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CONFIRMATION BIASES IN PARANOID AND NONPARANOID SCHIZOPHRENIA

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CONFIRMATION BIASES IN PARANOID AND NONPARANOID SCHIZOPHRENIA

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Graduate School of the Ohio State University

By

Diana Lynn Chamrad, B.A., M.A.

The Ohio State University

1986

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To Patrick...
McKay...
And life post-dissertation style
ACKNOWLEDGEMENTS

This document symbolizes the end of a very long process that began in 1973 with an instructor at a junior college in Texas, Mr. Dry. Neither of us realized then how my naive fascination with introductory psychology would carry me through the years. I have had the pleasure of working with many enthusiastic and prodding professors over the years, and those individuals helped sustain my desire to reach this goal. My greatest thanks have to go to the adviser who got me over the fence, Dr. Denny Nolan. I most appreciate the ease with which he took me on as an advisee mid-graduate-school, the subsequent support he has provided, and his astute manner of studying psychology. My sincere thanks to Dr. Neal Johnson, who is sitting in for a third time on one of my committees, and Dr. Gifford Weary, a second-timer. They both sparked my interest in two areas, cognitive and social psychology, greatly influencing the conceptual framework of this dissertation. The personal support I have received from family and friends over the years has been at least as important as the academic support. Especially the support of my husband, Patrick Johnson, who has seen me through this with amazing consideration and understanding. Thanks.
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CHAPTER I
INTRODUCTION

Disorders in which an individual apparently loses the ability to reason have long been of interest to clinicians and researchers in psychiatry and psychology. Such disorders were originally termed dementias (Kraeplin, 1921) to distinguish them from amentias in which the ability to reason never developed. The term "schizophrenia" (Bleuler, 1911) is now used to describe disorders involving "characteristic disturbances in several of the following areas: content and form of thought, perception, affect, sense of self, volition, relationship to the external world, and psychomotor behavior" (American Psychiatric Association, 1980, p. 182).

Schizophrenia is not a unitary concept. Over the past few decades, there has been a growing awareness of the potential value of subclassifying schizophrenia into more homogeneous diagnostic categories. Such classification is especially critical in research studies because of the high degree of variability in the performance of groups of heterogeneous schizophrenics on a number of cognitive tasks (Neale & Oltmanns, 1980). The most useful subclassifications for reducing heterogeneity are based on premorbid adjustment (Carpenter & Stephens, 1979; Garmezy & Rodnick, 1959), process
versus reactive status (Garmezy, 1970), and paranoid versus nonparanoid symptomatology (Neale & Oltmanns, 1980).

Research in several areas suggests that the paranoid-nonparanoid distinction within schizophrenia is a particularly useful one. When compared to nonparanoid schizophrenics, paranoid schizophrenics have been found to demonstrate: lower platelet monoamine oxidase activity (Potkin, Cannon, Murphy, et al., 1978); different response to phenothiazines (Silverman, 1972); lower incidence of schizophrenia in relatives (Kendler & Davis, 1981; Kendler & Hays, 1981); less severe formal thought disorder (Chapman & Chapman, 1973); better prognosis (Strauss, Sirotkin, & Grisell, 1974); higher social competence (Zigler, Levine, & Zigler, 1976); less distractability (McGhie, 1970); and superior performance on a variety of cognitive tasks (Bourne, Justesen, Abraham, et al., 1977; Hamlin & Lorr, 1971; Shakow, 1963). In general, the paranoid schizophrenic patient appears to be more intact and less disturbed than the nonparanoid (Zigler & Glick, 1984).

The most commonly noted symptom criteria for distinguishing paranoid from nonparanoid schizophrenia are delusions of persecution and grandiosity (Kendler & Tsuang, 1981). Early theorists influenced by the psychoanalytic school of thought proposed that paranoid delusions represented the externalization of an individual's wishes, conflicts or fears (e.g., Freud, 1911). More recent theories propose cognitive or social determinants of paranoid delusions (Cameron, 1943, 1959; Maher, 1974; McReynolds, 1960).
Many theorists have suggested that paranoid delusions, like many other symptoms, are understandable distortions of normal functions and not exotic symptoms superimposed on the personality (Maher, 1974; Meissner, 1978; Strauss, 1969). Only when the normal psychological functions reach a certain level of distortion and begin to impair social functioning, are they considered "symptoms."

If delusions can be thought to be distributed along a continuum from normal to pathological, it should be possible to identify an analog of delusional qualities even in nonpatient groups. Beliefs can vary along several dimensions, ranging from the "normal" to the "abnormal." Extreme distortions on any of these dimensions could be interpreted as "symptoms," though, in isolation, they would rarely result in impaired functioning. The dimensions most commonly noted in the analysis of delusions are as follows:

1. **conviction** (Hole, Rush & Beck, 1979; Kendler, Glazer & Morgenstern, 1983; Strauss, 1969) - degree to which the person is convinced of the reality of the belief.

2. **pervasiveness** (Hole et al., 1979; Strauss, 1969) or pressure (Kendler et al., 1983) - degree to which the person is preoccupied with the belief.

3. **departure from cultural determinants** (Kendler et al., 1983; Moor & Tucker, 1979; Strauss, 1969) - degree to which the belief departs from culturally determined consensual reality.

4. **implausibility** (Strauss, 1969) - degree to which the belief is possible, e.g., believing that one has been kidnapped by Venutians...
as compared to believing that one is followed by drug dealers.

(5) **extension** (Kendler et al., 1983) - degree to which the belief involves various areas of the person's life.

(6) **disorganization** (Kendler et al., 1983) - degree to which the belief is internally consistent and organized.

(7) **accommodation** (Hole et al., 1979) - degree to which the belief can be modified by external events or incongruities.

Most researchers and theorists have concerned themselves with the dimensions of conviction and the degree of departure from cultural determinants in the delusions of paranoid schizophrenics. The present thesis addresses the dimension of accommodation and related cognitive processes, relatively unexplored aspects of delusions.

