The Defective Filter Model. Broadbent (1958) proposed a model of normal information processing that would later be adopted by psychopathologists to account for schizophrenic cognition. Using the high speed digital computer as an analogue, Broadbent proposed that an upper limit existed
on the rate at which man can encode and process sensory information. He demonstrated that as the rate of sensory input increased beyond this "limited capacity," the accuracy of a subject's reproduction of presented stimuli sharply decreased. Broadbent proposed that under normal conditions the amount of stimuli collected by the sensory system exceeded the processing capacity of the central encodement apparatus. Information overload was avoided, he argued, by a "selective filtering mechanism" that inhibited the flow of non-relevant information from the senses to the limited capacity encodement system.

Stimulated by Broadbents (1958) work, a number of investigators proposed that the various manifestations of schizophrenic thought resulted from defects in the patients' selective filtering apparatus. Weckowicz and Blewett (1959) argued that schizophrenics' difficulty in abstracting essential information from the environment was the result of an excessively "wide open" selective filter. In a series of experiments Weckowicz and his co-workers showed that schizophrenics' were prone to perceptual anomalies, an effect they hypothesized to result from the patients' inability to disregard irrelevant sensory stimuli. Weckowicz (1957) and Weckowicz, Sommer and Hall (1958) showed, for example, that schizophrenics had a reduced ability to maintain perceptual constancies. On size constancy tasks where subjects
were asked to compare proximal and distal objects of identical size, schizophrenics showed a marked tendency to see the distal objects as smaller. According to Weckowicz, this indicated their inability to disregard the irrelevant information yielded by the retinal image of the object and to focus more selectively on relevant contextual cues.

Weckowicz and Whitney (1960) showed further that the illusory effect of the Muller-Lyer illusion was greatly increased for schizophrenics, a result they attributed to the patients' inability to focus their attention on the lengths of the lines of the figures and to disregard the perceptually perturbing arrowheads.

Shakow (1962) also proposed that schizophrenics are unable to screen out irrelevant informational output. He described schizophrenics as inordinantly preoccupied with the normally disregarded details of experience, giving the irrelevancies of a stimulus situation focal, rather than ground significance. According to Shakow, this attentional disturbance has a profound effect on the patients' ability to choose the optimal behavioral response in a given situation:

It is as if in the normal scanning process which takes place before the response to a stimulus is made, the schizophrenic is unable to select out the material relevant for optimal response. He apparently cannot free himself from the irrelevant among the numerous possibilities available for choice. In other words, that function which is of equal importance as a response to stimuli, namely the protection against stimuli is abeyant. (p. 9)
Shakow's formulations are derived from his extensive experimental work on reaction time in schizophrenia. Reaction time studies typically involve the following procedure: The subject is exposed to a warning signal after which a variable duration of time (e.g., 1-25 seconds) referred to as the "preparatory interval" (PI) is allowed to elapse. The "reaction stimulus" is then presented with the subject being called upon to respond (usually by pressing a key) as quickly as he can. Reaction time (RT) is generally recorded over several blocks of trials consisting of either regular or irregular sequences of PI's.

Work by Shakow and his colleagues over the last 40 years (Huston, Shakow and Riggs, 1937; Rodnick and Shakow, 1940; Shakow, 1950, 1962; Zahn, Rosenthal and Shakow (1961) has revealed that: 1) Schizophrenics have slower reaction times than normals; 2) chronic schizophrenics have slower reaction time than acutes; 3) normals demonstrate improved reaction times when PI's are presented in regular as opposed to irregular sequences; schizophrenics show no such improvement; and 4) schizophrenic reaction time is inordinantly influenced by the preparatory intervals of preceding trials.

Shakow (1963) interprets all of these findings as evidence that schizophrenics cannot disregard irrelevant stimuli and maintains a "major set" to respond to appropriate stimuli. Shakow reasons that in order to respond
quickly one must maintain attentional focus on the anticipated stimulus. In order to benefit from regularity one must have the ability to focus on the relationships among events and disregard the isolated and singular aspects of a task. To perform efficiently in situations where stimuli are irregular, one must have the ability to disregard previous stimuli that are no longer relevant for optimal response. Each of these abilities is deficient in schizophrenics, according to Shakow, because the patients' selective filtering apparatus allows the input of distracting internal and external stimuli to contaminate the maintenance of a proper mental set.

McGhie and Chapman (1961) offer a striking set of clinical examples to support the notion that schizophrenics are flooded by extraneous sensory impressions. In citing patients' descriptions of their own cognitive processes, these writers argue that schizophrenics have lost the ability to direct their attentional focus and are, instead, distracted by the "diffuse pattern of stimuli existing in the environmental situation." The following passages typify the attentional disturbances that plagued the patients interviewed by McGhie and Chapman:

(Patient 13) - My concentration is very poor. I jump from one thing to another. If I am talking to someone they need only to cross their legs or scratch their head and I am distracted and forget what I was saying. (P. 104)
(Patient 14) - Things are coming in too fast. I lose my grip of it and get lost. I am attending to everything at once and as a result I do not really attend to anything at all. (P. 104)

As noted in the previous chapter, a good deal of evidence supporting the notion that schizophrenics fail to selectively filter non-relevant information comes from studies of distractability. In general these studies involve subjects' completing tasks in the absence and then in the presence of a distracting stimuli. The rationale is that if schizophrenics fail to narrow their attention sufficiently, they should evidence greater reductions in task efficiency in the presence of distractors than control groups.

Chapman and McGhie (1962) tested schizophrenics, non-schizophrenic psychiatric patients and normals on a number of psychomotor and immediate recall tasks with and without distractors present. On a "spot tracer" task where subjects followed the movements of a spot of light with a hand lever, schizophrenics had greater reductions in efficiency when auditory distraction was presented than either the psychiatric or normal controls. On a "auditory-rotor" test where subjects were instructed to turn a wheel at a constant tempo, schizophrenics showed significantly greater variability in rotor tempo than either control group when auditory metronomic rhythms were introduced. On an
"auditory-visual distraction" task where subjects were asked to memorize an auditorally presented list of random letters in the absence and then the presence of a visually presented list, schizophrenics had greater reductions in recall as a result of the distraction than did either of the other groups.

In a later series of investigations, McGhie, Chapman & Lawson (1965) and Lawson, McGhie and Chapman (1966) attempted to further delineate the effect of auditory and visual distraction on auditory and visual task performance of schizophrenics. The results showed that distraction effects were greatest when auditory tasks were coupled with auditory or visual distractors while distraction effects were weakest when visual tasks were coupled with auditory or visual distractions (McGhie, 1969).

Shakow and McCormick (1965) examined the effect of distraction on reaction times of schizophrenics. The experiment involved a visual RT task in which the subject was to respond to only one of two colored lights. A yellow light served as the designated reaction stimulus and a red light served as the distractor. The lights were presented alternately (red-yellow), one, three or five times and then followed by a single yellow presentation. The effect of distraction was taken to be the difference in RT between the last yellow of the alternating sequence and the single yellow. Shakow and McCormick reasoned that
schizophrenics would be more influenced by the minor, "segmental set" established by the alternating series than normals. In other words, schizophrenics were expected to be more prone to establish mental sets based on extraneous information. In fact, they found that schizophrenics evidenced greater reductions in RT performance as a result of distraction than controls.

Chapman (1956) extended the examination of schizophrenic distractability to an investigation of the effects of extraneous stimuli on conceptual performance. Chapman employed a card matching task where subjects were instructed to match a "response card" to a "standard card" on the basis of some commonality between the figures printed on each. The figures were of common objects, geometric symbols, letters or numerals. Matches could be made on the basis of identity (e.g., identical figures) or on the basis of some conceptual commonality (e.g., a dress and a shirt = clothing). Four series of cards were used. In the first series, the standard and response cards contained only one figure. In each successive series the number of figures on each card was increased by one so that in the fourth series each card had four figures. In the second, third and fourth series subjects were instructed to match the response card with only the figure which appeared in the lower right hand corner of the standard. The subject was allowed to make the match using any figure on the response
card, though only one provided a correct match. Chapman found that schizophrenics and normals made similar numbers of errors on the first matching series where no distractors or extraneous figures appeared on the standard cards. As the number of distractor increased with each series, however, the performance of normals remained more or less constant, while schizophrenics evidenced significantly greater numbers of errors.

Another major line of evidence called upon to support the defective filter theory of schizophrenic cognition has come from studies of overinclusive thinking. Overinclusion usually refers to the process of including in a concept, or category items that would ordinarily be regarded as inappropriate and, therefore, be omitted by normal subjects (Maher, 1966). Overinclusive thinking has been related to the idea that schizophrenics attend to too many irrelevant stimuli and, thus, broaden their conceptual boundaries to accommodate the excess information. Cameron (1938, 1939, 1947) introduced the term "overinclusiveness" to describe the fashion in which schizophrenics answered questions, completed sentence fragments and sorted blocks of different geometric shapes and colors into categories. Cameron observed that schizophrenics often answered questions with long winded, vague replies including in their responses information that was only tangentially related to the
original query. Sentence fragments such as "I am alive..." were typically completed by patients with responses that included irrelevant and/or redundant information, such as ". . . because I was born a human and animal life and normal life." On block sorting tasks, schizophrenics frequently included in categories non-task oriented materials, such as the blotter on the examiner's desk, or the examiner himself.

In an experimental study comparing schizophrenics and normals, Chapman and Taylor (1957) employed a card sorting task as a measure of overinclusion. The task consisted of two subtests. On each subtest the subject was given thirty index cards with the name of some object printed on each. The objects fell into three categories. On the first subtest, for example, there were ten fruits, ten vegetables and ten items of sports equipment. The subjects were presented with two small boxes and instructed to put all the fruits in one box and everything else in the second box. Chapman and Taylor reasoned that if schizophrenics employed excessively broad categories they would tend to include with the fruit incorrect similar items (e.g., vegetables), but would exclude incorrect dissimilar items (e.g., sports equipment). The results showed that schizophrenics included significantly more incorrect similar items in the designated category than normals.
Payne, Mattusek and George (1959) offered further experimental evidence to support the idea that schizophrenics were overinclusive in thought. Comparing schizophrenics and neurotic controls, they found schizophrenics to be significantly more overinclusive on the Goldstein Scheerer (1941) Object Sorting Test and Payne's (1962) own Object Classification Test. The Object-Sorting Test involves subjects being presented with a variety of objects (e.g., nail, screwdrivers, hammer, fork, knife, apple, orange, etc.) each of which belongs to some conceptual class (e.g., tools, food, eating utensils). The examiner hands the subject one object and asks him to choose all the other objects that might be grouped with it. Payne et al. found that schizophrenics included in their grouping approximately twice as many objects as neurotics, a statistically significant difference. The Object Classification Test involves subjects being presented with 12 small geometric forms that vary in size, weight, thickness, material and shape. Subjects are instructed to sort the objects according to as many logical classificatory schemes as they can. After each sort they are asked to explain the basis of the ordering. Payne et al. determined that ten correct solutions were possible. Other solutions were taken to be the result of sorting on the basis of irrelevant aspects of the stimuli. The results showed that schizophrenics produced
four times as many incorrect sorts as the neurotic controls. In addition, schizophrenics often reported basing their sorts on irrelevant characteristics of the objects, such as scratches and shadows.

Results such as these and those obtained by Chapman and Taylor (1957) led Payne et al. (1959) to conclude:

All purposeful behavior depends for its success on the fact that some stimuli are "attended to" and some stimuli are ignored...It is as if some filter mechanism cuts out or inhibits the stimuli both internal and external which are irrelevant to the task in hand to allow the most efficient processing of incoming information. Overinclusive thinking might be only one aspect of a general breakdown in this filter mechanism. (p. 631).

Elaborations of the Defective Filter Model. In essence, all of the studies reviewed thus far have proposed that schizophrenics have an excessively broad and diffuse attentional focus. Hyperdistractability and overinclusive thinking have been seen as resulting from excessive amounts of information "flooding" the schizophrenic's central processing system. In other words, the "pores" of the selective filter have been seen as being too large, too open or too indiscriminate. While the evidence reviewed to this point has tended to support this view, later research has shown that not all schizophrenics are plagued by excessive informational input.

Payne and Hewlett (1960) found that only about half of the schizophrenics they tested were abnormally overinclusive.
Factor analysis of patients' test scores on measures of overinclusiveness, concreteness, intelligence and motor ability showed further that while the scores of some schizophrenics loaded heavily on an "overinclusion" factor, the scores of others loaded heavily on a "psychomotor retardation" factor. Chapman (1961), employing an elaborated version of the card sorting task used by him and Taylor (1957), found that schizophrenics as a group were not only more overinclusive than organically damaged and normal controls, but also more overexclusive. In other words Chapman found that his sample not only included irrelevant items within designated categories, but excluded relevant items. It should be noted additionally, that while most schizophrenics made errors of overinclusion and overexclusion, some (17%) were primarily overexclusive and others (18%) were primarily overinclusive. Taken as a whole, these results suggest that some aspects of schizophrenic cognition may be the result of a narrowing rather than a broadening of conceptual boundaries. From this perspective overexclusiveness may be seen as a manifestation of an overactive, rather than underactive filtering mechanism.

Later work by Payne and his associates attempted to relate overinclusive and non-overinclusive thinking to the traditional subclassifications of schizophrenia and to other measures of attentional dysfunction such as
distractability. Payne (1962), Payne and Frielander (1962) and Payne, Frielander, Laverty and Hayden (1963) found that while acute schizophrenics were overinclusive, chronic schizophrenics were no more overinclusive than normals. Payne and Caird (1967) found that overinclusive schizophrenics were more affected by distractors on reaction time tasks than were non-overinclusive schizophrenics. Distractability was also studied by Lawsen (1965) and by McGhie and his colleagues (cited in McGhie, 1970). These investigators found that while some schizophrenics had heightened distractability, others, especially paranoid patients, were even less distractable than normals.

Taken together these data suggest that: 1) not all schizophrenics have a broadened focus of attention, and 2) some, perhaps a sizeable percentage within the chronic and paranoid subclasses, have a narrowed focus of attention as evidenced by overexclusive tendencies and subnormal distractability. Theories of schizophrenic cognition based exclusively on the notion that schizophrenics have an underactive, indiscriminate attentional filter appear to be unable to account for these findings. It is difficult to see, for example, how subnormal distractability and overexclusive thinking could be the result of an "information flood" in the central processing system. Possibly as a result of these problems with the information flood model, several writers (Silverman, 1964 a,b; Broen, 1966; Venables, 1964) have
proposed theories which posit that both narrowed and broadened attentional scopes exist in schizophrenia. Because Broen and Silverman's theories are less crucial to the rationale of the present thesis than Venables' they will be given only brief attention. Following this, Venable's work will be reviewed in detail.

Silverman (1964 a, b) proposed that while non-paranoid patients engage in minimal selective filtering, paranoid schizophrenics engage in excessive filtering, or as he calls it "field articulation." According to Silverman, paranoid patients "overscan" their environments for information. This eventually brings them into contact with a variety of aversive stimuli. In order to reduce this aversive stimulation, the paranoid engages in compensatory, excessive filtering. Silverman further sees this excessive filtering as insuring that only information consistent with the paranoids' delusional system will be allowed to enter consciousness. Silverman (1964 a, b) reviewed a number of perceptual studies the results of which he interprets as supporting his formulations. For example, he cites studies by Taylor (1953) and Witkin, Lewis, Hertzman, Machover, Meissner and Wagner (1954) who found paranoids were more field independent, or higher in "field articulation" than non-paranoids as measured by performance on an embedded figures task and a rod-frame test. Conducting his own size estimation experiments, Silverman also found that paranoids underestimated and
non-paranoids overestimated the size of objects. Gardner, Holzman, Klein, Linton & Spence (1959) had previously shown that underestimation is associated with excessive visual scanning. It should be noted, however, with regard to the Silverman scanning hypothesis that Neale and Cromwell (1968) found the same differences in the size estimations of paranoid and non-paranoid patients even when scanning was restricted by presenting the stimulus object for only 100 milliseconds. These findings and others led Neale and Cromwell (1970) to conclude that size estimation experiments do not lend support for Silverman's formulations about excessive scanning in paranoids and to call into question the basic assumption of his theory.

Broen (1966) has proposed a theory which posits that chronic schizophrenics have excessively narrow attentional focus, whereas acutes have excessively broad attentional focus. Broen argues that in the acute stage schizophrenics evidence "response disorganization"; that is, they attend to response choices within a response hierarchy that normal subjects would disregard. Because of this, acute schizophrenics have a tendency to make inappropriate or less than optimal responses to stimuli. As patients become more chronic, according to Broen, they narrow their attentional focus to only the most prominent response choices in an attempt to reduce the likelihood of choosing the wrong response. In this way Broen sees the chronic's narrowing of
attention as an adaptive strategy to compensate for response disorganization. Support for this theory comes from a study conducted by Broen and Nakamura (1972) comparing chronic-nonparanoid and acute-paranoid schizophrenics. Subjects were required to track a visual stimulus while also completing an auditory signal detection task under two different conditions. In the first condition the examiner emphasized the importance of accuracy on the signal detection task. In the second condition he emphasized the importance of accuracy on the tracking task. The results showed that chronic-nonparanoid and acute-paranoid were no different in the accuracy of their signal detection performance when signal detection accuracy was emphasized. When tracking was emphasized, however, chronics showed significant reductions in signal detection accuracy while acutes showed almost no decrement in accuracy. Broen and Nakamura interpreted these results as indicating that chronics narrow their attention to single sensory channels while acutes process information from several channels. However, as Chapman and Chapman (1973) pointed out, because these experimenters used chronic-non paranoids and acute-paranoid subjects for comparison, it is unclear whether their findings are attributable to differences between the groups on the chronicy or paranoid dimension. In addition, the lack of a normal control group prohibits the estimation of the degree to
which each of the schizophrenic groups deviates from the norm in terms of attentional focus.

Venables's Theory. Like Broen (1966), Venables (1964) proposed that while acute schizophrenics evidence a broadening of attentional focus, chronics evidence a narrowing of such focus. Unlike Broen, however, Venables attributes these differences to changes in the schizophrenic's level of CNS or cortical arousal which result from chronicity, not to adaptive or compensatory strategies:

Chronic schizophrenics - and possibly included in this category are process patients - tend to be characterized by a state of restriction of the attentional field resulting from elevated states of sympathetic and cortical activation.... In contrast...the acute (and possible the reactive and paranoid) patient is characterized by an inability to restrict the range of his attention so he is flooded by sensory impressions from all quarters. The acute patients' broadened level of attention would appear to arise from a low level of cortical activation or possibly the parasympathetic imbalance which he displays. (Venables, 1964, pp. 41-42)

At its core, Venables's theory is based on the well established neurophysiological finding that the electrical activity of the cortex is associated with different states of consciousness (e.g., Jasper, 1941). States of high cortical arousal, indicated by fast wave EEG reading are associated with states of heightened alertness, whereas states of low cortical arousal, indicated by slow wave EEG readings, are associated with states of relaxation.

According to Venables, cortical arousal, alertness and the
span of attention are associated via a negative feedback mechanism. The tonic, or resting level of cortical arousal, serves as the organism's input regulation threshold. A stimulus salient enough to elicit an arousal response that exceeds this threshold engenders attentional focus and heightens the organism's level of cortical activation. This heightening establishes a new threshold which inhibits the eliciting of attentional focus by any stimulus less salient than the original. In this way, attentional focus is narrowed to the original stimulus. The higher the level of cortical arousal, according to Venables, the more narrow the focus of attention, the lower the level of cortical arousal, the more diffuse the focus of attention. These formulations are consistent with the "law of initial value" (Wilder, 1958), which states that the organism's physiological reactivity to a stimulus is inversely proportional to its resting or tonic state of arousal. Essentially, then, Venables proposes that the hypothetical selective attention filter referred to throughout this review is mediated at the neurophysiological level by cortical arousal.

Venables cites several studies that appear to confirm his formulations concerning the relationship of arousal and attention. Callaway and Thompson (1953) found that increasing sympathetic arousal by administering amyl nitrate or immersing a subject's foot in cold water resulted in a
narrowing of attention as measured by a size constancy task. High arousal subjects produced underestimations of the distal object, an effect, it will be remembered, that is associated with restricted attentional focus. Callaway (1959) found that subjects with heightened levels of arousal induced by metamphitamine had a more narrow scope of attention as measured by the Stroop (1935) Test. The Stroop Test, in essence, is a measure of distractability. The subject is first presented with a card bearing several different colored boxes and told to name the colors as quickly as he can. Next he is presented with a card bearing the names of various colors written in contrasting colored inks. For example, the word "BROWN" might be written in blue ink. The colors of the inks on the second card correspond to the colored spots on the first card. The subject is instructed to name the color of the inks on the second card as quickly as possible. The difference between the time taken to name the first and second lists is assumed to be an indicator of the degree to which the subject was distracted by task irrelevant stimuli, that is, the names of the colors on the second list.

Callaway (1959) noted that the arousal induction procedures of the above cited studies had as a common effect the heightening of subjects' EEG activation. If conditions that increase EEG activation lead to a narrowing of
attentional focus, it should also be true, according to Venables's theory, that conditions which decrease EEG activation should engender a broadening of attention. In fact, Callaway and Band (1958) and Callaway (1959) using atropine and amobarbital as cortical depressants confirmed this prediction using the Stroop Test and other measures of distractibility.

In addition to the above work supporting the view that the breadth of attention is mediated by cortical arousal, a considerable amount of evidence can be adduced to support Venables's (1964) theory that chronic schizophrenics are overaroused and have narrowed attention and that acute schizophrenics are underaroused and have broadened attention. Before reviewing this evidence, however, it may be instructive to first outline the commonly used measures of arousal.

As mentioned earlier, electroencephalographic (EEG) measurements often have been used as direct measures of cortical activation. Fast frequency, low amplitude beta waves have been associated with heightened states of arousal. Slow frequency, high amplitude alpha waves, on the other hand, have been associated with lowered states of arousal.

Several investigations have employed a two flash threshold (TFT) technique to measure cortical activation. The two flash technique involves the subject being asked
to discriminate two temporally close flashes of light. In other words, the flash pairs are presented and the subject instructed to indicate whether he perceives one flash or two. With an electronic timing device the experimenter is able to control the duration of time between the flashes or the "interflash interval" (IFI). At relatively short IFI's (e.g., less than 40 msecs.) most normal subjects will be unable to temporally resolve the two flashes and will report seeing only one. At relatively long IFI's (e.g., greater than 80 msecs.) most subjects will report seeing two separate flashes. Two flash threshold (TFT) may be defined as that interflash interval in an ascending series of IFI's where a subject reliably reports seeing two distinct flashes. Lindsley (1958) and Steriade and Demetrescu (1962) have shown that TFT is inversely proportional to the level of a subject's cortical arousal with low TFT indicating high arousal. At the neuronal level, TFT is associated with the length of the evoked potential refractory period. The shorter the refractory period, the higher the arousal and the shorter the IFI required to elicit a second distinct neuronal response to the second flash of a pair.

Another widely used measure of central nervous system arousal has been sedation threshold. Sedation threshold involves administering central nervous system depressants such as amobarbital to subjects until they become sedated. The rationale of sedation threshold experiments
is simply that the higher the subject's tonic level of arousal the more drug it will take to sedate him. In other words, the higher the level of arousal the higher the sedation threshold. A variant of sedation threshold experiments involve noting changes in schizophrenics' behavior as a result of CNS depressants. If some schizophrenics are overaroused, CNS depressants should improve their clinical picture.

A variety of autonomic measures of arousal such as pulse rate, respiration rate, skin conductance and muscle tension have also been employed to infer central arousal. Heightened states of arousal have been associated with increases in each of these autonomic functions (Ax, 1953). It should be noted, however, that autonomic measures of arousal often do not correlate with one another (Lacey, 1950), and sometimes have been shown not to correlate with central nervous system measures of arousal such as EEG readings (Sternbach, 1960).