The concepts of assimilation and accommodation have been thoroughly articulated by Piaget (Flavell, 1963; Inhelder & Piaget, 1958). Accommodation involves modifying an existing schema in response to information provided by the environment whereas assimilation involves adapting the environmental information to fit the schema. Piaget hypothesized that assimilation and accommodation are complementary processes which allow an individual to effectively adapt to the environment.

A great number of studies have indicated that people generally tend to assimilate incongruent information rather than accommodate existing schemas to fit the incongruent information. Not only do people tend to distort and bias incoming information (Minsky, 1975;
Neisser, 1976), they also appear to actively seek information which confirms existing hypotheses or judgments. This tendency is referred to as a "confirmation bias" and has been observed in a variety of situations, ranging from problem solving in the experimental laboratory to diagnosing clinical disorders (Mahoney, 1974). Peter Wason and his colleagues have conducted a series of studies that demonstrate confirmation biases. The basic procedure of these studies will be described in some detail as it was employed in the present investigation.

In an attempt to elucidate common hypothesis testing strategies used by subjects in a laboratory setting, Wason (1966) employed a selection task which involved placing four cards in front of a subject which read "E," "4," "K," and "7," with one character per card. The subject was told that there was a letter on one side of the card and a number on the other side, and that the following rule applied to the four cards: "If a card has a vowel on one side, then it has an even number on the other side." The subject was required to name only those cards that s/he would need to turn over in order to determine if the rule was true or false.

Expressed in the traditional terminology of logic, the rule used in this study is conditional, "if p then q," where the letter "E" is equivalent to "p," "K" to "not-p," "4" to "q," and "7" to "not-q." Thus, the correct response to the problem is "E and 7," (i.e., "p" and "not-q"). Any odd number on the other side of the "E" or a vowel on the other side of the "7" falsifies the rule. In
the Wason (1966) study, however, most of the subjects replied that "E and 4" or "only E" needed to be turned over to test the rule. On reflection, it is clear that disconfirmation is the only form of valid conclusive inference in hypothesis testing (Popper, 1959). Affirming a hypothesis through successful predictions gives one the false illusion that the hypothesis is true; only unsuccessful predictions have conclusive logical implications (Mahoney, 1976). However, subjects in this study attempted to confirm rather than disconfirm the rule. It would be unnecessary to select "not-p" because no value on the other side of the "K" could falsify the rule. Since no value on the other side of the "K" would verify the rule either, subjects seldom selected it. Subjects did select "E" the majority of the time, however, Wason and Johnson-Laird (1972) suggest that subjects actually selected the "E" for the wrong reason - they selected the "E" in an attempt to verify the rule rather than disconfirm it. If they were trying to disconfirm, subjects should have made an attempt to ascertain that there was not an odd number on the other side. However, Goodwin and Wason (1972) recorded verbal protocols that indicated that subjects who chose "p" and "q" only tried to verify the rule while subjects who chose "p" and "not-q" tried to falsify the rule.

Most of the subjects in Wason's (1966) study also indicated that the "4" needed to be turned over to determine if the rule was true or false. However, regardless of what was on the other side of the "4," the rule could not be falsified. Selecting the "4" card
could only serve to verify the hypothesis. Most subjects did not select the "7" card. This card should have been chosen because "p" occurring without "q" would falsify the hypothesis.

Subsequent to this initial study, Wason and other researchers have continued to investigate the factors that either interfere with or promote a subject's attempts at falsification of a hypothesis in the selection task. Modifications of the original task such as eliminating memory limitations of the task (Goodwin & Wason, 1972) and ensuring familiarity with the conditional rule (Wason & Shapiro, 1971) have produced little facilitation. In an effort to induce subjects to attempt to falsify their original hypothesis, Wason (1968a) emphasized the role of falsification in the task. Subjects were instructed to select cards which "could break the rule." Subjects usually chose "not-p" and "not-q" presumably because they both had already broken the rule. Other studies in which the experimenters have confronted subjects with the inconsistencies between their selections and subsequent evaluations of the cards have indicated that many subjects do not gain any insight into the logical structure of the task even when self-contradiction is explicit (Wason, 1969; Wason & Johnson-Laird, 1970). There is some evidence that when the selection task is phrased in concrete or realistic terms rather than abstract ones, logical reasoning is facilitated (Johnson-Laird, Legrenzi, & Legrenzi, 1972; Wason & Shapiro, 1971); however, this method of facilitation has been found ineffective in other studies (Griggs & Cox, 1982; Yachanin & Tweney,
Wason's selection task is but one method used to demonstrate confirmation biases in normals (for recent books see Evans, 1982; Johnson-Laird & Wason, 1977; Kahneman, Slovic, & Tversky, 1982; Nisbett & Ross, 1980). Despite the great interest in the topic of belief biases and "irrationality" (Cohen, 1981, and associated commentaries), this area of research has typically deemphasized the roles of motivation, affect or other individual differences as they are associated with beliefs (Crocker, Fiske, & Taylor, 1984) and instead has focused on schematic or cognitive factors (Rumelhart & Ortony, 1977; Taylor & Crocker, 1981). Clearly individuals modify and abandon beliefs and there are some tentative indications in the research literature that individuals differ in the degree to which they maintain, modify, and relinquish beliefs. Assuming that information incongruent with a schema actually exists in the environment, there are at least three variables which might affect the likelihood that an individual will attend to the disconfirming or incongruous information: current processing capacity, strength with which the belief is held, and motivation.

Current processing capacity. A large body of literature indicates that an individual's attention will be drawn to inconsistent or novel stimuli (Berlyne, 1970; Taylor & Fiske, 1978). However, the individual's available processing capacity must be such that the person is able to attend to the incongruent information (Hastie,
which takes longer to process than congruent information (Brewer, Dull, & Lui, 1981). Thus, if a person is under pressure to process information quickly, it is more likely that congruent rather than incongruent information will be processed.