Investigations employing many of the measures of arousal described above have produced a number of results consistent with Venables's formulations. Davis and Davis (1939), Jasper, Fitzpatrick and Solomon (1939), Davis (1942), and Hill (1957) all found that chronic schizophrenics had significantly more "choppy" EEG records than normals. Choppy EEG patterns indicate a reduction in alpha activity and increased arousal. Several investigators
(Fulcher, Gallagher and Pfeiffer, 1957; Stevens and Derbyshire, 1958) have found that drugs that lower arousal such as amobarbital and arecoline help reduce catatonic behavior and thought disturbance in chronic patients. It is noteworthy that writers who have reviewed the literature on arousal in schizophrenia (Lang and Buss, 1965; Maher, 1965; Buss, 1966) have concluded that the bulk of the evidence supports the view of chronic schizophrenics as hyperaroused. In addition a number of findings suggest that acutes are underaroused. Borinsky, Neale, Cromwell and Fox (1967) showed acute schizophrenics to be less aroused than normals as indicated by two-flash threshold. Williams (1953) and Malmo, Shagass and David (1951) found acutes to be lower in arousal than chronics on autonomic measures such as heart rate and skin conductance. These findings are consistent with sedation threshold studies which show acutes to have lower sedation thresholds than chronics (Boudreau, 1956; Claridge, 1967; Shagass, 1960).

Evidence may also be adduced to support the contention that the level of arousal mediates the breadth of attentional focus in schizophrenia. Venables and Wing (1962) found that cortical and autonomic arousal was significantly correlated with the degree of social withdrawal in chronic patients as measured by staff ratings. Patients high on measures of arousal were also found to be highly withdrawn, possibly indicating that their scope of attention had become so
narrow they failed to respond appropriately to external stimuli. More direct evidence was offered by Venables (1963 a) who found that highly aroused chronic schizophrenics were less distracted by extraneous stimuli on a sorting task than less aroused patients. In addition, it will be remembered that consistent with Venables's theory, Broen and Nakamura (1972) found chronic schizophrenics to restrict attention to single sensory channels, and Payne, Frielander, Laverty and Hayden (1963) found them to be less overinclusive than acutes, indicating a more narrow range of attention in chronics. Furthermore, Venables (1964) interprets Weckowicz and Blewett's (1959) findings that chronic schizophrenics evidence diminished size constancy as support for his view that chronics have narrowed attention, rather than the view that they are unable to filter irrelevant stimuli, as Weckowicz and Blewett contend. That is, Venables attributes diminished size constancy to the chronic schizophrenic's failure to attend to peripheral contextual cues, a manifestation of narrowed attentional scope, rather than to their failure to disattend to the information provided by the retinal image of the distal object, presumably a manifestation of excessively broad attentional scope.

Problems with Venables's Theory. As Neale and Cromwell (1970) point out, Venables's (1964) theory can be seen as resting on two major points. First, it must be
shown that chronic schizophrenics have supernormal levels of arousal and that acutes have subnormal levels of arousal. Second, it must be shown that these arousal differences mediate the breadth of attentional focus with chronics having narrow and acutes having broad attentional spans. While the studies reviewed in the preceding section appear to confirm these two predictions, other studies appear to contradict them.

The writers who reviewed the literature on arousal and schizophrenia (Lang and Buss, 1965; Maher, 1965 and Buss, 1966) concluded that while a number of experimental findings supported the view that chronic schizophrenics are overaroused, very little support could be found for the view that acute schizophrenics are underaroused. Furthermore, since these reviews were conducted evidence has been offered that brings into question the validity of the contention that chronics are overaroused. Neale and Cromwell (1970) reported that, contrary to Venables's predictions, chronics were no more aroused on a two flash threshold measure than normals. These results were consistent with those of Thetford, Spohn and Everds (1972) and Spohn, Thetford and Woodham (1970) who found no differences between chronic and acute groups on a number of autonomic measures of tonic arousal. Furthermore, Magro (1972) in direct contrast to Venables theory found that some acutes (those with relatively normal prepsychotic
histories) were even more aroused than chronics on skin conductance measures. It is noteworthy, also, that while Venables's (1964) formulations focus on arousal differences between chronics, acutes and normals, he has never directly compared chronic and acute groups on arousal measures, and in the two studies where he compared chronics and normals (Venable, 1963 b, c) he found no differences in cortical activation as measured by two-flash threshold.

Other research findings cast some doubt on the view that chronics have narrower than normal attention and acutes have broader than normal attention. Chapman (1956), it will be remembered, found that chronic patients were more distractable than normals, indicating that these patients attended to too many rather than too few stimuli. McGhie, Chapman and Lawsen (1965) employing a sample that consisted of mostly chronic patients, also found them to be more affected by distraction than normals. Shakow (1962) found chronic patients to be slower in reaction time than acutes, presumably indicating that they were more distracted by internal and external stimuli while completing the task. Nideffer, Neale, Kopfstein and Cromwell (1971) in addition, found no differences between chronic and acute groups in the degree to which their reaction time was affected by preceding prepatory intervals. That is, no differences were found in the degree to which irrelevant stimuli affected task performance. Chapman (1961)
found that chronic schizophrenics were overinclusive in thought, another indication that their attention was diffuse, rather than narrow.

Schizophrenic Cognition, Cortical Arousal and Duration of Arousal Disturbance.

In spite of the experimental findings presented in the last section that tend to contradict Venables's (1964) formulations, enough supporting evidence has been adduced to warrant modifying, rather than discarding his theory. The present thesis proposes that this modification can be accomplished, and Venables's theory made more comprehensive by accounting for the role that duration of arousal disturbance plays in the determination of attentional breadth in schizophrenia. A schizophrenic's chronicity status, defined for the moment as the length of his inpatient hospital treatment, is assumed to provide one measure of arousal disturbance duration. Premorbid adjustment status is assumed to be another reflection of arousal disturbance duration.

The Process - Reactive Distinction. Premorbid adjustment status generally refers to the quality of a patient's psychosocial adjustment prior to the onset of clear psychiatric disturbance. With respect to schizophrenia, Bleuler (1911) was the first to note that some schizophrenics had a good premorbid status marked by a sudden onset of schizophrenic symptoms and little or no history of
pre-psychotic pathology, whereas others had relatively poor premorbid status marked by a long history of psychological disturbances and a gradual, insidious onset of schizophrenic symptoms. Good premorbid schizophrenics have also been referred to as "reactive schizophrenics" while poor premorbid patients have been referred to as "process schizophrenics". Scales designed to measure premorbid adjustment status, for example, Phillips's (1953) Scale, Wittman's (1941) Elgin Prognostic Scale, Ullman and Giovannoni's (1964) Process-Reactive Questionnaire, usually contain items that examine the patient's heterosexual, occupational and social history. The patient's marital status in particular has been shown to be a crucial variable with respect to his premorbid status, reactive patients having a far greater probability of being married. It should be noted also that various measures of premorbid adjustment appear to be measuring the same construct, yielding intercorrelation between .70 and .90 (Kokes, Strauss & Klorman, 1977; Watson and Logue, 1969). Perhaps the greatest utility of the process-reactive distinction has been in the area of prognosis. A number of writers have concluded on the basis of clinical and experimental evidence that reactive schizophrenics tend to have a relatively good prognosis while process schizophrenics have a relatively poor prognosis (Bleuler, 1911; Bellak, 1948; Phillips, 1953; Farina and Webb, 1956;
While some writers (Becker, 1956) suggest that process and reactive schizophrenia might best be looked at as end points on the continuum of premorbid adjustment, others have argued that they represent distinct and dichotomous diagnostic entities. Chapman and Chapman (1973) argue this latter view offering as evidence the finding that measures of premorbid adjustment, such as the Elgin Prognostic Scale yield bimodal distributions (Wittman, 1941; Becker, 1955; Chapman, Day, and Bernstein, 1961) and the finding that good and poor premorbid groups have differential responses to psychoactive medications (Goldstein, Judd, Rodnick, and La Polla, 1969; Goldstein, Rodnick, Jackson, Evans, Bates, and Judd, 1972). Higgins (1964, 1969) after two extensive reviews of the related literature on premorbid adjustment status in schizophrenia concluded that while problems surround the concept, the process-reactive distinction remains a useful diagnostic dichotomy.

**Breadth of Attention as a Function of Cortical Arousal Level and Duration of Arousal Disturbance: A Two Factor Theory.** It is proposed that the breadth of attention in schizophrenia is dependent on the interaction of the patient's level of cortical arousal (high vs low) and the duration of his arousal disturbance (short vs long). As noted earlier, arousal deviance of short duration is assumed to be characteristic of good premorbid and acute
schizophrenics; arousal deviance of long duration is assumed to be characteristic of poor premorbid and chronic schizophrenics. Broadened attentional focus as indicated by overinclusive thought and hyper-distractability is hypothesized to characterize overaroused-short duration and underaroused-long duration schizophrenics. Narrowed attentional focus as indicated by overexclusive thinking and hypo-distractability is hypothesized to characterize underaroused-short duration and overaroused-long duration schizophrenics. Essentially, then, it is proposed that under the rubric of schizophrenia, there exist two basic forms of thought disorder each having two possible etiological bases.

These propositions are based on a three dimensional view of the relationship between cortical arousal and attention. First, cortical arousal is seen as a physiological response to an informationally relevant stimulus. This view is based on the well established findings that arousal increases in the presence of relevant stimuli and decreases in the presence of non-relevant stimuli (Berger, 1929; Sharpless and Jasper, 1956). Second, cortical arousal is seen as a cue producing internal stimulus with arousal having the ability to elicit attentional focusing independent of informationally relevant external stimuli. This view is based on the general learning principle that an internal state which mediates or accompanies an overt
behavioral response to a stimulus, may, after enough trials, elicit the behavioral response in the absence of the original stimulus (Dollard and Miller, 1941; Miller and Dollard, 1950). Third, and finally, cortical arousal is seen as the neurophysiological mediator of the central nervous system's input coding mechanism. Harter (1967) has reviewed considerable evidence which indicates that the CNS codes incoming sensory information in discrete temporal units or "psychological moments" (Stroud, 1949). Such coding is necessary for events to be cognitively placed in the proper temporal sequence. Cortical arousal, or the frequency of the EEG wave (in cycles per second) has been related to the frequency of the discrete temporal units (Lindsley, 1952) with one cycle corresponding to one "moment" or temporal unit. Thus, as arousal increases so does the frequency of the discrete units and the number of discrete chunks of information encoded by the cortex per second.

The present thesis proposes that the psychological effects of abnormally high or low levels of arousal depend, in large part, on whether arousal is chronically or intermittently deviant. Acute or intermittent disturbances in arousal, it is assumed, would be experienced within the context of normal CNS activation. For example, acute over-arousal might lead a person to behave as he would normally when experiencing high arousal: being alert, focusing
attention and processing information rapidly. In other words, acute disturbances in arousal would lead to arousal being experienced as a cue producing stimulus which elicits typically associated responses. Chronically abnormal levels of arousal, on the other hand, would, in essence, be experienced by the afflicted person as being the normal state of affairs. In terms of Wilder's (1958) "law of initial values," chronically low levels of arousal would establish a low threshold for activation response, whereas chronically high levels would establish a high threshold for activation response. A schizophrenic's premorbid adjustment status, it is assumed, will reflect whether his cortical arousal has been suddenly or chronically abnormal. In turn this will predict whether he will react to the deviant arousal level as cue producing stimulus or an abnormal threshold for attentional activation. Likewise, a patients' chronicity status is assumed to reflect whether he experiences relatively continuous or intermittent periods of deviant arousal. Given their relatively short and episodic periods of illness, acutes are assumed to experience intermittent arousal disturbances. Chronics, on the other hand, are assumed to experience relatively long term, continuous disturbances in arousal.

Good premorbidss and acutes, it is proposed, have experienced periods of normal central nervous system
activity prior to the onset or in between periods of dis­
turbance in arousal level. They will, therefore, respond
to intermittent abnormalities in arousal by treating them as
cue producing stimuli. It is assumed that these dis­
turbances may be manifested by either abnormally high or
abnormally low levels of arousal. Overaroused good pre­
morbids and acutes will be stimulated to focus their atten­
tion on a greater proportion of stimuli. Their heightened
state of arousal and focusing behavior will provide the
cues normally associated with the attribution that stimuli
in the environment are informationally relevant. These
cues will, thus, lead to the attribution that immediately
focused upon stimuli are relevant, regardless of their
objective informational importance. Heightened arousal
will, in addition, increase the rate at which stimuli are
encoded into discrete temporal units. Experiencing many
stimuli to be relevant and coding at a rapid rate, over­
aroused-good premorbid and acute patients will appear hyper­
distractable and agitated. Their thought will tend to be
overinclusive as they strive to integrate more information
than their central processing apparatus can ac­comodate.
In short, these patients experience information flooding.
They are hypothesized to present clinically as anxious,
fragmented and emotionally overwrought.

Underaroused-good premorbid and acutes, it is pro­
posed, will react to their abnormally low levels of
activation by treating them as cues for relaxation of attentional focus. Underaroused good premorbid and acutes will therefore focus on a smaller proportion of stimuli. Their lowered arousal and infrequent focusing will provide the cues normally associated with stimuli that are informationally non-relevant. These cues will, in turn, lead to the attribution that stimuli in the immediate experiential field are, likewise, non-relevant, regardless of their objective informational importance. Lowered arousal will, in addition, decrease the rate at which information is encoded in discrete temporal units. Experiencing relatively few stimuli to be important, the underaroused good premorbid or acute patient will appear hypo-distractable and lethargic. Their thought will tend to be overexclusive as they fail to integrate information they perceive as irrelevant or unimportant. In short these patients may be seen as informationally deprived. As a result they may be prone to the hallucinatory experiences often associated with stimulus deprivation (Heron, Bexton and Heff, 1953; Rosensweig; 1959). In addition, they are proposed to present clinically as withdrawn, anhedonic and schizoid.

Poor premorbid and chronic schizophrenics, it is proposed, have experienced long term or possibly congenital disturbances in cortical arousal. These patients will therefore respond to their abnormal levels of activation by establishing deviant thresholds for attentional
responsiveness. Overaroused-poor premorbids and chronics are seen as having an abnormally high threshold for attentional responsiveness. Because they are already near their arousal ceiling only very few stimuli can produce enough additional cortical activation to exceed threshold and induce attentional focus. These patients should present in much the same way as the underaroused good premorbid/acute group. They will focus on few stimuli and thus be hypodistractable, overexclusive, withdrawn and possibly prone to hallucinations. Underaroused-poor premorbids and chronics on the other hand are proposed to have an exceedingly low threshold for attentional responsiveness. Because they have such a low baseline of arousal, even comparatively minor stimuli produce enough cortical activation to exceed threshold and elicit attentional focus. These patients should present in a way similar to the overaroused-good premorbid/acute group. They will focus on many stimuli, and thus be hyperdistractable, overinclusive, agitated and emotionally overwrought.

**Breadth of Attention as a Function of Level and Duration of Cortical Arousal Abnormality: Supporting Evidence.** No investigation to date has compared attentional breadth in schizophrenic criterion groups dichotomized along the arousal and premorbidity dimensions or the arousal and chronicity dimensions. Hence, no direct evidence to support the formulations in the preceding
section can be presented. However, several lines of evi-
dence that may be interpreted as lending indirect support
for these formulations can be adduced with perhaps the
strongest line of evidence coming from the laboratory of
Venables and his associates themselves.

Over the last decade, Venables and his principle
collaborator Gruzelier have conducted extensive research
into the orienting responses of schizophrenic patients
(Gruzelier and Venables, 1972, 1973, 1974, 1975; Gruzelier,
response refers to the organism's behavioral, autonomic and
neurophysiological reaction to a novel, sudden or intense
stimulus. The behavioral component includes turning atten-
tion to the source of the stimuli and possibly approaching
it. Autonomically, this is accompanied by changes in
respiration, heart rate, muscle tension and perspiration.
The primary central nervous system concomitant is the block-
ing of the resting state alpha rhythms and the stimulation
of high frequency beta waves (Grossman, 1973). Perhaps
more important than the response itself is the fact that the
behavioral, autonomic and neurophysiological concomitants
of the orienting response habituate in the presence of
repeated stimuli that have no attentional significance.
Thus, an orienting response may be elicited by the sudden
start of a clock ticking. After a short time, however,
orienting to the ticking disappears and the sound of the
clock, having no particular attentional significance, fades from awareness.

The orienting response has particular relevance to the present thesis for a number of reasons. First, it provides a simple operationalization of attentional focusing. Second, it is associated with the organism's basic discrimination of relevant and non-relevant stimuli. And third, it offers a measure of autonomic and cortical reactivity as distinguished from autonomic and cortical tonus, allowing for their comparison.

A number of studies conducted by Venables and Gruzelier employing skin conductance measures of the orienting response (SCOR) have shown that schizophrenic patients are either hyper-responsive or hypo-responsive to signal-orienting stimuli (Gruzelier and Venables, 1972, 1973, 1974, 1975; Gruzelier, 1973, 1975, 1978; Venables, 1975a, b, 1977). Skin conductance was measured while the patients and normal controls were presented with a series of 15 one second, 85 db tones sounded at irregular intervals. The results, reviewed by Gruzelier (1978), showed that: 1) the majority of normal subjects habituated (i.e., showed no increase in skin conductance) after five tone presentations and all had habituated by the eighth tone presentation; 2) the schizophrenics, on the other hand, failed to respond (or responded minimally) even to the first few tones or responded excessively, not habituating even by
the fifteenth presentation; 3) skin conductance orienting responses (SCOR's) were sharply bimodal for the schizophrenics with 50% being responders and 50% being non-responders; 4) various measures of resting state autonomic and central arousal showed responders to be more aroused than non-responders; 5) responders evidenced more motoric excitement, hebephrenic symptoms, anxiety, manic behavior and belligerence than non-responders; and 6) responders and non-responders did not differ in terms of paranoid status, length of hospitalization or chronicity.

It is not immediately clear how to reconcile these results with Venables's (1963a; 1964) early findings and theoretical conclusions. First, while it may be, as the above results indicate, that responders are more aroused than non-responders, it is difficult to construe them as having the narrowed span of attention Venables's (1964) theory asserted to be associated with high states of arousal. In fact, hyper-responding would appear to be associated with just the opposite attentional dysfunction, that is, excessively broad attentional breadth. Almost by definition hyper-responding refers to the organisms' reacting to stimuli that would normally be disregarded. This type of hypernormal responsivity has typically been associated with an absence rather than an excess of selective filtering. Second, in his early papers, Venables
(1964) explained the chronics' hypo-responsiveness and the
acutes' hyper-responsiveness to stimuli by invoking
Wilders's (1958) notion that physiological responsivity and
tonic arousal level are inversely related (i.e., "law of
initial value").

It is against the proposed low level of activity
of the acute schizophrenic that a large emotional
response may be seen, while because of the high
existing level of activity of the chronic
patient only a small response may be invoked.
(Venables, 1964, p. 40.)

It is difficult to reconcile this view with the finding that
hyper-responders, those patients with excessive physio-
logical responsivity, have also been shown to exhibit higher
resting states of arousal, whereas non-responders, those
patients with an absence of responsivity, have been shown to
exhibit lower resting states of arousal. Indeed, these
findings directly contradict the predictions of Venables's
(1964) theory. Third, and perhaps most strikingly inconn-
sistent with earlier formulations, is Gruzelier's finding
that chronics and acutes were more or less evenly distrib-
uted among the responder and non-responder groups. That
is to say that within the high arousal (responder) and low
arousal (non-responder) groups there were approximately
equal numbers of chronic and acute patients. This finding
directly contradicts Venables's (1964) early formulations
and findings that suggested that chronics are overaroused
and acutes are underaroused. While it appears from
Venables's (1977, 1978) recent writing, that he now attributes the absence of selective filtering to overarousal resulting from hippocampal damage and the excess of selective filtering to underarousal resulting from amygdaloid damage, he offers no explanation for the contradictory findings between his earlier and more recent investigations. The "two factor theory" of schizophrenic attentional breadth outlined in the preceding section, on the other hand, gains some support from these inconsistent findings.

First, the finding that acutes and chronics were evenly distributed among the responder-high arousal and the non-responder-low arousal groups, is consistent with the two factor theory, particularly if it is assumed that good premorbid comprised a large proportion of those patients considered acute and that poor premorbid comprised a large proportion of those patients considered chronic. In other words this finding supports the prediction of the two factor theory that a bimodal distribution of arousal exists within both the long and short duration schizophrenic groups. The assumption that the acutes were largely good premorbid and the chronics were largely poor premorbid appears reasonable given that acutes were drawn from "short stay wards" and, thus, presumably had good prognoses, whereas the chronics were drawn from "long stay wards" and thus presumably had poor prognoses. Favorability of prognosis and favorability of premorbid status,
it will be remembered, have been shown to be directly re-
related (e.g., Phillips, 1953; Farina and Webb, 1956).

Further support for the two factor theory comes from
Venables's (1963b) finding that a group of normals and
chronic schizophrenics did not differ on two flash measures
of cortical arousal. Assuming again that the chronic
patients employed were by and large bad premorbid individuals, the two
factor theory would predict these results. That is to say,
that the bimodal distribution of arousal scores within
Venables's long-duration group would be expected to offset
each other, leaving their mean arousal level no different
than that of normals. If, indeed, this was the case, it
would also be expected that variance differences would be
found between the arousal score distributions of the two
samples with the schizophrenics demonstrating greater
variability than normals. In fact, a comparison of the
variances of the two groups ($s^2_{schiz} = 436.81/s^2_{control}
= 278.9$) yields an $F$ ratio of 1.57 which is significant
at the .05 level for the sample of 63 schizophrenics and 47
normals. Further support for the notion that the bimodal
distribution of tonic arousal scores within short and
long duration groups tends to "wash out" mean differences
between the groups is provided by the number of studies
that report no differences between good and poor premorbid
groups on autonomic measures of arousal such as skin con-
ductance. (DeVault, 1957; Ward and Carlson, 1966; Thetford,
Spohn and Evards, 1972; Spohn, Thetford and Woodham, 1970; Goldstein, Judd, Rodnick, and LaPolla, 1969; Rice, 1970). In fact, a review of the results of the major investigations of arousal in good and poor premorbid groups over the last 25 years (Klorman, Strauss and Kokes, 1977) reveals that findings of no differences between good and poor premorbid groups on a variety of tonic arousal and physiological reactivity measures outnumber findings of significant differences approximately 2:1.

One additional line of evidence supporting the notion that bad premorbid schizophrenics are bimodally distributed in terms of arousal comes from a curious methodological idiosyncrasy in the early experiments conducted by Venables and his colleagues (Venables, 1963a, b, c; Venables and Wing, 1962). Each of these studies involved measuring two-flash thresholds of chronic schizophrenic subjects. With the exception of one study (Venables, 1963b) mentioned above, the reported results lent no indication that two-flash threshold scores for chronics were bimodally distributed. In fact, a graph of two-flash thresholds for a sample of chronics (contained in Venables, 1963a) showed a rather unimodal distribution of scores. However, it should be noted that in each of the studies just mentioned, Venables deleted from his results the scores of patients whose two-flash thresholds exceeded 140 msecs. In one study (Venables, 1963a) he deleted seven of 41, in a second
(Venables, 1963b) he deleted five of 68, in a third (Venables and Wing, 1962) he deleted 15 of 55. The deletion of these subjects, Venables explained in each study, was based on his finding (Venables, 1963c) that two-flash thresholds in excess of 140 msec. "tended to be unreliable". Inspection of the findings from this study, however, reveals that a test retest-reliability coefficient \( r = 0.96 \) was computed only for subjects \( N = 38 \) whose two-flash thresholds fell below 140 msecs. Six subjects whose TFTs were above 140 msec. were deleted from this sample because "they were considered likely to be unreliable...giving very different TFTs on two separate occasions." However, no reliability coefficient was reported for this group. It is difficult to see, even if the test-retest reliability of these patients was poor, how Venables could justify the repeated deletion of up to 27 percent of his study samples on the basis of an unreported reliability coefficient from a sample with an \( N = 6 \). It should be noted, further, that other investigators (Lykken and Maley, 1968) using two-flash threshold procedures, employed to cutting score criteria for the deletion of subjects from the study sample. It appears reasonable to conclude, therefore, that Venables has consistently deleted a sub-sample of chronic schizophrenics who, judging from their abnormally high TFT's, are exceedingly under-aroused. This, of course, lends further support to the
notion that chronics (long duration schizophrenics) are bi-modally distributed in terms of arousal.

A second line of evidence that tends to support the two-factor theory comes from investigations of the relationship between central and autonomic arousal in schizophrenia. The two-factor theory would predict that while the correlation between resting state measures of central and autonomic arousal will be positive in normals, and short duration schizophrenics, it will be negative in long duration schizophrenics. This prediction is made according to the following rationale. Behavioral, autonomic and central arousal occurs in the presence of "significant" stimuli and diminishes or is absent in the presence of insignificant stimuli (Grossman, 1973). It must be recognized, however, that while to some degree a stimulus' significance is determined by its physical attributes (i.e., loudness, brightness, pressure), by and large its significance is determined by its motivational relevance to the organism. Motivational relevancy, in turn, may be seen as determined largely by higher cognitive processes such as judgment. Returning to the example of the ticking clock for the moment, it can be seen that for the student studying intently for a final exam, the ticking of the clock elicits little arousal. On the other hand, for the expectant father pacing in the maternity ward waiting room, the ticking of the clock might elicit considerable arousal. In the same
way, the sound of a firecracker might elicit a startle on any night, except the Fourth of July, when it might elicit little more than a turn of the head.

It will be remembered that the two-factor theory hypothesizes a direct relationship between cortical arousal and the proportion of stimuli judged relevant by short duration patients, but an inverse relationship between cortical arousal and the proportion of stimuli judged relevant by long duration patients. Assuming that the autonomic nervous system of schizophrenics is intact, and that autonomic arousal is elicited by cognitive attributions of stimulus saliency, it should be true that: 1) for poor premorbid/chronics low cortical arousal will be associated with high autonomic arousal whereas high cortical arousal will be associated with low autonomic arousal; and, 2) for normals and good premorbid/acutes high cortical arousal will be associated with high autonomic arousal and low cortical arousal will be associated with low autonomic arousal.

Some support for these formulations comes from a study by Lykken and Maley (1968). Their results showed a significant positive correlation (r=0.39) between two flash threshold, a central measure of arousal, and skin potential, an autonomic measure of arousal, for a group of poor premorbid-chronic schizophrenics. Remembering that low two flash threshold indicates high arousal, the
positive sign of this correlation indicates an inverse relationship between cortical and autonomic arousal in these patients. Lykken and Maley (1968) further found significant negative correlations ($r=-0.46$ to $-0.67$) between two flash threshold and a variety of electodermal indicators of arousal for a group of normals, indicating a direct relationship between cortical and autonomic arousal in these subjects.

It should be noted that Venables and Wing (1962) and Venables (1963c) reported a series of results that tend to contradict those of Lykken and Maley (1968). Venables (1963c) reported correlations of $-0.79$ between skin potential and two flash threshold for a group of chronic non-paranoid schizophrenics, $+0.61$ for a group of normals, and $+0.52$ for a group of paranoids. The direction of the signs of these correlations are opposite those found by Lykken and Maley (1968) indicating a direct relationship between central and autonomic arousal in chronic non-paranoids and an inverse relationship in paranoids and normals. At first glance, these results appear to contradict the predictions of the two factor theory, but upon closer inspection it can be seen that there are several problems with Venables's (1963c) data.

First, a comparison of Venables's (1963c) sample with Venables and Wing's (1962) sample lends reason to believe that many of the same patients were tested in both studies
(i.e., similar sample size, selection criteria and demographic characteristics). Venables and Wing (1962) employing a sample of 40 chronic schizophrenics, 26 non-paranoids and 14 paranoids, report a correlation of -0.83 \( (p<.001) \) between skin potential and two flash threshold for the entire \((N=40)\) patient population. They do not report the correlation between these two measures for the non-paranoid and paranoid groups separately in their (Venables and Wing, 1962) results, however. These correlations appear in Venables (1963c) where they are, as noted above, -0.79 for non-paranoids and +0.52 for paranoids. Assuming similar, if not identical samples were employed in these two studies it is difficult to see how a correlation of the magnitude of -0.83 could be found between skin potential and two flash for a mixed sample of schizophrenics, if in a sizable subsample (i.e., paranoids) a correlation of +.52 was found.

A second criticism of Vanables's (1963c) findings can be made on intuitive grounds. The finding of a strong inverse relationship between cortical and autonomic arousal in normals simply does not seem "logical" since it implies that in a neurologically healthy person as the central nervous system becomes more activated and alert the peripheral nervous system becomes more relaxed. Not only does this finding appear counter-intuitive, but it is at odds with several findings of a positive relationship between
cortical and autonomic measures of arousal in normals (Hume and Claridge, 1965; Harlow, McGough & Thompson, 1971) and non-schizophrenics (Lykken and Maley 1968; Lykken, Rose, Luther and Maley, 1966).

A final line of evidence to support the two-factor theory comes from the work of Payne and his colleagues (Payne and Hewlett, 1960; Payne, 1966; and Chapman, 1961). It will be remembered that the two-factor theory predicts that only two subsamples of schizophrenics will demonstrate overinclusive thinking, overaroused-short duration and underaroused-long duration schizophrenics. The remaining two subsamples, underaroused-short duration and overaroused long duration schizophrenics, will demonstrate overexclusive thinking. In addition, the two-factor theory predicts that the former two subsamples will be agitated, whereas the latter two will be depressed and withdrawn. Using a mixed group of schizophrenics, Payne and Hewlett (1960) found that half were overinclusive while the other half could be characterized as demonstrating psychomotor retardation. Chapman (1961), using a group of chronic patients found a bimodal distribution of overinclusive thinking with some patients being predominantly overinclusive and others being predominantly overexclusive. Furthermore, in an intriguing experiment employing acute schizophrenic subjects, Payne (1966) found a correlation of +0.90 between
overinclusion scores and the briefest tachistoscopic exposure of a picture to which subjects would attempt an identification. If it is assumed that cortical arousal, by virtue of its association with the span of the psychological moment and the rate at which information is processed, mediates the discrimination of tachistoscopic presentations just as it mediates the resolution of paired light flashes, then Payne's finding suggests that in acutes overinclusiveness is directly proportional to level of CNS activation. Thus, the findings of each of these studies (Chapman, 1961; Payne and Hewlett, 1960; Payne, 1966) support the predictions concerning attention and arousal made by the two-factor theory.
EXPERIMENTAL RATIONALE AND HYPOTHESES

The present investigation will assess breadth of attentional focus and cortical arousal for a sample of schizophrenic patients and a group of normal controls. Breadth of attentional focus is assumed to be reflected by performance on the Stroop (1935) test, a measure of distractability, and the Chapman (1961) card sorting task, a measure of overinclusive-overexclusive thinking. Broad attentional focus is taken to be reflected by overinclusive thinking and high distractability, while narrowed attentional focus is taken to be reflected by overexclusive thinking and low distractability. Cortical arousal will be measured using a two-flash threshold procedure with high arousal being reflected by low two-flash threshold.

For the schizophrenic group premorbid adjustment status, chronicity, level of social withdrawal, level of psychomotor retardation, level of agitation, level of hallucinations and presence of paranoid delusions will also be assessed. Premorbid adjustment will be measured using the Bromet-Harrow (1973) modification of the Phillips (1953) Scale of Premorbid Adjustment Status in Schizophrenia.
based on information derived from DeWolfe's (1968) General Information Questionnaire. Chronicity will be taken to be the percent of the schizophrenic subject's life spent as an in-patient. This information will be obtained from the patient's chart. Social withdrawal, psychomotor retardation, agitation, hallucinatory experience and presence of paranoid delusions will be assessed by staff ratings.

Schizophrenics will be assigned to good or poor premorbid groups on the basis of the Phillips Scale scores. All schizophrenics will in addition be assigned to chronic or acute groups on the basis of their percent of life spent as psychiatric inpatients. Each of the schizophrenics in these four groups will be designated as high or low arousal on the basis of his two-flash threshold scores. Schizophrenics falling above the control group two-flash threshold median will be considered "low arousal"; those falling above will be considered "high arousal". This classification paradigm will therefore yield eight schizophrenic criterion groups for comparison: a high arousal-good premorbid (HG), a low arousal-good premorbid (LG), a high arousal-poor premorbid (HP), a low arousal-poor premorbid, a high arousal-acute (LA), a high arousal-chronic (HC) and a low arousal-chronic (LC) group. The HG, LG, HA, and LA groups will be referred to as "short duration" arousal deviance groups. The HP, LP, HC, and LC groups will be referred to as "long duration" arousal deviance groups.
Some analyses will require that a high arousal control group and a low arousal control group be derived. Controls with two-flash thresholds above the control median will be considered "low arousal controls", those below will be considered "high arousal controls".

The "two-factor theory" of schizophrenic cognition makes the central assumption that thought disorder is mediated by abnormal levels of cortical arousal with one group of schizophrenics having abnormally high levels of arousal and another group having abnormally low levels of arousal. Three hypotheses will be examined with regard to this theoretical formulation.

I. The schizophrenic group will be bimodally distributed in terms of arousal. A graph of their two-flash threshold scores will show a low arousal mode (high TFT) and a high arousal mode (low TFT).

II. The high arousal schizophrenic group will be significantly more aroused than the high arousal control group. That is, the high arousal schizophrenics will have lower TFT scores than the high arousal controls.

III. The low arousal schizophrenic group will be significantly less aroused than the low arousal control group. That is, the low arousal schizophrenic group will have higher TFT scores than the low arousal controls.

Given the assumption that schizophrenics are plagued by either abnormally high or abnormally low levels of cortical arousal, the two-factor theory goes on to hypothesize that good premorbid and acute schizophrenics will experience their abnormal levels arousal as internal cue producing
stimuli, whereas poor premorbids and chronics will experience them as deviant thresholds for selective attention responsiveness. The complete theoretical rationale for this distinction may be found on pages 40-46 in the section "Breadth of Attention as a Function of Cortical Arousal Level and Duration of Arousal Disturbance: A Two Factor Theory." Briefly stated, good premorbids and acutes owing to their periods of normal central nervous system activity, experience their abnormal levels of arousal in the context of previously learned associations between arousal level and informational relevance: high arousal being associated with informationally relevant stimuli and low arousal being associated with informationally non-relevant stimuli. High arousal-good premorbids and acutes are therefore expected to attribute informational relevance to an abnormally large proportion of stimuli and to have a broad attentional focus. This should be reflected by overinclusive thinking and hyper-distractability. Low arousal good premorbids and acutes, on the other hand, are expected to attribute informational relevance to an abnormally small proportion of stimuli and to have a narrow attentional focus. This should be reflected by overexclusive thinking and hypo-distractability. Poor premorbids and chronics, owing to their chronically or congenitally abnormal arousal levels, respond to their
activation levels not as internal cues which deviate from a normal arousal tonus, but as the "normal" arousal tonus itself. Given that arousal tonus is assumed to represent the neurophysiological threshold for attentional response, high arousal-poor premorbids and chronics are proposed to have an abnormally high responsiveness threshold, focusing on relatively few stimuli; whereas low-arousal poor premorbids and chronics are proposed to have an abnormally low responsiveness threshold, focusing on relatively many stimuli. High arousal-poor premorbids and chronics are expected therefore to have a narrow focus of attention reflected by overexclusion thinking and hypo-distractability; whereas low arousal-poor premorbids and chronics are expected to have a broad focus of attention reflected by overinclusive thinking and hyper-distractability. Nine hypotheses will be examined with regard to these formulations:

IV. The high arousal-short duration (HG and HA) groups will be more overinclusive than the low arousal-short duration (LG and LA) groups who will not differ from controls.

V. The low arousal-short duration (LG and LA) groups will be more overexclusive than the high arousal-short duration (HG and HA) groups who will not differ from controls.

VI. The high arousal-short duration (HG and HA) groups will be more distractable than the low arousal-short duration (LG and LA) groups who will be even less distractable than controls.

VII. The low arousal-long duration (LP and LC) groups will be more overinclusive than the high arousal-long duration (HP and HC) groups who will not differ from controls.
VIII. The high arousal-long duration (HP and HC) groups will be more overexclusive than the low arousal-long duration (LP and LC) groups who will not differ from controls.

IX. The low arousal-long duration (LP and LC) groups will be more distractable than the high arousal-long duration (HP and LC) groups who will be even less distractable than controls.

X. The high arousal-short duration groups and the low arousal-long duration groups combined, that is the (HG + LP) and the (HA + LC) groups will be more overinclusive than the low arousal-short duration groups and the high arousal-long duration groups combined, that is the (LG + HP) and the (LA + HC) groups who will not differ from controls.

XI. The low arousal-short duration groups and the high arousal-long duration groups combined, the (LG + HP) and the (LA + HC) groups, will be more overexclusive than the high arousal-short duration groups and the low arousal-long duration groups combined ie: the (HG + LP) and (HA + LC) groups, who will not differ from controls.

XII. The high arousal-short duration groups and the low arousal-long duration groups combined ie: the (HG + LP) and (HA + LC) groups will be more distractable than the low arousal short duration groups and the high arousal-long duration groups combined ie: the (LG + HP) and (LA + HC) groups who will be even less distractable than controls.

The two factor theory also proposes that narrowed and broadened attentional scopes are associated with the degree of psychomotor retardation, agitation, social withdrawal, and hallucinatory experience schizophrenics evidence. Schizophrenics with broadened attentional focus (high arousal-good premorbid and acutes; low arousal-poor premorbid and chronics) are expected to be agitated because
their attention is "gripped" by a high proportion of stimuli. Schizophrenics with narrow attentional focus (low arousal-good premorbid and acutes; high arousal-poor premorbid and chronics) are expected to be motorically retarded and withdrawn because of their attention is focused on a relatively low proportion of stimuli. In addition, because schizophrenics with narrow attentional focus are proposed to code and process fewer sensory stimuli, they are hypothesized to experience a kind of sensory stimuli deprivation which will lead to a more marked degree of hallucinatory experience. Three multifaceted hypotheses will be examined with regard to these formulations.

XIII. The high arousal-short duration (HG and HA) groups will be more agitated, less motorically retarded, less socially withdrawn, and less prone to hallucinations than the low arousal-short duration (LG and LA) groups.

XIV. The low arousal-long duration (LP and LC) groups will be more agitated, less motorically retarded, less socially withdrawn, and less prone to hallucinations than the high arousal-long duration (HP and HC) groups.

XV. The high arousal-short duration and the low arousal-long duration groups combined i.e., the (HG + LP) and the (HA + LC) groups, will be more agitated, less motorically retarded, less socially withdrawn and less prone to hallucinations than the low arousal-short duration and the high arousal-long duration groups combined i.e., the (LG + HP) and the (LA + HC) groups.
METHOD

Subjects

**Schizophrenic Group.** Seventy schizophrenics patients from the psychiatric facilities of Nassau County Medical Center, East Meadow, New York were employed. Of the total group, 20 were inpatients, 25 were day hospital patients and 25 were outpatients being treated individually or in a variety of after-care socialization-medication groups. The patients ranged in age from 19 to 56 years with a mean age of 30.81 and a standard deviation of 9.17. There were 41 males and 29 females.

All the schizophrenic subjects met the following selection criteria: a) diagnosed by their primary care clinician as unambiguously schizophrenic; b) carried an official, current medical chart diagnosis of schizophrenia; c) carried at least one other chart diagnosis of schizoprenia by a clinician other than the current primary care clinician; d) carried no diagnosis of affective disorder, character disorder, or neurosis in the past five years; e) showed no evidence of seizure disorder or organic brain syndrome.

All the schizophrenic subjects were volunteers. They were briefed as to the nature of the study (Appendix A) and they signed informed consent forms (Appendix B) prior to
the initiation of any experimental procedures.

Each schizophrenic patient was rated on the Bromet-Harrow (1973) modification of the Phillip's (1953) Scale of Premorbid Adjustment Status in Schizophrenia (Appendix C) based on information gathered by 31 selected items from DeWolfe's (1968) General Information Questionnaire (Appendix D). The General Information Questionnaire was administered verbally in a short interview by the examiner. Patients receiving Phillips Scale scores of 13 or below were considered Good Premorbids; patients receiving scores of 18 or above were considered Poor Premorbids; patients receiving scores between 14 and 17 were considered Fair Premorbids. Of the total patient sample, 28 were Good Premorbids, 29 were Poor Premorbids and 13 were Fair Premorbids.

Each schizophrenic was rated for educational level, paranoid status and chronicity. Educational level was taken to be the highest grade in school completed. The patients level of education ranged from eighth grade to six years of college with a mean grade level of 12.07 and a standard deviation of 1.61.

Paranoid status was determined by the patient's primary clinician's response to the question: "Does this patient evidence coherent paranoid delusions." Patients

1 Considered by DeWolfe to be the most relevant items (DeWolfe, 1979 personal communication.)
rated as having coherent paranoid delusions were considered paranoid, patients rated as not having such delusions were considered Non-Paranoid. Patients for whom this distinction was "difficult to determine" were not assigned a Paranoid/Non-Paranoid diagnosis. Of the total sample, there were 31 Paranoids and 39 Non-Paranoids and 20 received neither diagnosis. Chronicity was taken to be the percent of the patients' life spent as a psychiatric inpatient. Patients ranged in chronicity from 0.0% to 15% of life spent as inpatients with a mean of 2.86% and a standard deviation of 3.31%. Patients spending less than 2% of their life as inpatients were considered acutes; patients spending more than 2% of their lives as inpatients were considered chronic. Of the total sample 39 were Acutes and 31 were Chronics.

All but two of the patients were being treated with anti-psychotic medication. For ethical as well as practical reasons, no attempt was made to control medication administration.

A breakdown of the patient groups on the basis of diagnostic criterion, age, sex, hospital status (i.e.: inpatient, outpatient, day hospital) educational background and daily medication dosage is shown in Table I.

Control Group. Thirty members of the secretarial, housekeeping, orderly and janitorial staff of Nassau County Medical Center were employed as controls, 12 were males, 18
TABLE 1

Descriptive Statistics for the Schizophrenic and Control Groups

<table>
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<tr>
<th>Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>F</th>
<th>Education</th>
<th>Education</th>
<th>Age</th>
<th>Sex</th>
<th>Education</th>
<th>Hospital Status</th>
<th>Medication</th>
<th>Paranoid Status</th>
<th>Chronicity</th>
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<tr>
<td>Good Premorbid</td>
<td>28</td>
<td>35.50</td>
<td>11.18</td>
<td>9</td>
<td>19</td>
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</tr>
</tbody>
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*a = Education = years of school completed

*b = IP = Inpatient, OP = Outpatient, DH = Day hospital

*c = Medication = daily thorazine dosage equivalent

*d = P = Paranoid, NP = non-paranoid, OP = no paranoid Dx assigned

*e = A = acute, C = Chronic
were females. They ranged in age from 19 years to 55 years with a mean of 32.24 and a standard deviation of 11.61 years.

Controls were selected according to the following criteria: a) no history of inpatient psychiatric treatment; b) no history of seizure disorder.

All control subjects were volunteers. They were briefed as to the nature of the study (Appendix A) and signed consent forms (Appendix B) before any experimental procedures were initiated.

The controls ranged in educational level from 8 years to 13 years of school completed with a mean educational level of 11.96 years and S.D. of 1.19.

Materials

Two-Flash Apparatus. A photo-stimulator and flash lamp (Model PS 2; Grass Medical Instruments, Massachusetts) was employed. The photo-stimulator was capable of producing flash pairs with the inter-flash interval continuously adjustable from 15 to 150 milliseconds. Each flash of the pair had a duration of 10 microseconds and an intensity of 93,750 candle power.

White Noise Apparatus - (Sleep Sound; Invento Products, N.Y.)

Staff Rating Scale. Four six-point semantic differential scales assessing psychomotor retardation, social withdrawal, agitation and hallucinations. One item assessing presence of paranoid delusions (Appendix E). The semantic
differential scales were keyed positively with a score of six representing most motorically retarded, socially withdrawn, agitated and hallucinatory.

**Stroop Test.** Two 11" by 14" cards: Card I bearing 10 rectangular colored boxes 3/4" by 5", lengthwise top to bottom (Appendix F), Card II bearing the printed names of 10 colors, in 10 contrasting colored inks lengthwise top to bottom (Appendix F). In addition three 3" by 5" index cards were employed as samples. Sample I bore a blue colored 3/4" by 5" box similar to the colored boxes on the first card. Sample II bore the word "White" printed in red ink, Sample III bore the word "Blue" printed in brown ink.

**Chapman Card Sort.** Four decks of 3" by 5" index cards bearing the names of a variety of common foods, animals, plants and objects. Deck I consisted of 30 cards bearing the names of 10 fruits, 10 vegetables and 10 items of sporting equipment. Deck II consisted of 30 cards bearing the names of 10 birds, 10 flying insects, and 10 articles of clothing. Deck III consisted of 60 cards bearing the names of all 30 items from Deck I plus 10 flowers, 10 trees, and 10 tools. Deck IV consisted of 60 cards bearing the names of all 30 items from Deck II plus 10 wild animals, 10 domestic animals and 10 musical instruments. The names of all the items from Decks I - IV may be found in Appendix G.
The card sorting materials also included four small cardboard boxes with slots cut on their tops large enough for cards to be slipped through but small enough to prohibit taking cards out.

**Procedure**

**Stroop Test.** Each subject was administered the Stroop Test. Card I was placed face down in front of the subject with Sample card I to its side, face up. The following instructions were read to the subject: "On this card (examiner points to Card I) are some different colored boxes just like the one I'm showing you here (examiner points to Sample I). When I say go, I'm going to turn over the card and what I'd like you to do is name the colors of the boxes from top to bottom as quickly as you can." The time taken for the subject to recite the first list was timed with a stopwatch from the moment the card was turned over to the moment he named the last colored box. The subject was then presented Card II face down with Sample II beside it. The following instructions were read: "On this card (examiner points to Card II) are the names of colors written in different colored inks, just like the one I'm showing you now (examiner points to Sample II). You see here the word "WHITE" is written in red ink. When I say go I'm going to turn over this card and what I'd like you to do is name the color of the ink each word is written in. On the one I'm showing you now (examiner points to Sample II) you
would say "RED" because it's written in red ink. What would you say to this one?" (examiner turns over Sample III). If the subject answered correctly, responding "BROWN", the examiner said "That's right because it's written in brown ink." If the subject responded incorrectly, the directions were repeated again, and it was ascertained that the subject understood the task. (Only two subjects required a second reading of the instructions.) Just before Card II was turned over the examiner reminded all subjects, "Remember name the colors of the inks." As on Card I the time taken to name the colors was recorded from the time the card was overturned to the time the last color was named. In addition, the number of uncorrected errors (i.e., naming of words) was recorded and one second was added to Card II time for each error. The index of distractability yielded by the Stroop Test was taken to be the time taken for Card II minus the time task for Card I.

**Card Sort.** Each subject was next administered the Chapman Card Sort task, and reminded that no remaining tasks were timed. The subjects were required to make four sorts. Before each sort one of the cardboard boxes was placed in front of the subject, a separate box being used for each sort. On Sort I, the subject was handed Deck I and given the following instructions: "On these cards are the names of some things. Some are the names of fruit. Put all the fruits in the box." For Sort II, the subject
was handed Deck II and given the following instructions: "On these cards are the names of some other things. Some are the names of birds. Put all the birds in the box."

For Sort III the subject was handed Deck III and instructed: "Some of the things named by these cards grow from the earth. Put all the things that grow from the earth in the box." For Sort IV the subject was handed Deck IV and instructed: "Some of the things named by these cards can move without any outside help. Put all the things that can move without any outside help in the box."