Several studies of paranoid schizophrenics have suggested that this group exhibits a proclivity towards jumping to conclusions and providing hypotheses more quickly than other groups (Abroms, Taintor, & Lhamon, 1966; McCormick & Broekema, 1978; McReynolds, Collins, & Acker, 1964). This tendency to respond quickly might lead to less processing of incongruent stimuli because of processing demands involved in assessing incongruent information. Thus, paranoid schizophrenics might demonstrate more confirmation-bias responses than other subjects.

Several other studies have also related extensive scanning to paranoid schizophrenics and restricted scanning to nonparanoid schizophrenics (Clooney & Murray, 1977; Davis, Cromwell, & Held, 1967; Silverman, 1964; Venables, 1964). The extensive scanning by the paranoid group would increase the overall processing load and decrease the space available for processing incongruent information. If so, paranoid schizophrenics should make more confirmation-bias responses than the nonparanoid schizophrenics.

Hypothesis strength. Individuals vary in the degree to which they have well-developed schemas for particular stimulus domains (Markus, 1977). Bruner (1951) suggested that individuals vary in the extent to which they hold a belief —"the stronger a hypothesis, the
greater the likelihood of its arousal in a situation, the less the amount of appropriate information necessary to confirm it, and the more contradictory information necessary to infirm it" (p. 76).

There have been a few case reports in the literature describing attempts to alter delusions using cognitive techniques (Beck, 1952; Hole, et al., 1979; Watts, Powell, & Austin, 1973). These studies can not address the issue of typical changes in delusions over time (Carpenter & Strauss, 1974; Depue & Woodburn, 1975), but they do suggest that, while some paranoid delusional beliefs are perhaps amenable to contradictory evidence, they are frequently very difficult to eliminate. Young and Jerome (1972) also found paranoid schizophrenics to have difficulties in changing the direction of hypotheses in a learning task, suggesting that paranoid schizophrenics have difficulty in modifying both personally relevant and nonpersonal hypotheses. The paranoid's difficulty in relinquishing hypotheses has frequently been noted in the clinical literature as "rigidity" (Cameron, 1959; Meissner, 1978).

An individual who holds specific beliefs would be expected to conceptualize the environment according to cognitive categories found in those beliefs (Higgins & King, 1981). For example, Langer and Abelson (1974) reported that subject therapists "found" more pathology in individuals when the therapists believed they were listening to a psychiatric intake interview rather than a job interview. Similarly, Forgus and DeWolfe (1974) reported that the cognitive categories used by delusional patients on a logical
sequences task were similar to those categories evident in the subjects' delusions.

Motivation. While very little research has addressed the issue of individuals' motivation to change beliefs (Crocker, et al., 1984), many writers have proposed a "need" or "press" to confirm beliefs or schemas. As early as 1621, Francis Bacon suggested, "The human understanding, when any proposition has been once laid down...forces everything else to add fresh support and confirmation: and although most cogent and abundant instances may exist to the contrary, yet either does not observe, or despises them, or it gets rid of and rejects them by some distinction, with violent and injurious prejudice, rather than sacrifice the authority of its first conclusions" (p. 46). McReynolds (1960), in proposing that the delusional process is adopted by the paranoid to cognitively reorganize ambiguous stimuli that are anxiety-provoking, presented a similar picture of the paranoid schizophrenic. He stated that paranoids can avoid evidence contrary to the delusion in two ways: "the patient avoids percepts incongruent with his delusion and he seeks percepts congruent with it - or, to put it another way, he avoids percepts contradictory to his delusional beliefs, and he seeks percepts supportive of them" (p. 276). Thus, the paranoid incorporates information in such a way as to reduce anxiety. If McReynolds' (1960) proposal is correct, paranoid schizophrenics should show an increase in making confirmation-bias responses when confronted with information that is relevant to delusional beliefs
and anxiety-provoking.

Several studies have suggested that when anxious, normal subjects may exhibit the same biases as suggested by McReynolds (1960). Moffit and Stagner (1956) found established perceptual interpretations were adhered to more rigidly under conditions of threat. Smock (1955) and Binder (1958) found that subjects attempted to resolve ambiguous stimuli more rapidly under stressful conditions than in nonstressful situations. Brim and Hoff (1957) also found subjects to exhibit an increased desire for certainty in frustrating situations. Confirmation-bias responses may be commonly associated with anxiety in all individuals.

The anxiety associated with ambiguity or lack of closure can be a powerful motivator - individuals appear to "need" a reality, regardless of how distorted that reality may be (Cameron, 1959; Nisbett & Ross, 1980). Theories on the formation of paranoid delusions usually note the personal relief and insight that accompany the development of a paranoid delusion which eliminates uncertainty and tension (Cameron, 1943, 1959; Maher, 1974; Meissner, 1978).

Though the reduction of anxiety or emotional commitment may increase the likelihood that a person will maintain a certain belief, these factors are generally neither necessary nor sufficient explanations of belief perseverance. For example, neither of these factors would seem to play an important role in Snyder and Swann's (1978) study in which it was shown that subjects who were
interviewing someone to determine whether or not the person was an extrovert tended to ask questions which primarily elicited "data" indicating that the person was indeed an extrovert.

The present study was designed to investigate individual differences in the use of confirmation biases in testing hypotheses. A modification of Wason's original procedure was employed. Based on previous research with normal groups, it was hypothesized that all subjects, including controls, would initially make confirmation-bias responses, as demonstrated in several earlier studies. However, the paranoid schizophrenics were expected to have the most difficulties in selecting disconfirming stimuli due to their tendency to attend to congruent stimuli rather than incongruent stimuli. In other words, paranoid schizophrenics were expected to exhibit "normal" confirmation biases but to a greater degree than other subjects. Based on the findings of virtually every study on the cognitive functioning of schizophrenics, it was expected that the nonparanoid schizophrenic group would exhibit a general cognitive deficit but that this group would make less confirmation-bias responses than the paranoid schizophrenics.