If subjects expressed difficulty reading the names of the objects on the card sort decks, the examiner read the names out loud. Subjects requesting clarification of the category of objects they were to sort into the boxes were read the instructions a second time. Questions aimed at determining whether a particular object fell into the designated category (e.g., Is a duck a bird?) were answered with the following response. "Different people sort the cards in different ways. It's up to you. Sort them the way you think best."

Sorts I and II with their relatively narrow designated categories were expected to elicit more errors of overinclusion than overexclusion; Sorts III and IV with their relatively broad designated categories were expected to elicit more errors of overexclusion than overinclusion (Chapman, 1961). For Sorts I and II, the index of
overinclusion was taken to be the number of incorrect similar objects (i.e., vegetables; flying insects) minus the number of incorrect dissimilar items (sports equipment; clothing) placed in the box. This formula was employed because inclusion of incorrect similar items was considered a result of sorting according to broadened concepts while inclusion of incorrect dissimilar items was considered a result of carelessness, lack of motivation, or general performance deficit (Chapman, 1960). The index of overexclusion for Sorts I and II was taken to be simply the number of designated objects (e.g., fruits; birds) not placed in the box. For Sorts III and IV the measure of overexclusion was taken to be the number of designated items not placed in the box. (On Sort III these were the vegetables, fruits, flowers and trees; on Sort IV these were the birds, insects, wild animals and domestic animals). The measure of overinclusion for Sorts III and IV was taken to be the number of incorrect items (e.g., sports equipment; tools; clothing; musical instruments) placed in the boxes.

From the measures of overinclusion and overexclusion yielded by the individual sorts, two indices of overinclusion and two indices of overexclusion were derived. Overinclusion Index A (OI-A) was defined as the sum of the overinclusion scores on Sorts I and II. Overinclusion Index B (OI-B) was defined as the sum of OI-A and the
total number of overinclusion errors made on Sorts III and IV. Overexclusion Index A (OE-A) was defined as the sum of the total number of exclusion errors made on Sorts III and IV. Overexclusion Index B (OE-B) was defined as the sum of OE-A and the total number of exclusion errors made on Sorts I and II.

Two Flash Threshold. Two flash threshold was next determined for each subject. The subject was seated eight feet from the flash lamp which was placed at eye level. The following instructions were read: "On this lamp (examiner points) are going to be some flashes of light. Sometimes there will be one flash, sometimes there will be two flashes. Each time the light flashes I would like you to say whether there was one flash or two. We will try a couple of practice flashes in a few moments. Before each flash I will warn you that it is about to come on so you can be ready. I will say "READY", then the flashes will come on. Each time you tell me whether you saw one or two. Sometimes it may be hard to tell if there was one or two, in that case just make your best guess."

After the instructions were read the room was darkened and the subject was exposed to continuous 20db white noise. Two practice flash presentations were then made, one with an interflash interval (IFI) of 15 milliseconds, one with an IFI of 150 milliseconds.

Two flash threshold (TFT) was determined using a
standard method of limits procedure (Venables, 1963a, b, c; Gruzelier and Venables, 1975). Four series of flash pairs were presented two in ascending 10 millisecond IFI steps, two in descending 10 millisecond IFI steps. The series were presented: ascending-descending-descending-ascending. Approximately five seconds elapsed between each flash pair presentation. Two flash threshold for the ascending series was taken to be the first of three consecutive reports of two flashes. Two flash threshold for the descending series was taken to be the first of three consecutive reports of one flash.

In the first series all subjects were presented with an initial IFI of 20 milliseconds. The last presented IFI of the first series plus one 10 millisecond step determined the initial IFI of the second and third (descending) series. The last presented IFI of the third series minus one 10 millisecond step determined the initial IFI of the fourth (ascending) series.

Three measures of two flash threshold were derived from the TFT's of the four series: The mean two flash threshold (Mean TFT), the high point two flash threshold (High TFT) and the low point two flash threshold (Low TFT). It should be noted that in a few cases (7) the two flash threshold of subjects was higher than 150 milliseconds, the highest IFI the photo-stimulator could produce. In
these cases TFT was taken to be 150 milliseconds. Additionally in a few cases (8) on ascending series subjects reported their first perception of two flashes at 130 millisecond IFI's or above. For these subjects on these series TFT was taken to be the first of two consecutive reports of two flashes.

At the completion of the two flash procedure control subjects were debriefed (Appendix H) and released. Schizophrenic subjects were interviewed to complete the General Information Questionnaire, debriefed and released.
RESULTS AND FINDINGS

Distribution of schizophrenic and control group two flash threshold (TFT) scores.

The four block method of limits two flash threshold procedure yielded three two flash indices for each subject; mean two flash threshold (MEAN TFT) score (mean of the four TFT blocks), high point two flash threshold (HIGH TFT) score (highest TFT of the four blocks), and low point two flash threshold (LOW TFT) score (lowest TFT of the four blocks). Figures 1, 2 and 3 show the distributions of MEAN TFT, HIGH TFT, AND LOW TFT respectively for the schizophrenic and control groups.

Inspection of each of the figures shows the schizophrenic group's distribution to be considerably more variable on each of the two flash indices. Schizophrenics showed significantly more variance on MEAN TFT ($F = 9.27; \text{df} = 69, 29; \ p < .001$); HIGH TFT ($F = 5.45; \text{df} = 69, 29; \ p < .001$) and LOW TFT ($F = 11.24; \text{df} 69, 29; \ p < .001$). The apparent bimodality of the schizophrenic distributions on each of the TFT indices is, in all likelihood, illusory; the extreme right hand modal spike at 150 msec. in each of the figures probably resulted from the fact that the highest setting on the photostimulator employed was 150
Figure 3. Distribution of low point two flash threshold scores for schizophrenic and control groups.
FIGURE 1. DISTRIBUTION OF MEAN TWO FLASH THRESHOLD SCORES FOR SCHIZOPHRENIC AND CONTROL GROUPS.
FIGURE 2. Distribution of High Point Two Flash Thresholds For Schizophrenic and Control Groups
msecs. Thus it seems probable that at least some of the schizophrenics with MEAN, HIGH and LOW TFT's of 150 milliseconds would have actually scored above 150 msecs. had a photostimulator with a higher IFI capacity been used. This, of course, would have had the effect of flattening the extreme right hand side of the schizophrenic distributions.

The most noteworthy difference between the schizophrenic and control group distributions for each two flash indice appears to be the difference in MEAN, HIGH and LOW TFT range for the two groups. The control group ranges are 40 msecs. (43-83), 60 msecs. (50-110) and 30 msecs. (40-70) for MEAN, HIGH and LOW TFT respectively. The schizophrenic group ranges are 128 msecs. (23-150), 110 msec. (40-150) and 130 msecs. (20-150) for the same indices. Inspection of Figure 1, 2 and 3 shows further that the greater ranges in the schizophrenic distributions are largely due to differences between the high points of the ranges of the two groups. Twenty seven percent of all schizophrenics had MEAN TFT's in excess of 83 msecs; the highest control MEAN TFT; 21 percent of all schizophrenics had HIGH TFT's in excess of 110 msecs., the highest control HIGH TFT; and 23 percent of all schizophrenics had LOW TFT's in excess of 70 msecs., the highest control LOW TFT.

A series of t-tests showed that as a group schizophrenics had significantly higher MEAN TFT's
(t = 3.41* \(^2\); df = 94; \(p < .001\), HIGH TFT's (t = 3.63*; df = 98; \(p < .001\) and LOW TFT's (t = 2.78*; df = 91; \(p < .005\)). Table 2 shows the MEAN TFT, HIGH TFT, and LOW TFT scores for the schizophrenic and control groups.

Comparison of two flash threshold indices for schizophrenic and control criterion groups.

High arousal schizophrenics vs high arousal controls; low arousal schizophrenics vs low arousal controls. The schizophrenic and control groups were split at the control group median for MEAN, HIGH and LOW TFT, yielding a high arousal control group and a low arousal control group for comparison on each of these two flash indices. (The control median was 65, 76 and 56 msecs. for MEAN, HIGH and LOW TFT respectively). A series of t-tests was used to compare the mean TFT's of the two high and the two low arousal groups. Group means and standard deviations are shown in Table 2.

High arousal controls and high arousal schizophrenics did not differ significantly on MEAN TFT (t = 0.66; df = 45), HIGH TFT (t = 0.77; df = 39) or LOW TFT (t = 0.98; df = 46). The low arousal controls and the low arousal schizophrenics did differ significantly on MEAN

\(^2\)NOTE - t values followed by an asterisk indicate that t has been computed and df has been corrected for samples of unequal size and variance (Hayes, 1973).
TABLE 2

Criterion Group Means and Standard Deviations for All Two-Flash Threshold Indices

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<tr>
<th>Group</th>
<th>Two Flash Index (in Msecs.)</th>
<th></th>
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<tr>
<td></td>
<td>n</td>
<td>M</td>
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<td>M</td>
<td>SD</td>
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<td>97.37</td>
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<td>64.87</td>
<td>10.38</td>
<td>76.33</td>
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TFT ($t = 5.46; df = 42; p < .001$), HIGH TFT ($t = 5.51; df = 57; p < .001$) and LOW TFT ($t = 4.70; df = 38; p < .001$) with low arousal schizophrenics evidencing higher TFT's (lower arousal) in each case.

Chronic, acute and control groups comparisons. Table 2 shows the mean MEAN TFT, HIGH TFT, and LOW TFT for chronic schizophrenic, acute schizophrenic and control groups. A series of t-tests was employed to make pairwise comparisons of the groups. Chronic and acute schizophrenics did not differ significantly on MEAN TFT ($t = 1.67; df = 68$), HIGH TFT ($t = 1.45; df = 68$), or LOW TFT ($t = 1.56; df = 68$). Chronics and controls did differ significantly on MEAN TFT ($t = 3.17^*; df = 35; p < .005$), HIGH TFT ($t = 3.40^*; df = 39; p < .005$) and LOW TFT ($t = 2.17^*; df = 34; p < .01$) with chronics evidencing higher TFT's (lower arousal) on all three indices. Acutes and controls differed significantly on HIGH TFT ($t = 2.19^*; df = 57; p < .05$) with acutes evidencing higher HIGH TFT's but not on MEAN TFT ($t = 1.90^*; df = 52$) or LOW TFT ($t = 1.35^*; df = 49$).

Good premorbid, poor premorbid and control comparisons. Table 2 shows the mean MEAN TFT, HIGH TFT, and LOW TFT for good premorbid, poor premorbid and control groups. A series of t-tests showed that good and poor premorbid did not differ significantly on MEAN TFT ($t = 1.67; df = 68$), HIGH TFT ($t = 1.45; df = 68$) or LOW TFT ($t = 1.56; df = 68$). Good premorbid and controls did differ
significantly on MEAN TFT ($t = 2.58^*; df = 31; p < .05$), HIGH TFT ($t = 2.67^*; df = 34; p < .01$) and LOW TFT ($t = 2.12^*; df = 30; p < .05$) with good premorbid evidencing higher TFT's in each case. Poor premorbid and controls differed significantly on MEAN TFT ($t = 2.24^*; df = 35; p < .05$) and HIGH TFT ($t = 2.83^*; df = 39; p < .01$) with poor premorbid evidencing higher TFT's in each case, but did not differ significantly on LOW TFT ($t = 1.53^*; df = 34$).

Paranoid non-paranoid and control comparisons. Table 2 shows the mean MEAN TFT, HIGH TFT, and LOW TFT for paranoids, non-paranoid and controls. A series of t-tests showed that paranoid and non-paranoid schizophrenics differed significantly on MEAN TFT ($t = 2.79; df = 48; p < .05$) and LOW TFT ($t = 2.80; df = 48; p < .01$) with non-paranoids evidencing higher TFT's in each case. Paranoids and controls did not differ significantly on MEAN TFT ($t = 1.44^*; df = 38$) HIGH TFT ($t = 1.64^*; df = 40$) or LOW TFT ($t = 1.02; 1.02; df = 38$). Non-paranoids and controls did differ significantly on MEAN TFT ($t = 3.00^*; df = 20; p < .001$), HIGH TFT ($t = 4.13^*; df = 22; p < .001$) and LOW TFT ($t = 3.42^*; df = 20; p < .005$) with non-paranoids evidencing higher TFT's in each case.
Comparison of the low arousal-good premorbid (LG), high arousal-good premorbid (HG), low arousal-poor premorbid (LP) and high arousal-poor premorbid (HP) groups on cognitive and behavioral measures.

The low arousal-good premorbid (LG), high arousal-good premorbid (HG), low arousal-poor premorbid (LP) and high arousal-poor premorbid (HP) groups were derived in three ways: first, by splitting the good and poor premorbid groups at the control group median for MEAN TFT; second by splitting them at the control median for HIGH TFT and; third, by splitting them at the control median for LOW TFT. The TFT index employed to split the premorbid group in terms of arousal can be found below in the parentheses following the heading that indicates which criterion groups are being compared.

A series of t-tests was used to compare the different criterion groups on the dependent variables: overinclusion index A (OI-A), overinclusion index B (OI-B), overexclusion index A (OE-A), overexclusion index B (OE-B), Stroop test distractability score, motor retardation, social withdrawal, agitation and hallucinations. The criterion group comparisons that were made were: HG vs LG, HP vs LP, and (HG + LP) vs (LG + HP). Table 3 shows a tabular presentation of the two factor theory. It provides a summary of the predictions made by the two factor theory with regard to the attentional styles of the HG, LG, HP
TABLE 3

Tabular Presentation of the Two Factor Theory of Schizophrenic Cognition, Breadth of Attention as a Function of Level and Duration (Premorbid Status) of Cortical Arousal Abnormality

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<th>AROUSAL LEVEL</th>
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<th>Low</th>
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<td><strong>BROAD ATTENTION,</strong></td>
<td><strong>NARROW ATTENTION,</strong></td>
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<tr>
<td></td>
<td>Overinclusive (OI-A, OI-B)</td>
<td>Overexclusive (OE-A, OE-B)</td>
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<tr>
<td></td>
<td>Distractable (Stroop)</td>
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<td>Hallucinatory (Staff Rating)</td>
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<tr>
<td></td>
<td><strong>NARROW ATTENTION,</strong></td>
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<td>Overexclusive (OE-A, OE-B)</td>
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<td>Hypodistractable (Stroop)</td>
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<td>Hallucinatory (Staff Rating)</td>
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**DURATION (PREMORBITD STATUS)**

- **Short** (Good)
- **Long** (Poor)
and LP schizophrenic criterion groups.

LG, HG, LP, HP, (HG + LP) and (LG + HP) group means and standard deviations for all dependent variables can be found in Table 4. In addition to the criterion group comparisons that were made using the entire schizophrenic study sample, criterion group comparisons were also made for the chronic, acute, paranoid and non-paranoid samples separately. LG, HG, LP, HP, (HG + LP) and (LG + HP) group means and standard deviations for all the dependent variables within the chronic, acute, paranoid and non-paranoid subsamples, are shown in Tables 5, 6, 7 and 8 respectively. It should be noted that in some cases when criterion groups are compared within subsamples the number of subjects in criterion groups was low. In a few cases subsample criterion groups contained only one subject and, thus, no variance. Results for subsample criterion group comparisons should be interpreted with this in mind.

HG vs LG (MEAN TFT). The HG and LG groups did not differ significantly on OI-A (t = 1.21*; df = 21), OI-B (t = 0.72; df = 26), OE-A (t = 1.36*; df = 20), OE-B (t = 1.46*; df = 20), Stroop score (t = 0.16; df = 26), motor retardation (t = 0.45*; df = 18), social withdrawal (t = 0.42; df = 26), agitation (t = 0.50; df = 26) or hallucinations (t = 0.30; df = 26).

When HG and LG comparisons were made for chronic, acute, paranoid and non-paranoid subsamples separately no
### TABLE 4
Arousal Level X Premorbidity Criterion Group Means and Standard Deviations for Cognitive and Behavioral Measures:

**Total Schizophrenic Sample**

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*a Note: Mean, High and Low TFT refer to TFT indices used to split premorbid groups in terms of arousal.*


TABLE 5
Arousal Level X Premorbidity Criterion Group Means and Standard Deviations for Cognitive and Behavioral Measures:

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### TABLE 8

Arousal Level X Premorbidty Criterion Group Means and Standard Deviations for Cognitive and Behavioral Measures:

**Non-Paranoid Schizophrenic Sample**

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**Note:** The table provides means and standard deviations for cognitive and behavioral measures across different groups, including arousal levels and premorbidty criterion groups.
significant differences on any dependent variable were found between the groups except that the HG group was significantly more agitated than the LG group ($t = 2.24; df = 13, p < .05$) when acutes were examined separately and less motorically retarded ($t = 2.80*; df = 8; p < .05$) when non-paranoids were examined separately.

**HG vs LG (HIGH TFT).** The HG and LG groups did not differ significantly on OI-A ($t = 0.82*; df = 25$); OI-B ($t = 0.19; df = 26$), OE-A ($t = 1.29*; df = 25$), OE-B ($t = 1.40*; df = 25$), Stroop score ($t = 0.17*; df = 14$), motor retardation ($t = 0.28; df = 26$), social withdrawal ($t = 0.55; df = 26$) or hallucinations ($t = 0.50; df = 26$). The HG group was more agitated than the LG group with the difference approaching significance ($t = 1.59; df = 26; p < .07$).

When HG and LG comparisons were made for the paranoid subsample separately no significant difference were found between the groups on any of the dependent variables. When HG and LG comparisons were made for the non-paranoid subsample separately it was found that the HG group ($n = 1$) had significantly lower OE-A scores ($t = 2.09*; df = 9; p < .05$), higher Stroop scores ($t = 2.20*; df = 9; p < .05$), lower motor retardation scores ($t = 2.69*; df = 9; p < .05$), lower social withdrawal scores ($t = 5.01*; df = 9; p < .001$), and higher hallucination scores ($t = 4.24*; df = 9; p < .001$) than the LG group ($n = 10$). The HG and LG groups within the non-paranoid subsample did not differ on OI-A
or OI-B scores.

Within the chronic subsample, the HG group (n = 3) had significantly lower OE-A scores ($t = 2.43; df = 9; p < .05$), lower OE-B scores ($t = 2.50; df = 9; p < .05$) and higher motor retardation scores ($t = 2.69; df = 11; p < .05$) than the LG group (n = 10). The groups did not differ on OI-A, OI-B, Stroop, social withdrawal, agitation or hallucination scores. Within the acute subsample, the HG and LG groups did not differ significantly on any dependent variable except for agitation where the HG group (n = 8) scored significantly higher than the LG (n = 7) group ($t = 2.78*; df = 13; p < .01$).

**HG vs LG (LOW TFT).** The HG and LG groups did not differ significantly on OI-A ($t = 1.01*; df = 18$), OI-B ($t = 0.55; df = 26$), OE-A ($t = 1.26*; df = 18$), OE-B ($t = 1.27*; df = 17$), Stroop score ($t = 0.25; df = 26$), motor retardation ($t = 0.17*; df = 20$), social withdrawal ($t = 0.0; df = 26$), agitation ($t = 0.13; df = 26$) or hallucinations ($t = 0.10, df = 26$).

Within the paranoid subsample, the HG and LG groups did not differ on any of the dependent variables. Within the non-paranoid subsample the HG and LG groups did not differ on any of the dependent variables with the exception that the LG group was more motorically retarded ($t = 2.97*; df = 7; p < .05$). Within the acute subsample the HG and
LG groups did not differ significantly on any of the dependent variables. Within the chronic subsample the HG group (n = 4) had significantly lower OE-A scores (t = 2.35*; df = 8; p < .05) and OE-B scores (t = 2.47*; df = 8; p < .05) than the LG group (n = 9); the groups did not differ on the other dependent variables.

**HP vs LP (MEAN TFT).** The HP and LP groups did not differ significantly on OI-A (t = 0.60*; df = 19) OI-B (t = 0.45*; df = 20), OE-A (t = 0.72; df = 27); OE-B (t = 0.38; df = 27); Stroop score (t =0.11; df = 27); motor retardation (t = 0.46; df = 27), social withdrawal (t = 0.74; df = 27); agitation (t = 0.13; df = 27) or hallucinations (t = 0.31; df = 27).

No differences were found between the HP and the LP groups when acute, chronic, paranoid and non-paranoid subsamples were examined separately.

**HP vs LP (HIGH TFT).** The HP and LP groups did not differ significantly on OI-A (t = 0.27*; df = 25), OI-B (t = 1.31; df = 23) OE-A (t = 0.06; df = 27), OE-B (t = 0.20; df = 27), Stroop score (t = 0.61; df = 27), motor retardation (t = 0.60; df = 27), agitation (t = 0.32; df = 27) or hallucinations (t = 0.10; df = 27). The HP and LP groups did differ significantly on social withdrawal (t = 1.71; df = 27; p < .05) with the HP group being more withdrawn.
No differences were found between the HP and LP groups on any of the dependent variables when chronic, acute paranoid and non-paranoid subsamples were examined separately.

**HP vs LP (LOW TFT).** The HP and LP groups did not differ on OI-A ($t = 0.03^*; df = 19$), OI-B ($t = 0.91; df = 27$), OE-A ($t = 1.28; df = 27$), OE-B ($t = 0.89; df = 27$); Stroop score ($t = 1.05; df = 27$), motor retardation ($t = 0.26; df = 27$), social withdrawal ($t = 0.67; df = 27$), agitation ($t = 0.49; df = 27$) or hallucinations ($t = 0.21; df = 27$).

**Within the chronic subsample,** the HP and LP groups did not differ on any of the dependent measures. Within the acute subsample, the HP group (n = 9) had significantly lower OE-A scores ($t = 2.31; df = 13; p < .05$) than the LP groups (n = 6); the groups did not differ on any other dependent variable. **Within the paranoid subsample,** the HP group (n = 1) had significantly higher OI-B scores ($t = 16.00^*; df = 2; p < .005$) than the LP group (n = 3); the groups did not differ on any of the other dependent variables.

**HG + LP vs LG + HP (MEAN TFT).** The HG + LP combined group did not differ from the LG + HP combined group on OI-A ($t = 0.70; df = 55$), OI-B ($t = 0.15; df = 55$), OE-A ($t = 0.68^*; df = 43$), OE-B ($t = 1.01^*; df = 41$), Stroop score ($t = 0.88; df = 55$), motor retardation ($t = 0.04; df = 55$), social withdrawal ($t = 0.26; df = 55$), agitation ($t = 0.66; df = 55$) or hallucinations ($t = 0.61; df = 55$).
No differences were found between the HG + LP combined group and the LG + HP combined group when paranoid, non-paranoid, chronic and acute groups were examined separately with the exception that the HG + LP group (n = 13) had significantly lower OE-B scores (t = 1.83*; df = 19; p < .05) than the LG + HP group (n = 14) when the chronic subsample was examined separately.

**HG + LP vs LG + HP (HIGH TFT).** The HG + LP combined group did not differ from the LG + HP combined group on OI-A (t = 0.71; df = 55) OI-B (t = 0.56; df = 55), OE-A (t = 0.95*; df = 41) OE-B (t = 1.22*; df = 38), Stroop score (t = 0.48; df = 55), motor retardation (t = 0.17; df = 55), social withdrawal (t = 0.13; df = 55), agitation (t = 1.43; df = 55) or hallucinations (t = 0.84; df = 55).

When the paranoid, non-paranoid, acute, and chronic subsamples were examined separately there were no significant difference between the HG + LP combined group and the LG + HP combined group on any of the dependent variables with three exceptions: within the chronic subsample the HG + LP group (n = 14) had significantly lower OE-A scores (t = 1.86*; df = 17; p < .05) and OE-B scores (t = 1.91; df = 16; p < .05) than the LG + HP group (n = 13); within the acute subsample the HG + LP group (n = 8) had near significantly higher agitation scores (t = 1.61; df = 28; p < .06) than the LG + HP group (n = 7).
HG + LP vs LG + HP (LOW TFT). The HG + LP combined group did not differ from the LG + HP combined group on OI-A ($t = 0.77; df = 55$), OI-B ($t = 1.08; df = 55$), OE-A ($t = 0.30^*; df = 49$), OE-B ($t = 0.61^*; df = 47$), Stroop score ($t = 0.37; df = 55$), motor retardation ($t = 0.28; df = 55$), social withdrawal ($t = 0.49; df = 55$), agitation ($t = 0.46; df = 55$) or hallucinations ($t = 0.25; df = 55$).

When paranoid, non-paranoid, acute and chronic subsamples were examined separately, the HG + LP group and the LG + HP group did not differ on the dependent variables with the following exceptions: within the acute subsample, the HG + LP ($n = 16$) group had significantly higher OE-A scores ($t = 2.35^*; df = 21; p < .05$) and OE-B scores ($t = 2.14^*; df = 22; p < .05$) than the LG + HP group ($n = 14$); and within the chronic subsample the HG + LP group ($n = 12$) had lower OE-B scores than the LG + HP groups ($n = 15$) at levels that approached statistical significance, ($t = 1.68^*; df = 22; p < .055$).

Comparison of the Arousal Level x Premorbid Status Criterion Groups with the Control Group on the Cognitive Measures.

In cases where HG vs LG, HP vs LP, or HG + LP vs LG + HP groups differed significantly on OI-A, OI-B, OE-A, OE-B or Stroop score, t-tests were used to compare each criterion group with the control group on the cognitive measure of interest. The subheadings below indicate: the
criterion group comparisons that yielded significant differences on cognitive variables, the sample examined in the comparison (e.g., entire sample, or subsample) and the TFT index employed to derive the high and low arousal groups. The reader may refer to Table 3 (p. 91) for a tabular summary of criterion group attentional style as predicted by the two factor theory.

**HG vs LG; Non-Paranoid, (HIGH TFT).** The HG group had significantly lower OE-A scores \((t = 2.09*; df = 9; p < .05)\) than both the LG group, and the control group \((t = 2.56*; df = 28; p < .01)\). The LG and control groups did not differ on OE-A \((t = 0.87; df = 38)\).

The HG group had significantly higher Stroop scores \((t = 2.20*; df = 9; p < .05)\) than the LG group and the control group \((t = 15.95*; df = 29; p < .001)\). The LG group and control groups did not differ on Stroop scores \((t = 1.94; df = 11)\).

**HG vs LG; Chronic, (HIGH TFT).** The HG group had significantly lower OE-A scores \((t = 2.43; df = 9, p < .05)\) than the LG group, but did not differ \((t = 1.53*; df = 31)\) from controls. The LG group had significantly higher OE-A scores \((t = 2.00*; df = 10; p < .05)\) than controls.

The HG group had significantly lower OE-B scores \((t = 2.50; df = 9; p < .05)\) than the LG group but did not differ from the controls \((t = 1.58*; df = 29)\). The LG group had significantly higher OE-B scores \((t = 2.07*;
df = 10; p < .05) than the controls.

HG vs LG; Chronic, (LOW TFT). The HG group had significantly lower OE-A scores ($t = 2.35*$; $df = 8$; $p < .05$) than the LG group but did not differ from controls ($t = 1.11*$; $df = 30$). The LG group had significantly higher OE-A scores ($t = 2.05*$; $df = 9$; $p < .05$) than controls.

The HG groups had significantly lower OE-B scores ($t = 2.47*$; $df = 8$; $p < .05$) than the LG group but did not differ from controls ($t = 1.30*$; $df = 32$). The LG groups had significantly higher OE-B scores than controls ($t = 2.14*$; $df = 9$; $p < .05$).

HP vs LP; Acute (LOW TFT). The HP group had significantly lower OE-A scores ($t = 2.31$; $df = 13$; $p < .05$) than the LP group but did not differ from controls ($t = 0.11$; $df = 37$). The LP group had significantly higher OE-A scores ($t = 2.33$; $df = 34$; $p < .05$) than controls.

HP vs LP; Non-Paranoid, (LOW TFT). The HP group had significantly higher OI-B scores ($t = 16.00*$; $df = 2$; $p < .005$) than both the LP group and the control group ($t = 13.88*$; $df = 29$; $p < .001$). The LP and control groups did not differ on OI-B ($t = 0.68*$; $df = 13$).

HG + LP vs LG + HP Chronic, (MEAN TFT). The HG + LP group had significantly lower OE-B scores ($t = 1.83*$; $df = 19$; $p < .05$) than the LG + HP group, but did not differ from controls ($t = 0.71$; $df = 41$). The LG + HP group had
significantly higher OE-B scores ($t = 2.30^*; \text{df} = 16; p < .05$) than controls.

**HG + LP vs LG + HP; Chronic, (HIGH TFT).** The HG + LP group had significantly lower OE-A scores ($t = 1.86^*; \text{df} = 17; p < .05$) than the LG + HP group but did not differ from controls ($t = 0.61; \text{df} = 42$). The LG + HP group had significantly higher OE-A scores than controls ($t = 2.30^*; \text{df} = 14; p < .05$).

The HG + LP group had significantly lower OE-B scores than the LG + HP group ($t = 1.91; \text{df} = 16; p < .05$) but did not differ from controls ($t = 0.73; \text{df} = 42$). The LG + HP group had significantly higher OE-B scores than controls ($t = 2.35^*; \text{df} = 14; p < .05$).

**HG + LP vs LG + HP; Acute, (LOW TFT).** The HG + LP group had significantly higher OE-A scores than the LG + HP group ($t = 2.35^*; \text{df} = 21; p < .05$) but did not differ from controls ($t = 1.80; \text{df} = 44$). The LG + HP and control groups did not differ on OE-A ($t = 0.32; \text{df} = 42$).

The HG + LP group had significantly higher OE-B scores than the LG + HP group ($t = 2.14^*; \text{df} = 22; p < .05$) but did not differ from controls ($t = 1.81; \text{df} = 44$). The LG + HP group and controls did not differ on OE-B ($t = 0.00; \text{df} = 42$).

**HG + LP vs LG + HP, Chronic, (LOW TFT).** The HG + LP group had lower OE-B scores than the LG + HP group at levels that approached statistical significance ($t = 1.68^*; \text{df} = 42$).
df = 22; \ p < .055) but did not differ from controls (t = 0.76; \ df = 40). The LG + HP group had significantly higher OE-B scores than controls (t = 2.28*; \ df = 17; \ p < .05).

Comparison of the high arousal-acute (HA), low arousal-acute (LA), high arousal-chronic (HC), and low arousal-chronic (LC) groups on cognitive and behavioral measures.

The high arousal-acute (HA), low arousal-acute (LA), high arousal-chronic (HC) and low arousal-chronic (LC) groups were derived in three ways: first, by splitting the acute and chronic groups at the control group median for MEAN TFT; second by splitting them at the control median for HIGH TFT; and third, by splitting them at the control median for LOW TFT. The TFT index employed to split the acute and chronic groups in terms of arousal can be found below in the parentheses following the headings that indicate which criterion groups are being compared.

A series of t-tests was used to compare the different arousal x chronicity status criterion groups on the nine cognitive and behavioral measures: OI-A, OI-B, OE-A, OE-B, Stroop score, motor retardation, social withdrawal, agitation and hallucinations. The criterion group comparisons that were made were HA vs LA, HC vs LC, and (HA + LC) vs (LA + HC). Table 9 shows a tabular presentation of the two factor theory with chronicity used as the duration variable. It provides a summary of the predictions made by the two factor theory with regard to the attentional
TABLE 9

Tabular Presentation of the Two Factor Theory of Schizophrenic Cognition, Breadth of Attention as a Function of Level and Duration (Chronicity Status) of Cortical Arousal Abnormality

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**Duration (Chronicity Status)**
- Short (Acute)
- Long (Chronic)
styles of the HA, LA, HC and LC schizophrenic criterion groups.

HA, LA, HC, LC, (HA + LC) and (LA + HC) group means and standard deviations for all dependent measures are shown in Table 10. In addition to the arousal x chronicity status criterion group comparisons made employing the entire schizophrenic study sample, criterion group comparisons were made for the paranoid and non-paranoid subsamples separately. HA, LA, HC, LC, (HA + LC) and (LA + HC) groups means and standard deviations on all dependent variables for paranoid and non-paranoid subsamples are shown in Tables 11 and 12 respectively. Again, it should be noted that subsample criterion groups often contain only a few subjects. Results should be interpreted accordingly.

**HA vs LA (MEAN TFT).** The HA and LA groups did not differ on OI-A (t = 1.18*; df = 32), OI-B (t = 0.02*; df = 25), OE-A (t = 0.07; df = 37), OE-B (t = 0.30; df = 37), Stroop score (t = 0.85; df = 37), psychomotor retardation (t = 0.26; df = 37) social withdrawal (t = 0.15; df = 37), agitation (t = 0.13; df = 37) or hallucinations (t = 0.83; df = 37).

No differences between the HA and LA groups were found when the paranoid and non-paranoid samples were examined separately with the exception that within the non-paranoid sample the HA group (n = 4) was significantly
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### TABLE 11

Arousal Level X Chronicity Status Criterion Group Means and Standard Deviations for Cognitive and Behavioral Measures:

Paranoid Schizophrenic

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### TABLE 12
Arousal Level X Chronicity Status Criterion Group Means and Standard Deviations for Cognitive and Behavioral Measures:

#### Non-Paranoid Schizophrenic Sample

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less motorically retarded \( (t = 2.24^*; \textit{df} = 7; \ p < .05) \) than the LA group \( (n = 8) \).

**HA vs LA (HIGH TFT).** The HA and LA groups did not differ on OI-A \( (t = 1.13^*; \textit{df} = 27) \), OI-B \( (t = 0.16^*; \textit{df} = 30) \), OE-A \( (t = 0.16; \textit{df} = 37) \), OE-B \( (t = 0.37; \textit{df} = 37) \) Stroop score \( (t = 0.78; \textit{df} = 37) \), psychomotor retardation \( (t = 0.58; \textit{df} = 37) \), social withdrawal \( (t = 0.30; \textit{df} = 37) \), agitation \( (t = 0.37; \textit{df} = 37) \) or hallucinations \( (t = 0.35; \textit{df} = 37) \). No differences between the HA and LA groups were found when the paranoid and non-paranoid samples were examined separately with the exception that within the non-paranoid sample the HA group \( (n = 4) \) was significantly less motorically retarded \( (t = 2.24^*; \textit{df} = 7; \ p < .05) \) than the LA group \( (n = 8) \).

**HA vs LA (LOW TFT).** The HA group had significantly higher OI-A \( (t = 1.69^*; \textit{df} = 28; \ p < .05) \) and OI-B scores \( (t = 2.03^*; \textit{df} = 24; \ p < .05) \) than the LA group. The HA and LA groups did not differ on OE-A \( (t = 0.70; \textit{df} = 37) \), OE-B \( (t = 0.22; \textit{df} = 37) \), Stroop score \( (t = 1.52; \textit{df} = 37) \), psychomotor retardation \( (t = 0.31; \textit{df} = 37) \), social withdrawal \( (t = 0.10; \textit{df} = 37) \), agitation \( (t = 0.62; \textit{df} = 37) \) or hallucinations \( (t = 0.02; \textit{df} = 37) \).

When paranoid and non-paranoid subsamples were examined separately no differences were found between the HA and LA groups with the following exceptions: within the
non-paranoid sample, the HA group (n = 3) was significantly less motorically retarded (t = 2.17*; df = 8; p < .05) than the LA group (n = 9); and within the paranoid subsample the HA group (n = 9) had lower OE-A scores than the LA group (n = 6) with the difference approaching statistical significance, (t = 1.69; df = 13; p < .06).

**HC vs LC (MEAN TFT).** The LC group had significantly higher OI-A scores (t = 2.45*; df = 22; p < .05) than the HC group. The HC groups did not differ on OI-B (t = 0.27; df = 29), OE-A (t = 0.52; df = 29), OE-B (t = 0.61; df = 29), Stroop score (t = 0.19; df = 29), psychomotor retardation (t = 0.43; df = 29), social withdrawal (t = 0.91; df = 29), agitation (t = 0.33; df = 29), or hallucinations (t = 0.40; df = 29).

Within the non-paranoid subsample the LC group (n = 5) was significantly more agitated (t = 3.97; df = 5; p < .01) than the HC group (n = 2) and the LC group had higher OI-A scores than the HC group with the difference approaching statistical significance (t = 2.00*; df = 4; p < .06). Within the paranoid subsample, the HC group (n = 7) was significantly more motorically retarded (t = 2.08*; df = 7; p < .05) than the LC group (n = 9). No other differences were found between the groups when paranoid and non-paranoid samples were examined separately.

**HC vs LC (HIGH TFT).** The LC group had significantly higher OI-A scores (t = 1.93*; df = 28; p < .05) than the
HC group. The groups did not differ on OI-B ($t = 0.04; df = 29$), OE-A ($t = 0.12; df = 29$) OE-B ($t = 0.06; df = 29$), Stroop score ($t = 0.19; df = 29$), psychomotor retardation ($t = 0.44; df = 29$), social withdrawal ($t = 0.98; df = 29$), agitation ($t = 1.15; df = 29$) or hallucinations ($t = 1.02; df = 29$).

When paranoid and non-paranoid subsamples were examined separately no differences were found between the HC and LC groups on any dependent measure (within the non-paranoid sample, there were no subjects in the HC group).

**HC vs LC (LOW TFT).** The LC group had higher OI-A scores ($t = 1.68*; df = 26; p < .06$) than the HC group, at levels which approached statistical significance. The groups did not differ on OI-B ($t = 0.06; df = 29$) OE-A ($t = 0.74; df = 29$), OE-B ($t = 0.80; df = 29$), Stroop score ($t = 0.29; df = 29$), psychomotor retardation ($t = 0.12; df = 29$), social withdrawal ($t = 1.22; df = 29$), agitation ($t = 0.13; df = 29$) or hallucinations ($t = 0.79; df = 29$).

When the non-paranoid subsample was examined separately no differences between the HC and LC groups were found with the following exceptions: the HC group ($n = 2$) was significantly less agitated ($t = 3.97; df = 5; p < .01$) than the LC group ($n = 5$); the HC group had lower OI-A scores ($t = 2.00*; df = 4$), and lower Stroop scores ($t = 2.02*; df = 4$) than the LC group with differences that
approached statistical significance ($p < .06$) in each case. When paranoids were examined separately, no differences were found between the HC and LC group with the exception that the HC group ($n = 8$) was more motorically retarded ($t = 1.78*; df = 9$) than the LC group ($n = 8$) with the difference approaching significance ($p < .06$).

**HA + LC vs LA + HC (MEAN TFT).** The (HA + LC) group had significantly higher OI-A scores ($t = 2.67*; df = 47; p < .01$) than the (LA + HC) group. The groups did not differ on OI-B ($t = 0.42; df = 68$), OE-A ($t = 0.68; df = 68$), OE-B ($t = 0.86; df = 68$), Stroop score ($t = 0.22; df = 68$), psychomotor retardation ($t = 0.46; df = 68$), social withdrawal ($t = 0.65; df = 68$), agitation ($t = 0.50; df = 68$) or hallucinations ($t = 0.28; df = 68$).

When non-paranoids were examined separately, the (HA + LC) group ($n = 9$) had significantly higher Stroop scores ($t = 1.74; df = 17; p < .05$) and were more agitated ($t = 2.76; df = 17; p < .01$) than the (LA + HC) group ($n = 10$). When paranoids were examined separately, no differences between the groups were found with the exception that the (HA + LC) group ($n = 18$) was significantly less motorically retarded ($t = 2.06; df = 29; p < .05$) than the (LA + HC) group ($n = 13$).

**HA + LC vs LA + HC (HIGH TFT).** The (HA + LC) group had significantly higher OI-A scores ($t = 2.41*; df = 49; p < .01$) than the (LA + HC) group. The groups did
not differ on OI-B ($t = 0.46; df = 68$), OE-A ($t = 0.46; df = 68$), OE-B ($t = 0.71; df = 68$) Stroop score ($t = 0.09; df = 68$), psychomotor retardation ($t = 0.66; df = 68$), social withdrawal ($t = 0.74; df = 68$), agitation ($t = 0.20; df = 68$) or hallucinations ($t = 0.33; df = 68$).

When the non-paranoids were examined separately, the (HA + LC) group ($n = 11$) had significantly higher OI-B scores ($t = 1.76*; df = 12; p < .05$) than the (LA + HC) groups ($n = 8$). In addition, the (HA + LC) group was more agitated than the (LA + HC) group with the difference approaching statistical significance ($t = 1.64; df =17; p < .06$). The groups did not differ on any other dependent measure. When paranoids were examined separately, the (HA + LC) group and the (LA + HC) group did not differ on any of the dependent measures with the exception that the (HA + LC) group ($n = 19$) was significantly less motorically retarded ($t = 1.77; df = 29; p < .05$) than the (LA + HC) group ($n = 12$).

**HA + LC vs LA + HC (LOW TFT).** The (HA + LC) group had significantly higher OI-A scores ($t = 2.20*; df = 55; p < .05$) than the (LA + HC) group. The groups did not differ on OI-B ($t = 1.15; df = 68$) OE-A ($t = 0.43; df = 68$), OE-B ($t = 0.70; df = 68$), Stroop score ($t = 0.52; df = 68$), psychomotor retardation ($t = 0.30; df = 68$), social withdrawal ($t = 0.65; df = 68$), agitation ($t = 0.67; df = 68$) or hallucinations ($t = 0.41; df = 68$).
When non-paranoids were examined separately, the (HA + LC) group \((n = 8)\) had significantly higher OI-B scores \((t = 1.91^*; df = 8; p < .05)\) and were more agitated \((t = 1.94; df = 17; p < .05)\) than the (LA + HC) group \((n = 11)\). In addition, the (HA + LC) group had higher OI-A scores than the (LA + HC) group with the difference approaching statistical significance \((t = 1.85^*; df = 7; p < .06)\). No other differences between the groups was found. When paranoids were examined separately no differences were found between the groups with the exception that the (HA + LC) group \((n = 17)\) was significantly less motorically retarded \((t = 1.75; df = 29; p < .05)\) than the (LA + HC) group \((n = 14)\).

Comparison of the Arousal Level x Chronicity Status Criterion Groups with the Control Group on the Cognitive Measures.

In cases where HA vs LA, HC vs LC, or (HA + LC) vs (LA + HC) groups differed significantly on OI-A, OI-B, OE-A, OE-B, or Stroop score, t-tests were used to compare each criterion group with the control group on the cognitive measure of interest. The subheadings below indicate the criterion group comparison that yielded significant differences on cognitive variables, the sample examined in the comparison (e.g., entire sample or subsample) and the TFT index employed to derive the high and low arousal groups. The reader may refer to Table 9 (p. 103) for a summary of the predictions made concerning attentional style for
the HA, LA, HC and LC schizophrenic criterion groups.

**HA vs LA; Schizophrenics, (LOW TFT).** The HA group had significantly higher OI-A scores ($t = 1.69^*; df = 28; p < .05$) than the LA group but did not differ from controls ($t = 1.11; df = 50$). The LA and control groups did not differ on OI-A either ($t = .21^*; df = 41$).

The HA group had significantly higher OI-B scores than both the LA group ($t = 2.03^*; df = 24; p < .05$) and the control group ($t = 1.92^*; df = 24; p < .05$). The LA and control groups did not differ significantly on OI-B ($t = 0.14^*; df = 44$).

**HA vs LA; Paranoids, (LOW TFT).** The LA group had higher OE-A scores than both the HA ($t = 1.69; df = 13; p < .06$) and the control group ($t = 2.25; df = 34; p < .05$) at near or statistically significant levels. The HA and control groups did not differ on OE-A ($t = 0.40; df = 37$).

**HC vs LC; Schizophrenics, (MEAN TFT).** The LC group had significantly higher OI-A scores than both the HC group ($t = 2.46^*; df = 22; p < .05$) and the control group ($t = 2.57; df = 23; p < .01$). The HC and control groups did not differ significantly on OI-A ($t = 0.11; df = 39$).

**HC vs LC; Paranoid, (MEAN TFT).** The LC group had higher OI-A scores than both the HC ($t = 2.00^*; df = 4; p < .06$) and control groups ($t = 1.74; df = 4; p < .07$) at levels that approached significance. The HC group had significantly lower OI-A scores ($t = 2.35^*; df = 28; p < .05$)
than controls.

**HC vs LC; Schizophrenics, (HIGH TFT).** The LC group had significantly higher OI-A scores than both the HC group ($t = 1.93^*; df = 28; p < .05$) and the control group ($t = 2.41^*; df = 24; p < .05$). The HC and control groups did not differ significantly ($t = 0.64; df = 36$) on OI-A.

**HC vs LC; Schizophrenics, (LOW TFT).** The LC group had higher OI-A scores than the HC group at levels that approached significance ($t = 1.68^*; df = 26; p < .06$); the LC group had significantly higher OI-A scores than the controls ($t = 2.33^*; df = 20; p < .05$). The HC and control groups did not differ on OI-A ($t = 1.01; df = 40$).

**HC vs LC; Non-Paranoid, (LOW TFT).** The LC group had higher OI-A scores than both the HC group ($t = 2.00^*; df = 4; p < .06$) and the control group ($t = 1.74^*; df = 4; p < .07$) at levels which approached statistical significance. The HC group had significantly lower OI-A scores than the control group ($t = 2.35^*; df = 27; p < .05$).

The LC group had higher Stroop scores than the HC group ($t = 2.02; df = 4; p < .06$) and the control group ($t = 1.99; df = 4; p < .06$) at levels which approached statistical significance. The HC and control groups did not differ significantly on Stroop score ($t = 0.71; df = 27$).

**HA + LC vs LA + HC; Schizophrenic, (MEAN TFT).** The (HA + LC) group had significantly higher OI-A scores than
both the (LA + HC) group ($t = 2.67^*; df = 47; p < .01$) and
the control group ($t = 2.51^*; df = 56; p < .01$). The (LA +
HC) and the control groups did not differ significantly on
OI-A ($t = 0.02; df = 57$).

**HA + LC vs LA + HC; Non-Paranoid, (MEAN TFT).** The
(HA + LC) group had significantly higher Stroop scores than
both the (LA + HC) group ($t = 1.74; df = 17; p < .05$) and
the control group ($t = 2.99^*; df = 9; p < .005$). The LA +
HC group and the control group did not differ significantly
($t = 1.75; df = 38$).

**HA + LC vs LA + HC; Schizophrenics, (HIGH TFT).** The
(HC + LC) group had significantly higher OI-A scores than
both the (LA + HC) group ($t = 2.41^*; df = 49; p < .01$) and
the control group ($t = 2.35^*; df = 60; p < .05$). The (LA +
HC) and control groups did not differ on OI-A ($t = 0.22; df =
56$).

**HA + LC vs LA + HC; Non-Paranoid; (HIGH TFT).** The
(HA + LC) group had significantly higher OI-B scores than
both the (LA + HC) group ($t = 1.76^*; df = 12; p < .05$) and
the control group ($t = 1.97^*; df = 11; p < .05$). The (LA +
HC) and control group did not differ significantly ($t =
0.32; df = 36$).

**HA + LC vs LA + HC; Schizophrenics, (LOW TFT).** The
(HA + LC) group had significantly higher OI-A scores than
both the (LA + HC) group ($t = 2.20^*; df = 55; p < .05$) and
the control group ($t = 2.37^*; df = 55; p < .05$). The (LA
and the control group did not differ significantly on OI-A ($t = 0.36; df = 57$).

HA + LC vs LA + HC; Non-Paranoids; (LOW TFT). The (HA + LC) group had significantly higher OI-B scores than both the (LA + HC) group ($t = 1.91^*; df = 8; p < .05$) and the control group ($t = 2.06; df = 7; p < .07$). The (LA + HC) and control groups did not differ significantly on OI-B ($t = 0.40; df = 39$).