In addition to comparing the performance of paranoid and nonparanoid schizophrenics, four control groups were included. Unfortunately, until very recently, investigators concerned with psychopathology have often compared a single group of "schizophrenics" with a single group of normals (Neal & Oltmanns,
1980). Normal controls were a critical group to include in this study in order to replicate findings of previous studies using Wason's selection task. This group would include individuals not in treatment and not meeting criteria for a mental disorder. A second control group included in this study were nonpsychotic psychiatric controls, subjects hospitalized for psychiatric reasons but who did not demonstrate evidence of thought disorder. This group included diagnoses such as Personality Disorders and Adjustment Disorders.

It was expected that the performance of the normal controls and nonpsychotic psychiatric controls would differ from that of the schizophrenics. These differences might be attributable to a number of factors, including levels of neuroleptic medications, length of hospitalization, or presence of thought disorder. Thus, a group of subjects more similar to the schizophrenic subjects on these variables was included, delusional and nondelusional major depressives. Recent studies have indicated that these two groups of depressives differ in response to medications (Chamey & Nelson, 1981; Nelson & Bowers, 1978) and may represent two separate subtypes of depression. The delusional major depressives were expected to more closely match the schizophrenic groups in terms of neuroleptic medication level and degree of thought disorder. Assuming that the paranoid schizophrenics would make more confirmation-bias responses, including the delusional depressives allowed an analysis of whether confirmation-bias responses might be related more to delusional thought processes, which were present in both paranoid
schizophrenics and delusional depressives, or to paranoia, which was present in only the paranoid schizophrenics.

It was hypothesized that confirmation-bias responses would be more evident in all groups in an anxiety-provoking situation which was to be induced in the present study by presenting personally-relevant stimuli to the subjects. Unlike the usual procedure of administering the selection task only once to each subject, each subject in the current study was given a series of trials using various content: thematic, abstract, and personally relevant. The use of personally-relevant materials in this particular task have not been reported in the literature, though it has been suggested that tailoring stimuli to the emotional needs of individual subjects might prove fruitful in studies of schizophrenia (Chapman & Chapman, 1973). To develop personally-relevant stimuli, subjects indicated topics about which they had strong feelings and were later asked to test hypotheses regarding these topics. It was assumed that the personally-relevant materials would increase anxiety and it was hypothesized that paranoid schizophrenics would increase the use of confirmation biases in anxiety-provoking situations to a greater degree than other groups. The thematic and abstract materials were included in order to investigate the differences in subject's response selections previously reported (Griggs & Cox, 1982; Johnson-Laird, et al., 1972). The abstract and thematic materials were repeated at the end of the session, after the personally-relevant materials, to ascertain practice effects.
The procedure used in this study also differed from previously reported studies using the selection task in terms of the number of trials administered to each subject. Virtually all of the previous studies using this method have required subjects to make one, and only one, selection response. This study was construed as a training or instructional task in which subjects were provided extensive and structured feedback after a selection. It was hypothesized that the paranoid schizophrenic group would profit less from training based on previous studies indicating that paranoid schizophrenics are more rigid in their problem solving than nonparanoids (Hole, et al., 1979; Young & Jerome, 1972).
Subjects

Subjects were 14 paranoid schizophrenics, 14 nonparanoid schizophrenics, 14 delusional major depressives, 14 nondelusional major depressives, 14 nonpsychotic psychiatric controls, and 14 normal controls. Criteria for inclusion in the psychiatric subject pool were: 18 to 55 years in age; no evidence of organicity; no current drug or alcohol addiction; less than two years of total hospitalization; and never having received electroconvulsive therapy. The normal subject pool consisted of hospital staff who volunteered to participate in this study. These subjects met the criteria listed above and three additional criteria; never hospitalized for psychiatric reasons; never in long-term psychotherapy; and not currently taking psychoactive medications.

Procedure

Subject selection and consent. Available patient case files from University Hospital, University of Washington, were reviewed in selecting patients according to the criteria listed above. Due to confidentiality requirements, patients were initially screened by a staff member, a clinical psychology intern, who had normal access to patient charts. Those patients meeting the criteria listed above
were asked by the intern if they would be willing to talk with someone about participating in a research study. Those patients who agreed to be contacted were then approached by the experimenter, the study was briefly described, and those patients who agreed to participate in the study were asked to sign a consent form (Appendix A). Normal controls were contacted informally and asked to participate in the study. After the study was described to them, they were asked to sign a consent form explaining that they were included in the study as comparison subjects (Appendix B).

**Diagnosis.** Psychiatric subjects were grouped according to diagnoses based on both the Diagnostic and Statistical Manual-III (American Psychiatric Association, 1981) and Research Diagnostic Criteria (RDC) (Spitzer, Endicott, & Robins, 1978). The DSM-III nomenclature is the official diagnostic nomenclature currently used in clinical settings in this country. It relies on "clinical features" to determine diagnosis. The RDC was developed to provide a consistent set of criteria for investigators of affective disorders. The goal of the RDC is to identify relatively homogeneous groups of patients who meet specified diagnostic criteria. Diagnostic groups are organized on the principle that, for research purposes, it is better to avoid false-positives than false-negatives. Overall, then, though differing in the rigor of their criteria, the diagnostic distinctions in both the RDC and DSM-III are based on number, type, and severity of symptoms present within a specified time frame.

For present purposes, the DSM-III diagnosis was that for the
current admission made by the attending psychiatrist and confirmed by the experimenter. The RDC diagnosis was made by the experimenter and was based on information from patient charts and an interview with the patient. Only those subjects who met the criteria for specific group classification according to both the DSM-III and RDC were included in the analyses. Six psychiatric subjects were excluded in the final analyses because of disagreement between the two diagnostic systems.

Subjects were also rated on the Maine Scale (Magaro, Abrams, & Cantrell, 1981) to further validate the paranoid/nonparanoid distinction. Ratings on both paranoid and nonparanoid dimensions were made by the experimenter through a review of patient charts and an interview. A paranoid symptom score of 12 or more was required for inclusion in the paranoid group while a nonparanoid schizophrenia symptom score of 10 or more was required for inclusion in the nonparanoid group. Subjects in the other four groups were also rated on this scale, but scores were not used as a basis for inclusion or exclusion in a group.

Interviews and chart reviews for each subject were conducted after the experimental portion of the study to ensure that the experimenter was blind to diagnoses. The clinical psychology intern who conducted the initial screening of subjects referred to the experimenter only those subjects receiving the diagnoses included in this study. As each of the five patient groups was filled, the intern was asked to not refer any more subjects within that
particular diagnostic category.

Demographic survey. Data were collected in terms of age, sex, education level, and medication level using chlorpromazine as the standard unit (AMA Department of Drugs, 1980). These data were obtained during patient interviews and from medical charts.

Ratings of delusions. Based on information from the patients' records and the interview, the delusions of the paranoid and nonparanoid schizophrenics, and the delusional depressives were rated on five dimensions: (1) conviction; (2) extension; (3) organization; (4) pressure; and (5) bizarreness. Ratings on these five dimensions were made according to scales devised by Kendler, et al. (1983).

Session I:
After obtaining written informed consent, subjects were scheduled for the first of two individual one-hour sessions. The following procedures were followed in the sequence listed during the first session:

(1) Subjects were administered the State-Trait Anxiety Inventory (STAI) - Form Y (Spielberger, 1983) as a Q-sort task. Subjects were given 20 statements printed on index cards and asked to sort the cards into four categories indicating how descriptive the statements were of the way they felt right then. Then the subjects were given 20 more cards to sort into categories indicating how they generally felt.
(2) Subjects were asked to read through 100 statements printed on index cards. These statements were drawn from the Intimacy-Scaled Stimuli for the Use in Studies of Inter-personal Relationships (Taylor & Altmans, 1966) and were originally used in research on self-disclosure and interpersonal relationships. The statements involve topics such as religion, family, politics, and relationships. In this study, subjects were asked to sort the cards into five categories indicating how strongly they felt about the topics presented (see Appendix C). The ten statements about which the subject reported that s/he had the strongest feelings were discussed to develop content material for the experimental hypothesis-testing task administered in Session II.

(3) Subjects were readministered the state portion of the STAI to measure changes in state anxiety levels after discussing personal issues.

(4) Subjects were administered the Vocabulary subtest of the Wechsler Adult Intelligence Scale - Revised (WISC-R), which was included as a measure of individual verbal and intellectual abilities, variables which might relate to problem solving ability.

(5) Subjects were administered the Expanded Similarities test (Hamlin & Lorr, 1971) as a measure of abstraction abilities and pathology.

Session II:

(1) Subjects were administered the state and trait portions of the
(2) **Hypothesis Testing Task.** Subjects were presented with five sets of stimulus cards which varied in content material. Three types of content were used which are here referred to as "abstract," "thematic," and "personally relevant." The abstract and thematic content were based on previous studies (Wason, 1966; Wason & Shapiro, 1972) while the personally relevant content was based on information provided by the subject in the first session. Following is a detailed description of the administration of the hypothesis-testing task:

**ABSTRACT**

Four 4x6 index cards were laid in front of the subject. One card was covered in yellow (q) construction paper, one card was covered in blue (not-q) construction paper, on one card there was a black square (p), and on one card there was a black circle (not-p). The experimenter named the cards as they were laid out: "yellow," "blue," "a square," "a circle" and then said, "Each of these four cards has a color on one side, and a shape on the other side. So, these two cards (yellow and blue) have shapes on the other side of them, and these two cards (square and circle) have colors on the other side. Now, here's a statement (a written copy of the statement was laid on the table above the four cards): 'EVERY CARD THAT HAS A SQUARE ON ONE SIDE, HAS THE COLOR YELLOW ON THE OTHER SIDE.' What I would like you to do is tell me the card or cards that you would want to turn over to try to prove that this statement
is FALSE. The problem is not so easy as it looks, so please think carefully before giving me your answer. Remember, tell me only those cards which you would want to turn over to try to prove this statement false."

After the subject made a response, an instructional set was given which always followed the same pattern:

(1) The experimenter first pointed to the "p" card, in this example, the square and asked, "If the square has the color yellow (q) on the other side, would this statement be false?" The correct response is "no."

(2) The experimenter again pointed to the "p" card, and asked, "If the square has the color blue (not-q) on the other side, would this statement be false?" The correct answer is "yes."

(3) The experimenter pointed to the "not-p" card, in this example the circle, and asked, "If the circle has the color yellow (q) on the other side, would this statement be false?" The correct answer is "no," it is irrelevant what is on the other side of this card.

(4) The experimenter pointed to the "not-p" card, and asked, "If the circle has the color blue (not-q) on the other side, would this statement be false?" The correct answer is "no."

(5) The experimenter pointed to the "q" card, in this example, the yellow card, and asked, "If this yellow card has a square (p) on the other side, would this statement be false?" The correct answer is "no."

(6) The experimenter pointed to the "q" card, and asked, "If this
yellow card has a circle (not-p) on the other side, would this statement be false?" Again, the correct answer is "no."

(7) The experimenter pointed to the "not-q" card, in this example, the blue card, and asked, "If this blue card, has a square (p) on the other side, would that prove this statement false?" The correct response is "yes."

(8) The experimenter pointed to the "not-q" card, and asked, "If this blue card, has a circle (not-p) on the other side, would that prove this statement false?" The correct answer is "no."

Thus subjects were asked about the eight possible combinations of p, q, not-p, and not-q. The correct response was ALWAYS the combination of p and not-q.

After each of the eight possibilities was questioned, the experimenter asked, "Now that we've talked about these, which card or cards would you want to turn over to try to prove this statement false." A stopwatch was started when the experimenter completed the request for a response and was stopped when the subject made a first response. Then the subject was presented with four new cards, each bearing a color or shape, and a new statement to prove false. The statement was presented on an index card as the experimenter read it out loud. A stopwatch was started when the experimenter finished reading the statement and was stopped when the subject made a first response. Five abstract statements (in addition to the sample) were presented in this manner. Feedback was provided to the subject only on the first presentation of the sample problem.
After the completion of the first set of cards, the experimenter said, "Now these next cards are different in some ways, but the same in other ways. The subject was then presented with the second set of cards, which was either abstract or thematic, depending upon randomization of order.