The (HA + LC) group had higher OI-A scores than both the LA + HC group ($t = 1.85^*; df = 7; p < .06$) and the control group ($t = 1.69^*; df = 8; p < .05$) at levels which approached statistical significance. The (LA + HC) and the control groups did not differ significantly on OI-A ($t = 0.83; df = 37$).

Comparison of the Good Premorbid, Poor Premorbid, Acute, Chronic, Paranoid, Non-Paranoid, Schizophrenic and Control Groups on Cognitive and Behavioral Measures.

A series of t-tests was used to compare good and poor premorbid, acutes and chronic, paranoids and non-paranoids on OI-A, OI-B, OE-A, OE-B, Stroop score, psychomotor, retardation, social withdrawal, agitation and hallucinations. In addition all groups were compared with controls on each of the cognitive measures. Means and standard deviations for the schizophrenic diagnostic groups on all the cognitive and behavioral measures can be found in Table 13.
TABLE 13
Schizophrenic and Control Group Means and Standard Deviations for Cognitive and Behavioral Measures

<table>
<thead>
<tr>
<th>Group</th>
<th>MEASURE</th>
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<tr>
<td></td>
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<td>M</td>
<td>SD</td>
<td>OI-B</td>
<td>M</td>
<td>SD</td>
<td>OE-A</td>
<td>M</td>
<td>SD</td>
<td>OE-B</td>
<td>M</td>
<td>SD</td>
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<tr>
<td>Good Premorbid (n=28)</td>
<td>2.46</td>
<td>4.31</td>
<td>3.11</td>
<td>4.37</td>
<td>7.07</td>
<td>11.26</td>
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<td>6.36</td>
<td>6.06</td>
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<tr>
<td>Poor Premorbid (n=29)</td>
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<td>3.21</td>
<td>5.23</td>
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<td>7.64</td>
<td>7.14</td>
<td>7.53</td>
<td>6.34</td>
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<td>Acute (n=39)</td>
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<td>1.69</td>
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<td>5.87</td>
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<td>6.00</td>
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<td>4.95</td>
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<td>6.32</td>
<td>7.00</td>
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<td>5.01</td>
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<td>4.87</td>
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<td>Control (n=30)</td>
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<td>1.00</td>
<td>1.97</td>
<td>2.97</td>
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<td>6.83</td>
<td>4.30</td>
<td>2.31</td>
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Acute vs Chronic vs Control. Chronics had significantly higher OI-A scores ($t = 2.17*; df = 36; p < .05$) and were more prone to hallucinations ($t = 2.07; df = 67; p < .05$) than acutes. Chronics and acutes did not differ significantly on OI-B ($t = 1.96*; df = 48$), OE-A ($t = 1.77*; df = 39$), OE-B ($t = 1.81*; df = 39$), Stroop score ($t = 0.79*; df = 45$), psychomotor retardation ($t = 0.24; df = 67$), social withdrawal ($t = 0.21; df = 67$), or agitation ($t = 1.94; df = 67$).

Acute schizophrenics had higher Stroop scores than controls ($t = 2.24*; df = 66; p < .05$). Acutes and controls did not differ significantly on OI-A ($t = 0.59; df = 67$), OI-B ($t = 1.63*; df = 60$), OE-A ($t = 1.26; df = 67$) or OE-B ($t = 1.33; df = 67$).

Chronic schizophrenics had significantly higher OI-A scores ($t = 2.35; df = 59; p < .05$), OI-B scores ($t = 3.11; df = 59; p < .005$), OE-A scores ($t = 2.39; df = 59; p < .05$), OE-B scores ($t = 2.46; df = 59; p < .05$) and Stroop scores ($t = 2.02; df = 59; p < .05$) than controls.

Good Premorbid vs Poor Premorbid vs Control. Poor premorbid schizophrenics were significantly more socially withdrawn than good premorbids ($t = 4.19; df = 55; p < .001$). The two groups did not differ significantly on OI-A ($t = 0.84; df = 55$), OI-B ($t = 0.08; df = 55$), OE-A ($t = 0.37; df = 55$), OE-B ($t = 0.47; df = 55$), Stroop score ($t = 0.01; df = 55$), psychomotor retardation ($t = 1.55; df = 55$), agitation ($t = 1.92; df = 55$) or hallucinations ($t = 1.40$).
df = 55).

Good premorbid had significantly higher OI-B scores ($t = 2.34^*; df = 37; p < .05$) than controls but did not differ significantly from controls on OI-A ($t = 1.89^*; df = 36$), OE-A ($t = 1.69^*; df = 42$), OE-B ($t = 1.81^*; df = 41$) or Stroop score ($t = 1.69; df = 34$).

Poor premorbid had significantly higher OI-B scores ($t = 2.13^*; df = 35; p < .05$) and Stroop scores ($t = 2.41; df = 45; p < .05$) than controls. The poor premorbids and controls did not differ significantly on OI-A ($t = 1.20^*; df = 44$), OE-A ($t = 1.74; df = 57$), or OE-B ($t = 1.91; df = 57$).

Paranoid vs Non-Paranoid vs Control. Paranoids were significantly more agitated than non-paranoids ($t = 3.84; df = 48; p < .001$). Paranoids and non-paranoids did not differ significantly on OI-A ($t = 0.50^*; df = 25$), OI-B ($t = 0.13; df = 48$), OE-A ($t = 0.82; df = 48$), OE-B ($t = 0.55; df = 48$), Stroop score ($t = 0.34; df = 48$), social withdrawal ($t = 0.41; df = 48$) or hallucinations ($t = 1.40; df = 48$).

Paranoids had significantly or near significantly higher OI-B ($t = 2.30^*; df = 38; p < .05$), OE-A ($t = 1.95^*; df = 54; p < .056$), OE-B ($t = 1.97^*; df = 55; p < .054$) than controls. Paranoids and controls did not differ significantly on OI-A ($t = 1.49^*; df = 53$) or Stroop score ($t = 1.29^*; df = 48$).
Non-Paranoids had significantly higher Stroop scores \( (t = 2.96*; \text{df} = 23; p < .01) \) than controls. Non-paranoids and controls did not differ on OI-A \( (t = 1.31; \text{df} = 22) \), OI-B \( (t = 1.86*; \text{df} = 22) \), OE-A \( (t = 1.07*; \text{df} = 39) \) or OE-B \( (t = 1.35*; \text{df} = 38) \).

High Arousal vs Low Arousal Schizophrenics.

Table 14 shows the intercorrelations among OI-A, OI-B, OE-A, OE-B, Stroop scores, psychomotor retardation, social withdrawal, agitation, hallucinations, MEAN TFT, HIGH TFT, and LOW TFT for schizophrenic subjects. Table 15 shows the intercorrelations among OI-A, OI-B, OE-A, OE-B, MEAN TFT, HIGH TFT, and LOW TFT for controls.

None of the arousal measures correlated significantly with any of the cognitive or behavioral measures for schizophrenics. In fact they are almost uniformly quite low \( (r < .20) \). It is therefore reasonable to assume that high and low arousal schizophrenic groups would not differ on the cognitive or behavioral measures.

Schizophrenics vs Controls. Schizophrenics had higher OI-A \( (t = 2.08*; \text{df} = 95; p < .05) \), OI-B \( (t = 3.19*; \text{df} = 98; p < .005) \), OE-A \( (t = 2.30*; \text{df} = 82; p < .05) \), OE-B \( (t = 2.39*; \text{df} = 81; p < .05) \) and Stroop scores \( (t = 2.72*; \text{df} = 97; p < .01) \) than controls.

Medication Effects.

Average daily dosages of anti-psychotic medication in Thorazine equivalents were computed for all
### TABLE 14
Intercorrelation of Cognitive, Behavioral and Arousal Measures for Schizophrenics

<table>
<thead>
<tr>
<th>OI-A</th>
<th>OI-B</th>
<th>OE-A</th>
<th>OE-B</th>
<th>Stroop</th>
<th>Motor</th>
<th>Withdrawal</th>
<th>Agitation</th>
<th>Hallucination</th>
<th>M-TFT</th>
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<th>L-TFT</th>
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<td>-.08</td>
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<td>.96**</td>
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n = 70; *p<.05; **p<.001
TABLE 15

Intercorrelation of Cognitive and Arousal Measures for Controls

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<th>OI-B</th>
<th>OE-A</th>
<th>OE-B</th>
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n = 30
* p<.05
** p<.005
*** P<.001
The correlation between medication dosage and the major study variables were as follows: OI-A ($r = .09$), OI-B ($r = .01$), OE-A ($r = .00$), OE-B ($r = .02$), Stroop score ($r = .10$), motor retardation ($r = .03$), social withdrawal ($r = .05$), agitation ($r = .02$), hallucinations ($r = .09$), MEAN TFT ($r = .04$), HIGH TFT ($r = .11$), LOW TFT ($r = .02$), premorbid status-Phillips score ($r = .11$), chronicity-per cent life in hospital ($r = .30$; $p < .01$). As can be seen none of the correlations were significant with the exception of the dosage x chronicity correlation.

Recapitulation of the Results.

A summary of the results and findings listed by hypothesis may be found in Table 16.
### TABLE 16
Summary of Study Results and Findings

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Variable</th>
<th>Prediction</th>
<th>Supporting Evidencea</th>
<th>No Support/Contra dictory Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Arousal</td>
<td>Schizophrenics will be bimodally distributed.</td>
<td>1) Figures 1-3 show no marked bimodality of TTT.</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Arousal</td>
<td>High arousal schiz. &gt; high arousal control.</td>
<td>1) No significant differences between group TTTs.</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Arousal</td>
<td>Low arousal schiz. &lt; low arousal controls.</td>
<td>1) Low arousal schiz. &gt; low arousal control: Mean, High and Low TTT (p &lt; .001); and 25% of all schizophrenics had higher TTTs than the highest control TTT.</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Overinclusion</td>
<td>High arousal-short duration &gt; low arousal-short duration = controls.</td>
<td>HA &gt; IA (p &lt; .05), HA &gt; control (p &lt; .05) LA = control: OI-A, OI-B (Low TTT).</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Overexclusion</td>
<td>Low arousal-short duration &gt; high arousal-short duration = controls.</td>
<td>1) LG &gt; HG (p &lt; .05), LG &gt; control (p &lt; .05), HG = control: OE-A, OE-B (Chronics-High, Low TTT).</td>
<td></td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Hypothesis</th>
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<th>Supporting Evidence a</th>
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</tr>
</thead>
<tbody>
<tr>
<td>VI</td>
<td>Distractability</td>
<td>High arousal-short duration &gt; low arousal-short duration &lt; controls.</td>
<td>1) HG &gt; LG (p &lt; .05), HG &gt; control (p &lt; .001): Stroop score (Non-paranoids-High TFT).</td>
<td>1) LG = controls: Stroop score (Non-paranoids-High TFT).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VII</td>
<td>Overinclusion</td>
<td>Low arousal-long duration &gt; high arousal-long duration = controls.</td>
<td>1) LC &gt; HC (p &lt; .05 - .06), LC &gt; control (p &lt; .01 - .05), HC = control: OI-A (All TFT indices).</td>
<td>1) HP &gt; LP (p &lt; .005), HP &gt; controls (p &lt; .001), LP = control: OI-B (Non-paranoids-Low TFT).</td>
</tr>
</tbody>
</table>

Note: HP group n=1.

2) LC > HC (p < .06), LC > control (p < .05), HC = control: OI-A (Non-paranoid-Mean TFT).

3) LC > HC (p < .06), LC > control (p < .05), HC = control: OI-A (Paranoids-Low TFT).

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<table>
<thead>
<tr>
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<th>Prediction</th>
<th>Supporting Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIII</td>
<td>Overexclusion</td>
<td>High arousal-long duration &gt; low arousal-long duration = controls.</td>
<td>1) LC &gt; HC (p &lt; .06), LC &gt; control (p &lt; .06) (Non-paranoids-Low TFT).</td>
</tr>
<tr>
<td>IX</td>
<td>Distractability</td>
<td>Low arousal-long duration &gt; high arousal-long duration = control.</td>
<td>1) HC = controls (Non-paranoids-Low TFT).</td>
</tr>
<tr>
<td>X</td>
<td>Overinclusion</td>
<td>High arousal-short duration and low arousal-long duration groups combined &gt; low arousal-short duration and high-arousal long duration groups combined = control.</td>
<td>1) HA + LC &gt; LA + HC (p &lt; .01 - .05), HA + LC &gt; control (p &lt; .01 - .05), LA + HC = control: 01-A (All TFT indices).</td>
</tr>
<tr>
<td>XI</td>
<td>Overexclusion</td>
<td>Low arousal-short duration and high arousal-long duration groups combined &gt; high arousal-short duration and low arousal-long duration groups combined = controls.</td>
<td>1) HG + LP &gt; LG + HP (p &lt; .05), HG + LP = control: OE-A (Acutes-High TFT), OE-A (Chronics-Mean TFT).</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
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<th>Supporting Evidence</th>
<th>No Support/Contradictory Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>XII</td>
<td>Distractability</td>
<td>High arousal-short duration and low arousal-long duration groups combined &gt; low arousal-short duration and high arousal long duration groups combined = controls.</td>
<td>1) HA + LC &gt; LA + HC (p &lt; .05),</td>
<td>1) LA + HC = controls: Stroop score (Non-Paranoids-Mean TFT).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HA + IC &gt; controls (p &lt; .005):</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Stroop score (Non-paranoids-Mean TFT).</td>
<td></td>
</tr>
<tr>
<td>XIII</td>
<td>Motor Retardation</td>
<td>Low arousal-short duration &gt; high arousal-short.</td>
<td>1) LA &gt; HA (p &lt; .05): staff ratings (Non-paranoid-all TFT indices).</td>
<td>1) HG &gt; LG (p &lt; .05): staff ratings (Chronics High TFT).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2) LG &gt; HG (p &lt; .05): staff ratings (Non-paranoids-Mean TFT).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social Withdrawal</td>
<td>Low arousal-short duration &gt; high arousal-short duration</td>
<td></td>
<td>1) No significant differences between the criterion groups on staff ratings.</td>
</tr>
<tr>
<td></td>
<td>Agitation</td>
<td>High arousal-short duration &gt; low arousal-short duration.</td>
<td>1) HG &gt; LG (p &lt; .01 - .05): staff ratings (Acutes-Mean, High TFT).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hallucinations</td>
<td>Low arousal-short duration &gt; high arousal-short duration.</td>
<td></td>
<td>1) HG &gt; LG (p &lt; .001): staff ratings (Non-paranoids-High TFT).</td>
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</tr>
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<tr>
<td>XIV</td>
<td>Motor Retardation</td>
<td>High arousal-long duration &gt; low arousal-long duration.</td>
<td>1) HC &gt; LC (p &lt; .05 - .07): staff ratings (Paranoids-Mean, High TFT).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social Withdrawal</td>
<td>High arousal-long duration &gt; low arousal-long duration.</td>
<td>1) HP &gt; LP (p &lt; .05): staff ratings (High TFT).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agitation</td>
<td>Low arousal-long duration &gt; high arousal-long duration.</td>
<td>1) LC &gt; HC (p &lt; .01): staff ratings (Non-paranoids-Mean, Low TFT).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hallucinations</td>
<td>High arousal-long duration &gt; low arousal-long duration.</td>
<td>1) No significant differences between criterion groups on staff ratings.</td>
<td></td>
</tr>
<tr>
<td>XV</td>
<td>Motor Retardation</td>
<td>Low arousal-short duration and high arousal-long duration groups combined &gt; high arousal-short duration and low arousal-long duration groups combined.</td>
<td>1) LA + HC &gt; HA + LC (p &lt; .05): staff ratings (Paranoids-all TFT indices).</td>
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</tr>
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<tr>
<td>Social Withdrawal</td>
<td>Low arousal-short duration and high arousal-long duration groups combined</td>
<td>&gt; high arousal-short duration and low arousal-long duration groups combined.</td>
<td>1) HA + LC &gt; LA + HC (p &lt; .01 - .06): staff ratings (Non-paranoids-all TFT indices).</td>
<td>1) No significant differences between criterion groups on staff ratings.</td>
</tr>
<tr>
<td>Agitation</td>
<td>High arousal-short duration and low arousal-long duration groups combined</td>
<td>&gt; low arousal-short duration and high arousal-long duration groups combined.</td>
<td>2) HG + LP &gt; LG + HP (p &lt; .06): staff ratings (Acutes-High TFT).</td>
<td></td>
</tr>
<tr>
<td>Hallucinations</td>
<td>Low arousal-short duration and high arousal-long duration groups combined</td>
<td>&gt; high arousal-short duration and low arousal-long duration groups combined.</td>
<td></td>
<td>1) No significant differences found between criterion groups on staff ratings.</td>
</tr>
</tbody>
</table>

aNote - Evidence includes group comparison, significance level, measure employed, pertinent subsample if any, and TFT index used to dichotomize high and low arousal groups.
DISCUSSION OF THE RESULTS AND FINDINGS

Cortical Arousal Abnormality in Schizophrenia

The distributions of schizophrenic and control group two flash threshold scores shown in Figures 1, 2, and 3 indicate the following: 1) The distribution of two flash arousal indices are approximately normal and unimodal for both schizophrenics and controls. As noted in the results, the group of schizophrenics clustered at the 150 msec. TFT in all three distributions probably do not represent a second mode - they simply evidenced two flash thresholds in excess of the photostimulators' highest inter-flash interval setting. Had the photostimulator had a greater inter-flash interval capacity it seems likely that the extreme right hand side of the schizophrenic two flash distributions would have tailed off in a more normal fashion. 2) The variability of schizophrenic group TFT's is significantly greater (p < .001) than that of controls and the ranges of schizophrenic TFT's are approximately two to three times as great as those of controls. 3) The range and variance differences between the schizophrenic and control group are accounted for, in large part, by the substantial number of schizophrenics (approximately 25%) who evidenced two flash thresholds well above even
the highest control TFT. In other words, variance differences were accounted for by an abnormally low arousal schizophrenic group, high TFT reflecting low arousal. They were not the result of any significant number of schizophrenics evidencing lower TFT's (higher arousal) than controls. Thus, while the low arousal schizophrenic group had significantly higher \( p < .001 \) MEAN, HIGH and LOW TFTs than the low arousal control group, the high arousal schizophrenic and high arousal control groups did not differ significantly on the TFT indices.

With respect to the hypotheses posited earlier, the results lend no support for Hypotheses I or II. The schizophrenics were not bimodally distributed in terms of arousal and there was no evidence that any significant number of schizophrenics evidenced abnormally high cortical arousal. Hypotheses III was supported in that a group of schizophrenics evidenced abnormally low levels of cortical arousal. Rather than representing a "low arousal mode" in the schizophrenic distribution, these patients appear to represent the low arousal end of an arousal continuum. Thus, taken as a whole these results suggest that there is a large group of schizophrenics (75%) with normal levels of arousal and a smaller group (25%) with abnormally low levels of arousal; there was no indication of the existence of a schizophrenic group who evidence abnormally high levels of cortical arousal.
Comparison of schizophrenic subsample and control group TFT scores indicated in terms of arousal: 1) chronics and acutes did not differ significantly on any TFT index; 2) good premorbids and poor premorbids did not differ significantly on any TFT index; 3) non-paranoids were significantly less aroused ($p < .05 - .01$) than paranoids as indicated by all three TFT indices; 4) controls were significantly ($p < .05 - .01$) more aroused than acutes, chronics, good premorbids, poor premorbids, and non-paranoid schizophrenics with the schizophrenics evidencing higher scores on at least two of three TFT indices and 5) paranoid schizophrenics and controls did not differ on any TFT index. Table 2 shows that the highest TFT scores (lowest arousal) were evidenced by non-paranoid and chronic schizophrenic subsamples, the lowest by acute and non-paranoid subsamples. It is noteworthy, that no schizophrenic subsample had a lower mean score than normals on any TFT index.

The results presented thus far contradict Venables's (1964) theory which posits that acute schizophrenics are underaroused while chronic schizophrenics are overaroused. No "overarousal" group was found; acutes and chronics did not differ in terms of arousal; and, the schizophrenic group that was shown to be underaroused appears to be comprised of chronics and non-paranoids rather than acutes. It should be noted that while the results of this study
contradict Venables's (1964) notions about arousal abnormality in schizophrenics, they are completely consistent with his empirical findings (Gruzelier and Venables, 1974). A figure presented in Gruzelier and Venables (1974) showing the distribution of TFT scores for schizophrenics and controls, shows a group of schizophrenics (approximately 70%) with TFTs within the normal range, and a smaller group (30%) with abnormally high TFTs. No group of schizophrenics was shown to have abnormally low TFTs in this study, in Venables's (1963 b, c) earlier studies or in any other study cited in the present thesis (Lykken and Maley, 1968; Neale and Cromwell; 1970).

It is not immediately apparent how to reconcile the consistent finding that no substantial group of schizophrenics demonstrates abnormally low TFTs with the conclusions of Lang and Buss (1965); Maher (1965) and Buss (1966) that some schizophrenics, probably chronics, are overaroused. (It should be noted that each of these authors base their conclusion, in large part, on evidence coming from studies of autonomic arousal in schizophrenia, not central arousal, presumably measured by two flash threshold.) The possibility exists that the anti-psychotic medication with which this study's schizophrenic subjects were treated served to obscure detection of a high arousal group by reducing arousal levels. Gruzelier (1978) in fact presents evidence supporting the view that
phenothiazines lower high levels and heighten low levels of cortical arousal, bringing both closer to the norm. Earlier work reviewed by Maher (1965) also showed that major tranquilizers, such as chlorpromazine (Thorazine), markedly reduce both central and autonomic activity. This argument is weakened, to some extent, by the result of Lykken and Maley (1968) who found no TFT differences between drug free schizophrenics and controls. Thus, while it appears possible that the effects of anti-psychotic medication serves to obscure the detection of a centrally overaroused schizophrenic group, a confirmation of this hypothesis and a reconciliation of inconsistent findings awaits a better understanding of major tranquilizer psychopharmacology and the relationship between central and autonomic arousal.

One additional point is noteworthy in comparing the results of the present investigation to the work of Venables: the issue of the reliability of schizophrenic two flash thresholds above 140 msecs. It will be remembered that Venables (1963c) contends that TFTs in excess of 140 msecs. tend to be unreliable. It has already been noted that while Venables has consistently deleted from his study samples schizophrenics whose TFTs exceeded 140 msecs. he has not shown conclusively that these scores are any less reliable than lower TFTs. The results from the present investigation lent no indication that the scores of the 10 schizophrenics with TFTs in excess of
140 msecs. were unreliable. Intra-block and inter-block consistency for these subjects was near perfect. In most cases, they simply responded that they saw one flash at every inter-flash interval. Had they been uncooperative, unmotivated or inattentive, their intra-block and inter-block consistency would have been poor. There was no indication, further, these subjects performed in haphazard fashion or were uncooperative during the other parts of the experimental procedure. In fact, many of these subjects expressed concern that they saw only one flash on most trials. Given that they were instructed "sometimes there will be one flash and sometimes there will be two flashes", these subjects often worried that they were disappointing the examiner by seeing only one flash so often. Thus, it would appear, that some of these subjects reported seeing one flash in spite of an acquiescent willingness or desire, to see two.

Breadth of Schizophrenic Attention as a Function of Level and Duration of Cortical Arousal Abnormality.

A number of the results and findings of the present investigation support the formulation of the two-factor theory that breadth of attention in schizophrenia is a function of level (high vs low) and duration (long vs short) of cortical arousal disturbance. Recapitulating, the major hypotheses were that: 1) high arousal-short duration and low arousal-long duration patients would have broadened
attention reflected by overinclusiveness, hyper-distract-
ability and agitation and 2) low arousal-short duration and 
high arousal-long duration patients would have narrowed 
attention reflected by overexclusiveness, hypo-distract-
ability and lethargy. Short disturbance duration was as-
sumed for acute and good premorbid schizophrenics, while 
long disturbance duration was assumed for chronic and poor 
premorbid schizophrenics.