**THEMATIC**

Four cards were laid on the table with the words "TOLEDO," "MIAMI," "BUS," and "TRAIN" printed on them. The experimenter said, "Each of these cards has a city printed on one side, and a means of transportation on the other side. I would like you to imagine that each card represents a trip I took. So, this card would mean that I went to Miami, and on the other side of the card it would tell you how I got there. And here I went to TOLEDO, and how I got there is on the other side. On these two cards, it tells you how I got there, but you don't know where I went - that's on the other side of the cards. Now, here's a statement: 'EVERY TIME I GO TO MIAMI, I TRAVEL BY BUS.' Please tell me which card or cards you would want to turn over to prove that this statement is false."

After the subject made a selection, the experimenter went through the same sequence of questioning the eight possible combinations of p, q, not-p, not-q as described above. The subject was asked to make a second response to the sample problem and then five more statements and sets of cards were presented.

After the second set of cards was administered, the state portion of the STAI was administered as a Q-sort.
PERSONALLY RELEVANT

The statements presented in this set of cards varied from subject to subject. They were tailored to the issues that the subject reported having strong feelings about during the first session. For example, four cards were laid on the table with the words "GUILTY," "ANGRY," "MOTHER," and "SISTER" printed on them. The experimenter said, "These cards have feelings printed on one side, and a person printed on the other side. Look at this statement, "EVERY TIME I SEE MY FATHER STRIKE MY MOTHER, I FEEL GUILTY." So, this card means that I saw my father strike my mother, and on the other side of the card it tells you how I felt. This card means that I saw my father strike my sister, and it tells you how I felt on the other side. This card tells you how I felt, guilty, and on the other side it tells you who I saw my father strike. And on this card, I feel angry, and it tells you who my father struck on the other side. Please tell me the card or cards you would want to turn over to prove that this statement is false. The same procedure was followed as described for the abstract and thematic stimuli.

After the completion of this set of cards, the state portion of the STAI was again administered. Then two final sets of cards were administered. These sets were again thematic and abstract, with order balanced across subjects. The entire duration of the experimental portion of this session was recorded.

To summarize the experimental procedure, five sets of stimulus cards which varied in terms of content, were presented to each
subject. Three types of content were used, abstract, thematic and personally relevant. The first two sets presented to each subject were abstract and thematic, with order balanced across subjects so that half the subjects in each group were presented the abstract cards first and the thematic cards second; the other half of the subjects were presented the sets in the reverse order. The personally relevant cards were always presented third. Finally, subjects were presented abstract and thematic sets again, with order of presentation balanced.

For each set, subjects were presented with one sample. After the subject made an initial selection, the experimenter questioned the subject on the eight possible combinations of "p" and "q." Thus, direct feedback was provided to the subject as to the correct solution to the problem. After feedback was provided to the subject on the sample problem, the experimenter asked for another response to the sample problem. Then five more trials were given in which no further feedback was provided. Thus, for each of the five sets, the subject made seven selections: one response to the sample problem before feedback; one response to the same sample problem after feedback; and five responses to the next five individual trials.

Response times were recorded for six of the seven selections: the second response to the sample problem and the next five trials. Response time was not recorded for the initial sample problem because the subjects asked questions during this period. Additionally, the duration of the entire experimental portion was
recorded.

(3) Following the experimental portion of the second session, subjects were interviewed using the Schedule for Affective Disorders and Schizophrenia - Change Version (SADS-C) (Spitzer & Endicott, 1978a), which is an abbreviated version of the Schedule for Affective Disorders and Schizophrenia (SADS) (Spitzer & Endicott, 1978b). The information gathered in this interview was used to establish diagnosis.

(4) Finally, those subjects presenting some evidence of paranoia or delusions on the SADS-C were interviewed using the Delusions subsection of the SADS (Spitzer & Endicott, 1978b). Information gathered in this interview was used to rate delusional qualities and to confirm delusional symptoms.
CHAPTER III
RESULTS

Subject variables. Subject variables included: age, age at first psychiatric admission, education, neuroleptic medication level, sex, marital status, vocabulary score, expanded similarities score, mean ratings on the 100 personal issues, and ratings on the paranoid schizophrenia and nonparanoid schizophrenia dimensions of the Maine Scale. Table 1 summarizes these data. Each variable was analyzed by a one-way analysis of variance to assess possible group differences. Variables which differed significantly among groups were further analysed with Newman-Keuls post hoc tests of individual group means.

Analyses of age, education, vocabulary, and expanded similarities data did not result in significant group differences. However, several other variables were found to differ significantly among groups. A one-way ANOVA indicated group differences in medication level ($F=29.78$, df=5, 78, $p<.001$). A Newman-Keuls post hoc test indicated that the paranoid schizophrenics, nonparanoid schizophrenics, and delusional major depressives received significantly more neuroleptic medications than the major depressives and psychiatric controls, who received more medications than the normal controls ($p<.05$). A one-way ANOVA also indicated
<table>
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<th>Table 1. Subject variables by groups</th>
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<tr>
<td><strong>Paranoid</strong></td>
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<td>Schizophrenics</td>
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<td><strong>M</strong></td>
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<td>Age</td>
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<td>Age at first admission</td>
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<td>Medication level</td>
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<td>Marital status</td>
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<td>Personal issues ratings</td>
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<td>Paranoid dimension</td>
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<td>Nonparanoid dimension</td>
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group differences in the mean ratings of the 100 personal issues 
(F=3.23, df=5, 78, p<.01), with the nonparanoid schizophrenic 
subjects rating themselves as having stronger feelings about the 
issues than paranoid schizophrenics and normal controls (p<.05). As 
would be expected, group differences were found on the paranoid 
schizophrenia (F=107.89, df=5, 78, p < .001) and nonparanoid 
schizophrenia (F=48.90, df = 5, 78, p<.001) dimensions of the Maine 
Scale. The paranoid schizophrenic group was rated higher than all 
other groups on the paranoid dimension (p<.05) while the 
nonparanoid schizophrenics and delusional depressives were rated 
higher than the major depressives, psychiatric controls, and 
normal controls (p<.05). The nonparanoid schizophrenic group was 
rated higher (p<.05) on the nonparanoid schizophrenia dimension than 
the paranoid schizophrenic and delusional depressive groups, which 
were rated above the three remaining groups (p<.05).