Overinclusion. The results showed that when LOW TFT 
was employed to dichotomize the high and low arousal schizo-
phrenic groups, the HA group was significantly more over-
ineclusive (p < .05) than the LA group as indicated by both 
overinclusion measures (OI-A, OI-B). That the HA group, 
in fact, demonstrated a broadening of normal conceptual 
boundaries rather than the LA group demonstrating a narrow-
ing, is indicated by the fact that the HA group had signi-
ficantly higher OI-B scores (p < .05) and higher (but not 
significantly higher) OI-A scores than controls, while 
the LA group did not differ significantly from controls 
on either overinclusion measure. This finding lends 
support to Hypothesis IV which states that high arousal-
short duration schizophrenics will be more overinclusive 
than low arousal-short duration schizophrenics who will not 
differ significantly from normals.

The LC group was significantly or near significantly 
more overinclusive (p < .05 - .06) than the HC group as
indicated by OI-A scores, regardless of which TFT indice was used to dichotomize the arousal groups. That the LC group demonstrated an absolute broadening of conceptual boundaries is indicated by the fact that the LC group was significantly more overinclusive ($p < .01 - .05$) than controls as indicated by OI-A score, while the HC and control groups did not differ. This finding lends support to Hypothesis VII which states that low arousal-long duration schizophrenics will be more overinclusive than high arousal-long duration schizophrenics who will not differ from normals. Further support for Hypothesis VII comes from findings involving the paranoid and non-paranoid schizophrenic subsamples examined separately. Within the paranoid subsample the LC group had higher OI-A scores than both the HC group and controls at levels which approached significance ($p < .06 - .07$). This was the case when MEAN TFT was used to designate the high and low arousal groups. Additionally, the HC group was even less overinclusive than controls ($p < .05$), indicating that not only did the LC group evidence broadened conceptual boundaries, but the HC group evidenced narrowed boundaries as the two factor theory predicts. The same configuration of OI-A scores held for the HC, LC, and control groups when non-paranoids were examined separately and LOW TFT was used to dichotomize the high and low arousal groups. The LC group evidenced broadened conceptual boundaries and the HC group
narrowed boundaries. It should be mentioned that one finding directly contradicted Hypothesis VII: within the non-paranoid subsample when LOW TFT was used to dichotomize the arousal groups, the HP group was found to have significantly higher OI-B scores than both the LP and control groups (p < .005 - .001). The LP and control groups did not differ. This disconfirmation of the formulations of the two-factor theory is mitigated, however, by the fact that only one subject comprised the HP group for this comparison.

The HA + LC group had significantly higher OI-A scores than both the LA + HC group and the control group (p < .01 - .05) regardless of which TFT index was used to dichotomize the high and low arousal groups. The LA + HC and control groups did not differ significantly. These results lend support for Hypothesis X which states that the high arousal short duration and low arousal-long duration groups combined will be more overinclusive than the low arousal-short duration and high arousal-long duration groups combined. That the HA + LC group evidenced broader conceptual boundaries than both the LA + HC and control groups lends the strongest support thus far to the two factor theory, because it indicates that cognitive styles differ between schizophrenics groups counterbalanced both in terms of level and duration of arousal abnormality. This finding mitigates the argument that either arousal level or disturbance duration alone mediates type of thought
disorder. The findings lend support, instead, to the notion that level and duration of arousal disturbance interact in determining thought disorder type. Additional support for Hypothesis X comes from findings involving the non-paranoid schizophrenic subsample. In this case the HA + LC group had higher OI-B scores than both the LA + HC group (p < .05) and control group (p < .05 - .07) when HIGH TFT and LOW TFT were used to dichotomize the high and low arousal groups. Again, the LA + HC and control groups did not differ significantly on overinclusion.

Overexclusion. Within the paranoid schizophrenic subsample when LOW TFT was used to dichotomize the high and low arousal groups, the LA group had higher OE-A scores (p < .05 - .06) than both the HA and control groups. The HA and control groups did not differ. The LA group thus demonstrated a narrowing of conceptual boundaries as reflected by the tendency to be overexclusive. Within the chronic schizophrenic subsample when HIGH or LOW TFT were employed to dichotomize the high and low arousal groups, the LG group had significantly higher OE-A and OE-B scores than both the HG and control groups (p < .05). The HG and control groups did not differ on either overexclusion measure. The HG group thus also demonstrated a narrowing of conceptual boundaries as indicated by overexclusive tendencies. These results lend support to Hypothesis V which states that low arousal-short duration groups will be
more overexclusive than high arousal-short duration groups. Support for Hypothesis V is mitigated to some extent by the fact that differences in overexclusiveness between low arousal-short duration and high arousal-short duration groups were found only when schizophrenic subsamples were examined and not when the schizophrenic sample was examined as a whole. Speculation as to the reasons for particular subsamples showing differences on specific cognitive and behavioral measures while other subsamples or the entire schizophrenic sample do not will be addressed in a later section.

Within the acute subsample when LOW TFT was employed to dichotomize the high and low arousal groups, the LP group had significantly higher OE-A scores ($p < .05$) than both the HP and control groups. The HP and control groups did not differ on OE-A. This finding contradicts Hypothesis VIII which states that high arousal-long duration groups will be more overexclusive than low arousal-long duration groups. That the LP group evidenced narrowed conceptual boundaries is inconsistent with the two-factor theory's notion that chronically low arousal states lead to abnormally low thresholds for attentional focusing response and attributions of relevance to an abnormally high proportions of stimuli.

Within the chronic subsample when MEAN TFT was used to dichotomize the arousal groups, the LG + HP group had
significantly higher OE-B scores than the HG + LP group (p < .05) and the controls (p < .05) while the HG + LP group and controls did not differ significantly. When HIGH TFT was employed to dichotomize the arousal groups, the LG + HP group had higher OE-A and OE-B scores than both the HG + LP and control groups (p < .05) who did not differ on either overexclusion measure. These findings lend support for Hypothesis XI which states that the low arousal-short duration and high arousal-long duration group combined will be more overexclusive than the high arousal-short duration and low arousal-long duration groups combined who will not differ from controls. While these findings support the two factor theory's notion of narrowed conceptual boundaries in the low arousal-short duration and high arousal-long duration groups, this support is weakened to some extent by opposite findings within the acute subsample. For the acute sample when LOW TFT was used to dichotomize the high and low arousal groups the HG + LP group had higher OE-A scores than the LG + HP group (p < .05). Neither the HG + LP or the LG + HP group differed significantly from controls but the HG + LP group deviated from controls to a far greater extent than the LG + HP group, being more overexclusive. Thus, contrary to Hypothesis XI, within the acute subsample the high arousal-short duration and low arousal-long duration groups evidenced narrow, rather than broad conceptual boundaries.
It appears possible that part of the reason for inconsistencies in the findings concerning overexclusion has to do with the construct validity of the Chapman Card Sorting Task. If, indeed, the OE indices measure the tendency to use narrow conceptual boundaries, and the OI indices measure the tendency to use broad conceptual boundaries, then the correlations between these two sets of indices should be strongly negative, particularly if it is assumed that conceptual breadth is mediated by a stable information processing style. The results shown in Tables 14 and 15 demonstrate that this was not the case in the present investigation. The intercorrelations of IO-A and IO-B with OE-A and OE-B were all positive. This finding suggests that at least one set of these indices was not measuring the construct it was designed for. Unfortunately, these correlations alone do not allow for the determination of which, if either, lacks adequate construct validity. Inspection of the correlation matrices in Tables 14 and 15 offers some help in making this determination through the use of concurrent validity indicators, but even after inspecting these indicators the picture is still confusing. For schizophrenics, the overinclusion measures have relatively strong positive correlations with Stroop score and relatively strong negative correlations with withdrawal, as would be expected. The overexclusion measures, have relatively strong positive
as would be expected, but correlate negatively with withdrawal and only weakly with Stroop score, contrary to expectation. For controls, the OE indices have relatively strong positive correlations with TFT indices, contrary to expectation (high TFT indicates low attentional response threshold in normals and should lead to a broadness of attention, not narrowness); however, OI indices have negative correlations with TFT indices, also contrary to expectations. Thus because some evidence may be adduced in support and against the construct validity of both the overinclusion and overexclusion measures, it is difficult to determine which is the more valid. However, given the slight edge in favor of the concurrent validity of the OI measures and the greater consistency in the criterion group comparison that results involving OI measures, it may be very tentatively concluded that they are the more valid.

**Distractability - (Stroop Test Scores).** Within the non paranoid subsample when LOW TFT was employed to dichotomize the high and low arousal groups, the LC group had higher Stroop scores than both the HC and control groups at levels which approached statistical significance (p < .06). The HC and control groups, on the other hand, did not differ significantly. This finding lends partial support to Hypothesis IX which states that the low arousal-long duration groups will be more distractable than the high arousal-long duration group who will be less distractable than controls.
Within the non-paranoid population, again, when MEAN TFT was employed to dichotomize the arousal groups, the HA + LC group had significantly higher Stroop scores than the LA + HC (p < .05) and the controls groups (p < .005). The LA + HC and control groups did not differ significantly. This finding lends partial support to Hypothesis XII which states that the high arousal-short duration and low arousal long duration groups combined will be more distractable than the low arousal-short duration and high arousal-long duration group combined who will be less distractable than controls.

Also within the non-paranoid subsample when HIGH TFT was used to dichotomize the arousal groups, the HG group had significantly higher Stroop scores than the LG group (p < .05) and the control group (p < .001). The LG and control groups did not differ significantly. This finding lends partial support for Hypothesis VI which states that the high arousal-short duration groups will be more distractable than the low arousal-short duration groups who will be less distractable than controls.

Taken together the results discussed in this section lend partial and qualified support for the two factor theory's formulation that distractability in schizophrenia is mediated as a function of level and duration of arousal disturbance. It will be remembered that the two factor theory predicts that deviant arousal leads to both hyper-and
hypo-distractability depending on the duration of the arousal abnormality. These results support the idea that the high arousal-short duration and low arousal-long duration groups will be hyperdistractable, faulty internal cues leading to hyperdistractability in the former case, deviant threshold for attentional response leading to hyperdistractability in the latter case. The results do not support the idea that the low arousal-short duration and high arousal-long duration groups will be hypo-distractable. That is to say that no results showed these groups to be less distractable, or narrower in attentional scope than controls. In addition even the results showing the high arousal-short duration and low arousal-long duration groups to be hyperdistractable must be qualified, since they were found only for non-paranoids where criterion group sample size was often small.

**Psychomotor Retardation.** Within the non-paranoid subsample, the LA group and the LG group were rated as significantly more motorically retarded than the HA group and HG group (p < .05), regardless of which TFT index was employed to dichotomize the arousal groups. These findings lend some support for Hypothesis XIII which predicts that the low arousal-short duration groups will be more motorically retarded than the high arousal-short duration groups as a behavioral concomitant of their narrower scope of attention. These results must be qualified to some extent,
however, given that they were present only in the non-paranoid subsample. Within the chronic subsample, in fact, when HIGH TFT was employed to dichotomize the arousal groups, the LG group was significantly less retarded than the HG group, a finding that contradicts Hypothesis XIII.

Within the paranoid subsample when MEAN and LOW TFT were used to dichotomize the high and low arousal groups, the HC group was significantly or near significantly (p < .05 - .06) more motorically retarded than the LC group. These findings lend some support to Hypothesis XIV which predicts that the high arousal-long duration groups will be more motorically retarded than the low arousal-long duration groups as a behavioral concomitant of their narrower attentional scope.

Again within the paranoid subsample, the LA = HC group was significantly more motorically retarded (p < .05) than the HA + LC group regardless of which TFT measure was used to dichotomize the arousal groups. These findings lend support to Hypothesis XV which predicts that the low arousal-short duration and high arousal-long duration groups will be more motorically retarded owing to their narrower attentional scopes.

Taken as a whole the results above lend only qualified support to the two factor theory's notion that motor retardation, as a result of its relationship to attentional breadth, will be a function of level and duration of
arousal disturbance. Although some support for Hypothesis XIII, XIV and XIV could be found, it must be noted that the groups showing psychomotor retardation, presumably a correlate of narrowed attentional scope, did not evidence narrowed attentional scope on the cognitive indicators (OI, OE and Stroop). In addition, ratings of motor retardation did not correlate significantly with any of the cognitive measures as shown in Table 14. Thus, while it may be said that within some schizophrenic subsamples motor retardation appears to be mediated as a function of level and duration of arousal abnormality, it cannot be said that motor retardation is related to narrowed attention.

**Social Withdrawal.** When HIGH TFT was employed to dichotomize the high and low arousal groups, the HP group was significantly more socially withdrawn (p < .05) than the LP group. This finding lends support to Hypothesis XIV which predicts that the high arousal-long duration schizophrenic groups will be more withdrawn than the low arousal-long duration groups. As with psychomotor retardation, social withdrawal was assumed to be a behavioral concomitant of the HP group's narrowed attentional focus. However, no evidence can be found in the comparisons of the HP and LP groups on cognitive measures to show that the former group indeed had narrowed attentional scopes. The support for Hypothesis XIV concerning social withdrawal must therefore
be qualified in light of this fact. It should also be noted that the high and low arousal-short duration groups did not differ in terms of social withdrawal contrary to the prediction of Hypothesis XIII; nor did the high arousal-short duration and low arousal-long duration combined groups differ from the low arousal-short duration and high arousal-long duration combined group, contrary to the prediction of Hypothesis XV.

Agitation. Within the acute subsample when MEAN and HIGH TFT were used to dichotomize the arousal groups, the HG group was rated as significantly more agitated ($p < .01$) than the LG group. Additionally, when the entire schizophrenic sample was examined and HIGH TFT used to divide the high and low arousal groups, the HG group was rated as more agitated than the LG group with the difference approaching statistical significance ($p < .07$). These results lend some support to Hypothesis XIII which predicts that high arousal-short duration schizophrenics will be more agitated than low arousal-short duration schizophrenics.

Within the non-paranoid subsample when MEAN and LOW TFT were used to dichotomize the arousal groups, the LC group was rated as significantly more agitated ($p < .01$) than the HC group. These results lend some support to Hypothesis XIV which predicts that low arousal-long duration groups will be more agitated than high arousal-long duration groups.
Also within the non-paranoid subsamples, the HA + LC group was rated as significantly or near significantly more agitated (p < .01 - .06) than the LA + HC group regardless of which TFT index was used to divide the arousal groups. Additionally, within the acute subsample, when HIGH TFT was used to divide the arousal groups, the HG + LP group had near significantly higher agitation scores (p < .06) than the LG + HP group. These findings lend support to Hypothesis XV which predicts that the high arousal-short duration and low arousal-long duration groups combined will be more agitated than the low arousal-short duration and high arousal-long duration groups.

Taken together these results lend some support to the two factor theory's notion that agitation will be a behavioral concomitant of broadened attention and that attentional breadth is a function of level and duration of cortical arousal disturbance. That is to say that two of three groups shown to be more agitated (the LC non-paranoids and the HA + LC non-paranoids) were also shown to be broader in attentional focus than their respective comparison groups on cognitive measures. The LC and HA + LC non-paranoids were significantly more overinclusive and higher in distractability (Stroop score) than HC and LA + HC non-paranoids respectively.

Hallucinations. Very little evidence could be found to support the notion that narrowed attention results in
sensory information deprivation which in turn leads to greater frequency of a hallucinatory symptoms. Although a significant correlation \( r = .23; p < .05 \) was found between indices of overexclusion, presumably measures of narrowed attentional scope, and ratings of hallucinatory activity, no criterion group differences were found with one exception. Within the non-paranoid subsample when HIGH TFT was used to dichotomize the arousal groups, the HG group was rated as having significantly \( p < .001 \) more marked hallucinations than the LG group. While the HG group contained only one subject, these results directly contradicted the prediction of Hypothesis XIII that the narrowed attention LG group would have more marked hallucinations than the broadened attentional HG group.

**Issues and Conclusions**

Table 16, the summary of the results and findings of this study, shows that 12 of the 15 hypothesis generated earlier received at least some support in the results and three received unqualified support. (Unqualified support refers to predictions that were upheld for the entire schizophrenic sample across all TFT indices). Perhaps the most striking result was the recurrent finding that when one arousal level x duration criterion group of a pair deviated in cognitive style in the predicted direction, its comparison group often did not differ significantly from controls. For example, when broadened attention groups
(high arousal-short duration and low arousal-long duration) showed higher overinclusion scores as predicted, the narrowed attention groups (low arousal-short duration and high arousal-long duration showed overinclusion scores that were no different, or in some cases even lower than controls. When narrowed attention groups showed higher overexclusion scores as predicted, broadened attention groups showed overexclusion scores that were no different or in some cases even lower than controls. These findings lend strong support to the notion encompassed by the two fact theory that two different types of thought disorder exist in schizophrenia. They in addition, stand in contrast to the findings of studies that compare amount of cognitive deficit in controls and schizophrenics dichotomized on duration of illness (acute-chronic, good premorbid-poor premorbid) alone. The typical finding of these studies indicate that on any number of cognitive tasks, chronics and poor premorbid perform more poorly than acutes and good premorbids who in turn perform more poorly than normals (Chapman and Chapman, 1973). The results of the present investigation suggest that when both arousal level and duration of disturbance are accounted for, bidirectional predictions of schizophrenic attentional breadth are possible. That breadth of attention in schizophrenia is mediated as a function of level and duration of arousal disturbance and not by arousal or duration separately, is indicated by a number of findings.
First, measures of cortical arousal alone produced no significant correlations with any of the cognitive and behavioral measures when the entire schizophrenic sample was examined. Second, in comparisons of criterion groups where both arousal level and duration of disturbance were counterbalanced (i.e.; HA + LC vs LA + HC and HG + LP vs LG + HP comparisons) significant differences in attentional breadth were found in the predicted directions for a variety of the cognitive and behavioral measures. Third, although groups dichotomized in terms of duration alone (i.e.: chronic vs acute and good premorbids vs bad premorbids) differed on a few cognitive and behavioral measures, they did not differ significantly on the overwhelming majority of these measures.

With these findings, a good deal of evidence has been adduced to support the formulations of the two factor theory. However, acceptance of the theory as a whole is inhibited by a number of unresolved problems. The most important of these problems concerns the failure of this study (and other studies) to isolate a cortically over-aroused schizophrenic group. The lack of detecting such a group confronts the two factor theory with an interesting theoretical paradox. The two factor theory is predicated on the assumption that abnormal cortical arousal levels are the neurophysiological underpinnings of deviant attentional breadth in schizophrenia with type of attentional deviance, overly broad or narrow, a function of arousal level and
arousal disturbance duration. Yet, while it has been shown that narrowed and broadened attention vary as a result of this function, it has not been shown that all or even a majority of schizophrenics demonstrate cortical arousal deviance. Seventy-five percent, in fact, show arousal levels within normal limits. The other 25 percent were under-aroused. Thus, while it may be accurate to speak of the LA, LG, LC and LP groups as the low arousal schizophrenics, it is a misnomer to refer to the HA, HG, HC and HP groups as the "high" arousal schizophrenics for they are, in fact, the normal arousal schizophrenics. The question, then arises: if schizophrenia results from cortical arousal disturbance, why do the results indicate that schizophrenics with normal arousal sometimes evidence more attentional deviance than schizophrenics with abnormal arousal? Put another way, why is that the "high" arousal-short duration group showed abnormally broad attentional breadth, and the "high" arousal-long duration group showed abnormally narrow attentional breadth as predicted by the two factor theory, if in fact their cortical arousal was not abnormally high?

Two hypotheses, neither of which alone are totally adequate, can be offered to explain these apparently paradoxical findings. First, as mentioned earlier, it is possible that the effects of anti-psychotic medication served to obscure the detection of an overaroused schizophrenic group. While in theory normal arousal, drug
induced or not, should lead to normal attentional scope, the possibility cannot be ruled out that complete cognitive recovery lags behind the physiological effects of psychotherapeutic medication. Thus "high" arousal schizophrenics may be behaving as if they are overaroused, even though their cortical arousal is within normal limits. It is possible, for example, that their autonomic arousal is still at deviant levels, high for acutes and good premorbid, low for chronics and poor premorbid, leading them to overreact or underreact to informational stimuli. Of course, Lykken and Maley's (1968) failure to detect a cortically overaroused group using schizophrenics withdrawn from drugs mitigates the strength of this argument, but it nevertheless cannot be ruled out, particularly in light of how little is known about the long term effects of anti-psychotic agents. Second, examination of the two factor theory reveals that "high" arousal-short duration schizophrenic need not necessarily be abnormally high in arousal for the manifestations of broadened attentional scope to be evidenced as predicted. It will be remembered that the theory posits that short duration schizophrenics react to arousal states that deviate from their personal arousal tonus norm. If it is assumed that the high arousal-short duration patients, during their periods of normal brain functioning, had tonic arousal levels at the low arousal end of the normal distribution, then significant increases in arousal
might yield TFT readings within the normal range, but still serve as cue producing internal stimuli, eliciting hyper-attentional focus, overinclusive thinking, distractability and agitation. This formulation, of course, would not explain why high arousal-long duration schizophrenics evidenced a narrowing of attention. This is the case because long duration subjects, according to the two factor theory, should be reacting to chronically high levels of arousal which are absolute in their abnormality. As it turns out, this formulation is not needed to explain results concerning high arousal-long duration patients: Table 16 shows that no high arousal-long duration group deviated from controls on any cognitive measure (except that the non-paranoid HP group composed of one subject had a higher OI-B score than controls). The validity of this explanation as it concerns the high arousal-short duration groups can only be tested by obtaining measures of cortical arousal during and in between the patients' episodes of psychoses.

Another problem confronting the validity of the two factor theory lies in the fact that while its formulations involve schizophrenics in general, the results showed that some of the predictions made on the basis of these formulations held true only for specific subsamples. This is a thorny problem for several reasons. First, inspection of the results in Table 16 shows no immediately apparent consistency in the findings among the subsamples. That is to
say that no one subsample seems more sensitive to the predictions of the two factor theory than any other subsample. Second, because the criterion groups were derived on the basis of the interaction of two variables (i.e.: arousal and duration), the interpretation of subsample findings involves unraveling a three way interaction of variables, always a difficult and confusing task. Add to this the fact that different subsamples seem sensitive to different measures of attentional breadth and the result is an uninterpretable four way interaction of variables. Third, given the number of statistical comparisons made using subsamples (sometimes as many as 96) the possibility exists that some of the results confirming hypotheses were due to alpha error or chance. Table 17 shows the frequency of confirming and non-confirming significant results of unplanned subsample comparisons when whole sample results were not significant. It can be seen that for Hypotheses VI, IX and XII (involving distractability) the frequency of significant confirming results does not exceed the number expected due to chance alone. Subsample results in these cases cannot therefore be considered support for the two factor theory. The frequency confirming results yielded by subsample comparisons did exceed the number expected by chance for the other hypotheses listed in Table 17. In spite of these problems, however, some light can be shed on the pattern of subsample results.
TABLE 17

Frequency of Confirming and Nonconfirming Significant Results of Unplanned Subsample Comparisons When Whole Sample Results Were Not Significant

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Total</th>
<th>Significant Confirmations&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Significant Nonconfirmations&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Significant Results Expected by Chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>96</td>
<td>10</td>
<td>0</td>
<td>4.8</td>
</tr>
<tr>
<td>VI</td>
<td>48</td>
<td>2</td>
<td>0</td>
<td>2.4</td>
</tr>
<tr>
<td>VIII</td>
<td>96</td>
<td>0</td>
<td>0</td>
<td>4.8</td>
</tr>
<tr>
<td>IX</td>
<td>48</td>
<td>2</td>
<td>0</td>
<td>2.4</td>
</tr>
<tr>
<td>XI</td>
<td>96</td>
<td>5</td>
<td>1</td>
<td>4.8</td>
</tr>
<tr>
<td>XII</td>
<td>48</td>
<td>2</td>
<td>0</td>
<td>2.4</td>
</tr>
<tr>
<td>XIII</td>
<td>96</td>
<td>7</td>
<td>2</td>
<td>4.8</td>
</tr>
<tr>
<td>XIV</td>
<td>96</td>
<td>5</td>
<td>0</td>
<td>4.8</td>
</tr>
<tr>
<td>XV</td>
<td>96</td>
<td>7</td>
<td>0</td>
<td>4.8</td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant confirmations refer to results of unplanned comparisons which were in the direction predicted and statistically significant p<.05.

<sup>b</sup>Significant nonconfirmations refer to results of unplanned comparisons which were in the direction opposite to prediction and statically significant p<.05.
First, it should be noted that for several hypotheses (IV, VII, X), particularly those involving overinclusion, predictions were upheld for the entire schizophrenic sample. In these cases, additional findings involving subsamples can only increase understanding of which schizophrenic subgroups are particularly sensitive to a broadening of conceptual boundaries as a result of the arousal level-disturbance duration interaction. Given this, inspection of the results leads to the tentative conclusion that while overinclusion is mediated as a function of level and duration of arousal disturbance for schizophrenics in general, non-paranoid schizophrenics are particularly sensitive to this effect.

Second, it is noteworthy that most of the consistent findings supporting the predictions of the two-factor theory occur in cases where chronicity rather than premorbid status was employed as the "duration" variable. Not only was chronicity the duration variable employed in each case where predictions held up for the entire schizophrenic sample, but no results contradicting the predictions of the two factor theory were found when chronicity was employed. It is suggested that this was the case because in terms of the two factor theory chronicity yields a more accurate measure of arousal disturbance duration than premorbid status. The formulations of the two factor theory rest on the thinking that schizophrenics who are ill for the longest periods of time tend to adapt to their deviant levels of cortical
arousal. Given this, it is reasonable to assume that a middle aged patient with a 20 year chronic history adapted to his abnormal arousal state, even if he had a relatively good premorbid history. Likewise, a poor premorbid patient who has evidenced relatively long psychosis free periods in adult life might be more aptly considered a short duration patient. Viewed in this light, it can be suggested that the findings contradicting the two factor theory, which as has been noted occur only when premorbidity was used as the duration variable, may result from the misclassification of some long and short duration patients. It should be noted also that the effects of institutionalization per se are confounded with duration of illness.

The last problem confronting the two-factor theory concerns a confusing set of findings involving the control group. Table 15 shows that a number of the cognitive measures, OE-A, OE-B, and Stroop score correlated significantly with TFT arousal measures. This fact in itself is not unexpected as the two factor theory predicts that cortical arousal level and attentional breadth should be related in populations with stable arousal tonus (i.e., controls and long duration schizophrenics). What is confusing is the fact that the signs of these correlations stand in contrast to the predictions of the two factor theory and the results of other neurophysiological studies with normals. Two flash threshold was positively correlated with measures of
overexclusion ($r = +.38 - .40; p < .05$) and negatively correlated with measures of distractability (Stroop score) ($r = -.37 - .42; p < .05$) for controls. Remembering that high arousal is related to narrow attentional scope, rather than broad attentional scope, these findings are inconsistent with the work of Callaway (1959), Callaway and Band (1958), Callaway and Thompson (1953), Venables (1964) and Wilder (1958), all of whom present evidence to support the notion that narrowed attention is related to high arousal states in normals.

The explanations of these contradictory results may lie in problems involving the validity of the cognitive measures. It has already been noted that the validity of the overexclusion indices is, to some extent, questionable. Table 15 shows both OE measures correlating positively and in one instance significantly with measures of overinclusion. Thus, it may be the case that the overexclusion indices like the overinclusion indices reflect a broadening of attentional scope. Errors of omission tapped by OE measures may result from inattentiveness or weak achievement orientation, possible manifestations of diffuse attentional focus. The Stroop measure of distractability faces a different validity problems. First, because it employs difference scores (i.e., the difference in time taken to recite two lists) it is difficult to ascertain that subjects with similar scores have similar levels of distractability. A
subject scoring 12 on List I and 15 on List II, achieves the same distractability score as a subject scoring 4 on List I and 7 on List II. It would be fallacious to assume on the basis of these scores that the two subjects are equally distractable. If the time taken to recite the lists indeed reflects degree of distractability, then the former subject must be seen as far more distractable than the latter. Second, as Ferguson (1971) points out, when two scores are highly correlated, differences tabulated from the scores are unreliable containing large portions of error variance. The correlation between Stroop List I and List II was +.50 (p < .0005) for controls and +.45 (p < .001) for schizophrenics, calling into question the reliability of the Stroop test as a measure of attentional breadth. Third, it is possible that longer times on the Stroop Card II may represent a loss of motivation engendered by task difficulty rather than or in addition to distractability. Given the questionable validity of the Stroop test, as well as the fact that chance alone was shown to account for the findings when it was employed to compare subsamples, it appears reasonable to disregard findings involving the Stroop test. Hence, the statement made earlier that 12 of 15 study hypotheses received at least some support in the results must be revised: nine of 15 hypotheses received at least partial support and three received unqualified support.
In spite of the problems noted above, enough support for the two factor theory has been found in the results of this investigation to warrant future work examining the relationship of schizophrenic attentional breadth to the arousal level x disturbance duration interaction. In light of the problems arising from the results in this study several suggestions for future work can be made. First in any replication of this study, attempts should be made to employ a drug free, as well as, a medicated schizophrenic group to allow for an adequate comparison between the arousal score distributions of schizophrenics and normals. Second, in addition to cognitive measures, skin conductance orienting response (SCOR) measures might be used to provide indices of attentional breadth. As noted in an earlier section SCOR provides a rather basic, culture free and highly quantifiable measure of whether a subject is hyper-attentive to informationally irrelevant stimuli, or hypo-attentive to informationally relevant stimuli. Third, given that chronicity and premorbid adjustment status possibly yield different kinds of disturbance duration information, attempts might be made to derive an index of disturbance duration taking both variables into account. This might be accomplished by computing standard scores for each measure and combining them. Fourth, and finally, the external validity of the cortical arousal construct might be improved and understanding of the arousal concept itself
broadened by an investigation that employed several measures of central arousal, such as EEG and two flash, as well as measures of autonomic arousal.
SUMMARY

Breadth of attentional scope in schizophrenia was hypothesized to vary as a function of level (high-low) and duration (long-short) of cortical arousal abnormality. A "two factor" theory was proposed which posited broadened attentional scope for high arousal-short duration and low arousal-long duration schizophrenics. Narrowed attentional scope was predicted for low arousal-short duration and high arousal-long duration schizophrenics. Deviant arousal levels were proposed to be experienced as cue producing internal stimuli by short duration patients, resulting in misattributions of environmental stimuli relevance. Deviant arousal levels were proposed to be experienced as abnormal thresholds for attentional responsivity and adapted to by long duration patients.

Seventy schizophrenic and 30 control subjects were employed in the investigation. Cortical arousal was measured by two flash threshold. Duration was assumed to be reflected by chronic-acute and premorbid adjustment status. Attentional breadth was measured by indices of overinclusive-overexclusive thinking, distractability, and staff ratings of patient behavior. Of 15 hypotheses generated on the basis of the two factor theory, nine received at least
partial support, three received unqualified support. Although problems were noted, it was concluded that the two factor theory warranted further experimental examination.
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APPENDIX A
BRIEFING

I am conducting a study to see how different people put things in groups or categories. I am interested in what aspects of things people pay attention to or disregard when they make categorizations. My guess is that different people will group things together for different reasons because they pay attention to different things.

I was hoping that you would volunteer to help me with this project. I know that Dr. (staff member) has told you a little bit about the study but let me repeat what I would be asking you to do if you decide to participate. First, I will ask you to name some colors. That will take about three minutes. Second, I will ask you to sort cards with the names of things on them into different categories. This will take about 10 minutes. Third, I will ask you to look at a lamp where I will be presenting flashes of light and ask you whether you see one flash or two. This should take about 15 minutes. After these, I might ask you a few questions about yourself like whether you are married or if you used to belong to any clubs in school.

I want you to know that all the work you do with me is completely confidential. I will be identifying all my records with numbers instead of names to assure confidentiality.

Because this is a research project and has nothing to do with your treatment at the hospital, I will not report the results of your work with me to you or anyone else. After the project is over though, I will explain to you what it was about in greater detail and if you like, I will tell you its major findings.

Please remember that you are under no obligation to volunteer for this project. Even if you agree to participate, you can discontinue your participation at any time without any adverse consequences.

Do you have any questions?
APPENDIX B
INFORMED CONSENT

I hereby volunteer to participate in Mr. Pfau's study. The nature of the study and the things I will be asked to do have been explained to me. First, I will name some colors. Second, I will categorize some cards with the names of things printed on them. Third, I will watch a small flashing lamp and tell whether I saw one flash or two. After this I may answer a few questions about myself. I understand that I am under no obligation to participate and that I may discontinue my participation at any time. I have been informed that all information regarding my participation will be strictly confidential.

Volunteer's signature _________________________________

Date __________________________

Witnessed ________________________
APPENDIX C
I. Premorbid History

A1. Recent Sexual Adjustment (22 years and over, or under 22 years and has been married)

1. Stable heterosexual relation and marriage .... 0

2. Continued heterosexual relation and marriage but unable to establish home ....... 1

3. Continued heterosexual relation and marriage broken by permanent separation ....... 2

4. (a) Continued heterosexual relation and marriage but with low sexual drive ....... 3

(b) Continued heterosexual relation with deep emotional meaning but emotionally unable to develop it into marriage ....... 3

5. (a) Casual but continued heterosexual relations, i.e., "affairs," but nothing more ....................... 4

(b) Homosexual contacts with lack of or chronic failure in heterosexual experiences ....................... 4

6. (a) Occasional casual heterosexual or homosexual experience with no deep emotional bond ....................... 5

(b) Solitary masturbation with no active attempt at homosexual or heterosexual experiences ....................... 5

7. No sexual interest in either men or women .... 6

A2. Recent Sexual Adjustment (Under 22 years and never married)

1. Appropriate, age-related sexual contact with opposite sex, accompanied by prolonged relationship (> 6 months) ....................... 0
2. Appropriate, age-related sexual contact with opposite sex, but unable to establish prolonged relationships (of more than 6 months). 1

3. Appropriate, age-related sexual activities, but no durable friendships with opposite sex. 2

4. Regular socializing with opposite sex, but no or very little age-related sexual activity with opposite sex. 3

5. (a) Sporadic, superficial contact with opposite sex. 4

(b) Chronic failure with opposite sex or lack of relationships with them but some sexual experiences with same sex. 4

6. Solitary masturbation with no active attempt at homosexual or heterosexual experiences. 5

7. No sexual interest in either males or females 6

B. Social Aspects of Sexual Life During Adolescence and Immediately Beyond

1. Always showed a healthy interest in opposite sex with a steady girl friend (boyfriend) during adolescence. 0

2. Started dating regularly in adolescence. 1

3. Always mixed closely with boys and girls. 2

4. Consistent deep interest in same sex attachments with restricted or no interest in opposite sex. 3

5. (a) Casual same sex attachments with inadequate attempts at adjustment to going out with opposite sex. 4

(b) Casual contacts with boys and girls. 4

6. (a) Casual contacts with same sex and with lack of interest in opposite sex. 5

(b) Occasional contacts with opposite sex. 5
7. No desire to be with boys and girls; never went out with opposite sex................... 6

C. Social Aspects of Recent Sexual Life: 30 Years of Age and Above

1. Married and has children, living as a family unit................................. 0

2. Married and has children but unable to establish or maintain a family home........ 1

3. Has been married and had children but permanently separated..................... 2

4. (a) Married but considerable marital discord........................................ 3

(b) Single, but has had engagement or deep heterosexual relationship but emotionally unable to carry it through to marriage........................................... 3

5. Single, with short engagements or relationships with opposite sex which do not appear to have had much emotional depth for both partners, i.e., "affairs"......................... 4

6. (a) Single, has dated some but without other indications of a continuous interest in opposite sex................................. 5

(b) Single, consistent deep interest in same sex attachments, no interest in opposite sex............................................. 5

7. (a) Single, occasional same sex contacts, no interest in opposite sex............. 6

(b) Single, interested in neither men nor women........................................... 6

D1. Social Aspects of Recent Sexual Life: (22 to 29 Years of Age or Under 22 Years and Has Been Married)

1. Married, living as family unit, with or without children........................ 0
2. (a) Married with or without children, but unable to establish or maintain a family home.................................. 1
   (b) Single but engaged or in a deep heterosexual relationship (presumably leading toward marriage)........................ 1

3. Single, has had engagement or deep heterosexual relationship but has emotionally been unable to carry it through to marriage........ 2

4. Single, consistent deep interest in some sex attachments, with restricted or lack of interest in opposite sex.................. 3

5. Single, casual same sex relationships with restricted or lack of interest in opposite sex........................................ 4

6. Single, has gone out with a few members of opposite sex casually but without other indications of a continuous interest in opposite sex................................. 5

7. (a) Single, never interested in or never associated with either men or women...... 6
    (b) Antisocial.................................................. 6

D2. Social Aspects of Recent Sexual Life (Under 22 Years and Never Married)

1. Has a steady girl friend (boyfriend) with considerable emotional involvement........... 0

2. Has had a steady girl friend (boyfriend) but experienced problems or difficulty in the relationship................................. 1

3. Has had one, two or more girl friends (boyfriends), but never quite developed into a steady relationship with only one person..... 2

4. Considerable interest in same sex attachments with restricted or lack of interest in opposite sex.......................... 3
5. Superficial same sex relationships with restricted or lack of interest in opposite sex .......................... 4

6. Restricted interest in being with either males or females ................................................. 5

7. Antisocial .......................................................................................................................... 6

E. Personal Relations: History

1. Always has had a number of close friends but did not habitually play a leading role........ 1

2. From adolescence on had a few close friends ................................................................. 3

3. From adolescence on had a few casual friends ............................................................... 3

4. From adolescence on stopped having friends .............................................................. 4

5. (a) No intimate friends after childhood ......................................................................... 5

(b) Casual but never any deep intimate mutual friendships........................................... 5

6. Never worried about boys or girls; no desire to be with boys and girls ...................... 6

F. Recent Premorbid Adjustment in Personal Relations

1. Habitually mixed with others, but not a leader ......................................................... 1

2. Mixed only with a close friend or group of friends ..................................................... 3

3. No close friends; very few friends; had friends but never quite accepted by them .... 4

4. Quiet; aloof; seclusive; preferred to be by self ......................................................... 5

5. Antisocial .......................................................................................................................... 6
**DEWOLFE’S GENERAL INFORMATION QUESTIONNAIRE**

1. **What is your current marital status?**
   - Single
   - First marriage
   - Widowed
   - Divorced
   - Separated
   - Second marriage
   - Third or more marriage

2. **How well do you get along with your wife or girl friend, husband or boyfriend?**
   - Very well; never quarrel or disagree; almost perfect
   - Fairly well; a few quarrels or disagreements, but enjoy being together most of the time
   - All right; some ups and some downs
   - Not too well; mostly bickering and tension but occasional peace and contentment together
   - Poorly; constantly quarreling with disagreements and tension
   - No wife or girl friend at present

3. **If your answer to item 12 has not always been true, how long has it been true?**
   - Always been this way
   - Been this way a long time
   - Only a short time
   - No wife or girl friend at present

4. **What is your length of marriage?**
   (If more than one, length of longest)
   - Never married
   - Under 1 year
   - 1 to 5 years
   - 6 to 10 years
   - 11 to 20 years
   - Over 20 years

5. **How many children do you have?**
   - Never married
   - No children
   - 1 child
   - 2 to 4 children
   - Over 4 children

6. **How old were you when you were first married?**
   - Never married
   - Under 20
   - 20-24
   - 25-29
   - 30-34
   - 35 or over Husband’s

7. **What is your wife’s age comparison with yours?**
   - More than 5 years younger than I
   - Less than 5 years younger than I
   - Less than 5 years older than I
   - More than 5 years older than I
   - Same age as I am

8. **How many men/women have you dated in the past year?**
   - Only my wife/husband
   - None
   - 1 or 2
   - 3 to 5
   - 6 to 10
   - Over 10

9. **If single, have you dated any men/women more than 10 times in the past year?**
   - Married
   - Yes
   - No

10. **Are you now or have you ever been engaged to be married?**
    - Married before
    - Married now
    - Engaged now
    - Engaged before
    - Never engaged

11. **Do you now have definite plans to be married within one year?**
    - Married now
    - Yes
    - No
12) How many girls/boys did you date before you were eighteen?

- None
- 1 to 5
- 6 to 10
- 11 to 20
- Over 20

13) How many girls/boys did you date more than five times before you were eighteen?

- None
- 1 or 2
- 3 to 5
- 6 to 10
- Over 10

14) Have you ever dated frequently and regularly? If so, how old were you when you started?

- Never did
- Over 18
- 16 to 18
- 14 to 16
- 13 or younger

15) Did you have a "steady girl/guy" before you were eighteen?

- No
- Yes

16) How many friends did you have between the ages of 6 and 12? (Real friends, not just people whom you knew by name)

- No real friends, then
- 1
- 2
- 3
- 4 or 5
- 6 or 7
- 8 to 10
- More than 10

17) How close were your friends when you were between the ages of 6 and 12?

- No friends, then
- Mainly casual friendships
- Mainly close friends

18) How many real friends did you have between the ages of 12 and 18?

- No real friends
- 1 or 2
- 3 to 5
- 6 to 10
- Over 10

19) How close were these friends?

- No friends then
- A few casual friends
- A few close friends
- A number of close and casual friends

20) How well did you get along in elementary and high school?

- Never went to school
- Never seemed to have any trouble
- Disciplined by teachers a few times
- Often disciplined by teachers or by principal
- Expelled from school

21) How many of your real friends (before you were eighteen) were girls?

- Not really friendly with any girl
- One or two
- A few
- Quite a few
- Mainly girls for friends

22) When you are in a group, how do the others usually think of you?

- A "go getter"
- Just one of the group
- One of the quieter ones
- Other never notice me
- I usually try to stay out of groups as much as possible

23) How many real friends do you have now?

- None at present
- A few
- Some
- Many

24) Do you now have any close friends that you can share your feelings and thoughts with?

- No
- Yes

25) If you are single, before entering the hospital, did you:

- Live alone
- Live with parents
- Live with relatives
- Live with friends
- I am married
26) DO YOU NOW KNOW ANY MEN/WOMEN
THAT YOU CAN SHARE YOUR FEELINGS
AND THOUGHTS WITH? (Include your
wife/husband if married)
No
Yes

27) DO YOU HAVE ANY FRIENDS YOU
HAVE KNOWN FOR OVER FIVE YEARS
WITH WHOM YOU ARE STILL FRIENDS?
No
Yes

28) WHAT ACTIVITIES DID YOU TAKE PART
IN IN ELEMENTARY AND HIGH SCHOOL?
(Check as many as apply to you)
Language or Hobby Clubs
Student government
"Major" sports: Football
Basketball, Track, Baseball
Other high school sports
teams
Musical or Dramatic groups
Fraternities or Social
Clubs
Debate or Academic (Science
or literary, etc.) Clubs
Ran around with a group,
clique or gang.
Was not interested in
group activities.

29) HOW MANY BOOKS HAVE YOU
READ IN THE LAST YEAR?
None
1 or 2
3 to 5
6 to 10
Over 10

30) WHAT KIND OF BOOKS DO YOU
READ?
Fiction
Non-fiction
Both
Neither

31) WHAT MAGAZINES DO YOU
FREQUENTLY READ?

32) WHAT ARE YOUR HOBBIES?

33) WHAT GROUPS OR ORGANIZATIONS
DO YOU BELONG TO?
STAFF RATING SCALE

Below are a list of characteristics/symptoms followed by a six point continuum of intensity. Please check the point on the continuum that best describes the patient.

The patient evidences:

1) Psychomotor retardation

MARKED / / / / / NOT AT ALL
6 5 4 3 2 1

2) Social withdrawal

MARKED / / / / / NOT AT ALL
6 5 4 3 2 1

3) Agitation

MARKED / / / / / NOT AT ALL
6 5 4 3 2 1

4) Hallucinations

MARKED / / / / / NOT AT ALL
6 5 4 3 2 1

5) Does this patient evidence coherent paranoid delusions?

YES ________ NO ________ Difficult to Determine ________
APPENDIX F
STROOP CARD I

GREEN

BROWN

PINK

BLACK

RED

GREY

ORANGE

PURPLE

YELLOW

BLUE

Note: Color names refer to the color of ink used to fill each box.
STROOP CARD II

BLACK (GREEN)
PURPLE (BROWN)
YELLOW (PINK)
BLUE (BLACK)
BROWN (RED)
GREEN (GREY)
PINK (ORANGE)
GREY (PURPLE)
ORANGE (YELLOW)
RED (BLUE)

Note: Colors in parentheses refer to the color of ink used to print the color names in large type.
# Chapman Card Sorting Task Items

<table>
<thead>
<tr>
<th>DECK I</th>
<th>DECK II</th>
<th>DECK III</th>
<th>DECK IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEACH</td>
<td>SEAGULL</td>
<td>ROSE</td>
<td>HORSE</td>
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<tr>
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<td>PIG</td>
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<td>DUCK</td>
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<td>GOAT</td>
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<td>OWL</td>
<td>MARIGOLD</td>
<td>MULE</td>
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<td>ROBIN</td>
<td>DAISY</td>
<td>DOG</td>
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<td>DRESS</td>
<td>CROWBAR</td>
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<td>HAT</td>
<td>AX</td>
<td>VIOLIN</td>
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<td>BELT</td>
<td>VISE</td>
<td>SAXOPHONE</td>
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<tr>
<td>BASKETBALL</td>
<td>TIE</td>
<td>HACKSAW</td>
<td>TUBA</td>
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</tbody>
</table>

(Plus all of Deck I)  
(Plus all of Deck II)
DEBRIEFING

As was explained earlier, this was a study to see how different people put things into groups or categories and to see what thing people pay attention to when they are categorizing objects.

The task where you named the different colored boxes and words was called the Stroop test. It gives an index of how much you are distracted by interference, (the different color names). The task where you sorted the cards is called the Chapman Card Sort. It gives an index of whether you tend to put things into broad or narrow categories. The task where you watched the flashes gives a measure of how alert you were while completing the task.

My guess is that there is a relationship between peoples' alertness, how much interference distracts them and how they categorize things. I think, too, that peoples' personalities and emotions affects these things as well. The purpose of this study is to try and understand these relationships.

Do you have any questions?

If you have any questions later or you are interested in the major findings of this project please contact me through the Psychology Department at Ext: 2741.

Thank you for volunteering. Your participation is much appreciated.
Breadth of attentional scope in schizophrenia was hypothesized to vary as a function of level (high-low) and duration (long-short) of cortical arousal abnormality. A "two factor" theory was proposed which posited broadened attentional scope for high arousal-short duration and low arousal-long duration schizophrenics. Narrowed attentional scope was predicted for low arousal-short duration and high arousal-long duration schizophrenics. Deviant arousal levels were proposed to be experienced as cue producing internal stimuli by short duration patients, resulting in misattributions of environmental stimuli relevance. Deviant arousal levels were proposed to be experienced as abnormal thresholds for attentional responsivity and adapted to by long duration patients.

Seventy schizophrenic and 30 control subjects were employed in the investigation. Cortical arousal was measured by two flash threshold. Duration was assumed to be reflected by chronic-acute and premorbid adjustment status. Attentional breadth was measured by indices of overinclusive-overexclusive thinking, distractability, and staff ratings of patient behavior. Of 15 hypotheses generated on the basis of the two factor theory, nine received at least
partial support, three received unqualified support. Although problems were noted, it was concluded that the two factor theory warranted further experimental examination.
The dissertation submitted by Bruce Pfau has been read and approved by the following committee:

Dr. Alan S. DeWolfe, Director
Professor, Psychology, Loyola

Dr. Mark S. Mayzner
Professor, Psychology, Loyola

Dr. Eugene Kennedy
Professor, Psychology, Loyola

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Date 

Director's Signature