A one-way analysis of variance of age at first admission was 
performed excluding the normal control group. Significant 
differences between the psychiatric groups were found (F=4.59, df=4, 
65, p < .01). The nonparanoid schizophrenic subjects were first 
hospitalized at a younger age (p<.05) than the paranoid 
schizophrenic, delusional depressive, and major depressive groups, 
which did not differ from one another or from the psychiatric 
control group.

Chi-square analyses were performed on the marital status and 
sex data. The analysis of sex data indicated a significant group
difference, \( \chi^2 (5) = 25.68, p < .001 \). As summarized in Table 1, the delusional depressive and nondelusional depressive groups had a small percentage of male subjects. The analysis of marital status resulted in no significant differences, \( \chi^2 (5) = 6.44, p = .27 \).

Subject variables which differed among groups and might be associated with performance on the experimental task were correlated with a performance measure, the frequency of "p" and "pq" responses combined. These responses are considered to reflect a confirmation bias (Evans, 1982). Neuroleptic medication level \( (r = .30) \), age at first admission \( (r = .45) \), and the paranoid schizophrenia \( (r = .37) \), and nonparanoid schizophrenia \( (r = .49) \) dimensions of the Maine Scale were significantly \( (p < .01) \) correlated with the frequency of confirmation biases. The levels of state and trait anxiety initially reported during the first administration did not significantly correlate with the frequency of confirmation biases.

**Delusional Qualities.** The delusions of the three groups presenting delusions (paranoid schizophrenics, nonparanoid schizophrenics, and delusional depressives) were analyzed according to five dimensions: conviction, extension, bizarreness, disorganization and pressure. Group data on these variables are presented in Table 2. Every subject in the paranoid schizophrenic group and the delusional depressive group exhibited delusions, however, only six of the nonparanoid schizophrenic group were rated as having delusions. Group differences were found on all five dimensions: conviction \( (F = 63.42, df = 2, 39, p < .001) \); extension \( (F = 41.76, df = 2, 39, p < .001) \);
Table 2. Delusional qualities by three groups presenting delusions.

<table>
<thead>
<tr>
<th>Delusional qualities</th>
<th>Paranoid Schizophrenics</th>
<th>Nonparanoid Schizophrenics</th>
<th>Major Depressives</th>
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<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Conviction</td>
<td>6.6</td>
<td>0.50</td>
<td>0.9</td>
</tr>
<tr>
<td>Extension</td>
<td>2.7</td>
<td>0.47</td>
<td>0.6</td>
</tr>
<tr>
<td>Bizarreness</td>
<td>3.3</td>
<td>0.61</td>
<td>0.7</td>
</tr>
<tr>
<td>Organization</td>
<td>2.3</td>
<td>0.73</td>
<td>0.4</td>
</tr>
<tr>
<td>Pressure</td>
<td>4.1</td>
<td>0.48</td>
<td>0.6</td>
</tr>
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</table>
The delusions of the paranoids were rated significantly higher (p<.05) in terms of conviction, bizarreness, and pressure than both other groups and the delusional depressives were higher on these dimensions than the nonparanoid schizophrenics (p<.05). On the extension and organization dimensions, the delusions of the paranoid schizophrenics and delusional depressives were both rated higher than those of the nonparanoid schizophrenics (p<.05). The five delusional qualities were correlated with the number of responses reflecting confirmation biases (p and pq) and no significant correlations were found.

**State anxiety.** A two-way ANOVA (group x order), with repeated measures on the second factor, was performed on the state measure which was administered five times over the two sessions. The order of administration was: State 1 - beginning of first session; State 2 - after discussion of personal issues during first session; State 3 - beginning of second session; State 4 - after presentation of first two sets of stimulus cards and before personally relevant cards; State 5 - after presentation of personally relevant cards. Figure 1 shows group data on these variables.

Order effects were significant (F=6.96, df=4, 75, p<.001) due to subjects indicating greater (p<.05) state anxiety ratings during State 1 and State 5 than during the remaining three state anxiety
Figure 1. State and trait anxiety by groups. State anxiety measured at five intervals and trait anxiety measured at two intervals.
administrations. Group effects (F=13.4, df=5, 78, p<.001) and the
group by order interaction (F=3.23, df=20, 249, p<.001) were also
significant. To clarify the interaction, simple effects within and
between groups were analyzed; those simple effects which were
significant were further analyzed using Newman-Keuls post hoc tests.
Paranoid schizophrenics differed across state administrations
(F=3.05, df=4, 65, p<.05) due to higher State 1 anxiety than State 3
and State 4 anxiety levels (p<.05). The one-way ANOVA on delusional
major depressives indicated a significant effect across state
administrations (F=3.61, df=4, 65, p<.01); however, a Newman-Keuls
analysis did not identify significant mean differences within this
group at the p=.05 level. Anxiety data from the four remaining
subject groups did not significantly differ across the five state
administrations.

Simple effects between groups at each administration of state
anxiety indicated significant group differences. The nonparanoid
schizophrenics, paranoid schizophrenics, and delusional major
depressives did not differ (p<.05) from each other at any
administration, nor did the nondelusional major depressives and
nonpsychotic psychiatric controls differ from one another (p<.05).
The normal controls reported significantly less (p<.05) anxiety than
the nondelusional major depressives and psychiatric controls on all
five administrations, and less (p<.05) than the paranoid
schizophrenics, nonparanoid schizophrenics, and delusional major
depressives on State 1, State 2, and State 5 anxiety levels. The
nonpsychotic psychiatric controls reported significantly more (p < .05) state anxiety than the paranoids at States 2, 3, 4, and 5; more (p < .05) than the nonparanoid schizophrenics at States 2, 3, and 4; and more (p < .05) than the delusional depressives at States 3 and 4. The nondelusional depressives reported more (p < .05) anxiety than the paranoids at States 3, 4, and 5; more (p < .05) than the nonparanoid schizophrenics at States 3 and 4; and more (p < .05) than the delusional major depressives at States 3, 4, and 5.

According to the hypothesis that anxiety related to personal issues would lead to more confirmation biases, State 5 anxiety was correlated with the total of "p" and "pq" responses made during the presentation of the personally-relevant stimuli. The correlation between State 5 anxiety and "p" plus "pq" responses for all groups combined was not significant, nor were the correlations for each individual group. Additionally, the difference between State 4 and State 5 was correlated with the total of "p" and "pq" responses made during the presentation of the personally-relevant stimuli; however, the correlation was not significant. State 4 anxiety was correlated with the total of "p" and "pq" responses made during the presentation of the second set of stimuli, which were either abstract or thematic. While the correlation including all subjects was not significant, the nonparanoid group was found to demonstrate a significant negative correlation between State 4 anxiety and confirmation biases (r = -.66, p < .05). The higher the anxiety reported by the nonparanoid at State 4, the less
confirmation biases were used.

**Trait anxiety.** A two-way ANOVA (group x order), with repeated measures on the second factor, was performed on the trait measure which was administered once at the beginning of each session. This data is summarized in Figure 1. The order effect was not significant. Group effects were significant (F=6.23, df=5, 78, p < .001) as was the group by order interaction (F=3.03, df=5, 78, p < .05). One-way ANOVA's within groups were performed to clarify this interaction. No groups differed from Trait 1 to Trait 2 except the delusional depressive group (F=30.11, df=1,13, p < .001) which reported higher trait anxiety at the beginning of the second session than the first session.

**Confirmation biases.** For purposes of this research, response selections made by the subjects can be classified into three categories: (1) confirmation bias responses - "p" and "pq" responses combined; (2) correct response - "p" plus "not-q"; (3) random - all other responses. There are several other possible ways to classify responses; the categories used in these analyses reflect those outlined by Wason and Johnson-Laird (1972) and Evans (1982). Data were analyzed both in terms of confirmation bias responses (CBR) and correct responses. Both analyses yielded essentially the same results. The analyses presented here are based on the frequency of CBRs, defined as the joint occurrence of "p" and "pq" responses.

A two-way ANOVA (group x trials), with repeated measures on the
second factor, was performed on the frequency of "p" plus "pq" responses or CBRs. This analysis collapsed data across sets. The group effect was significant ($F=13.91$, $df=5, 78$, $p<.001$) with the paranoid and nonparanoid schizophrenics making more CBRs than the major depressives, nonpsychotic psychiatric controls, and normal controls ($p<.05$). The delusional depressives did not significantly differ from any group. The main effect of trials was also significant ($F=20.98$, $df=6, 73$, $p<.001$) as was the group by trials effect ($F=1.52$, $df=30, 294$, $p<.05$). Figure 2 summarizes these data for all seven trials. Because the interaction was significant, simple effects were analyzed for within group differences across trials. The paranoid schizophrenic group differed significantly across trials ($F=2.47$, $df=6, 91$, $p<.05$), with more CBRs exhibited during the first response to the sample problem than during the second response to the sample problem (post-feedback) ($p<.05$). The nonparanoid schizophrenic group also responded differently across trials ($F=3.61$, $df=6, 91$, $p<.01$). This group exhibited fewer ($p<.05$) CBRs during the second response to the sample problem (post-feedback) than during all other trials except the first trial after the two selections for the sample problem. Responses of the nonpsychotic psychiatric controls also were significantly different across trials ($F=4.33$, $df=6, 91$, $p<.001$). This group demonstrated more CBRs during the first response to the sample problem than any other trial. The frequencies of CBRs in the remaining three groups were not significantly different across trials ($p<.05$).
Figure 2. Mean frequency of "p" and "pq" responses (CBRs) on Example 1 through Trial 5 by groups.
Simple effects between groups for each of the seven selections were analyzed. Overall, three pairs of groups, with each pair not demonstrating any significant differences across the seven selections, emerge: (1) the paranoid schizophrenics and nonparanoid schizophrenics; (2) the delusional depressives and nondelusional depressives; and (3) the normal controls and nonpsychotic psychiatric controls.

On the first selection response to the sample problem (pre-feedback), the normals made fewer (p<.05) CBRs than the paranoid and nonparanoid schizophrenic groups. On the second selection response to the sample problem (post-feedback), the normals and nonpsychotic controls, which did not differ from one another made fewer (p<.05) CBRs than the paranoid schizophrenics, nonparanoid schizophrenics, and delusional depressives; the nondelusional major depressives also made fewer (p<.05) CBRs than the nonparanoid schizophrenics. On the first trial, the normals again made fewer (p<.05) CBRs than the paranoid schizophrenics, nonparanoid schizophrenics, and the delusional major depressives; the nonpsychotic controls and nondelusional major depressives made fewer (p<.05) CBRs than the paranoid and nonparanoid schizophrenics. Differences between groups on Trial 2 were very similar to those on Trial 1, with two additional group differences: the nonparanoid schizophrenics made more (p<.05) CBRs than the delusional depressives and the major depressives made more (p<.05) CBRs than the normal controls. Group differences on Trials 3 and 4 were
identical to those on Trial 2. Group differences on Trial 5 were also identical to those on Trial 2 with two additional group differences: paranoid schizophrenics made more ($p<.05$) CBRs than the nondelusional depressives and the delusional depressives made more ($p<.05$) CBRs than the nondelusional depressives.

Because none of the groups demonstrated significant differences in the frequencies of CBRs between trials 1, 2, 3, 4, or 5, only the data for three of the seven response selections was used in further analyses: (1) response to the sample problem before feedback was provided; (2) response to the sample problem after feedback was provided; and (3) response to the first trial. Five trials had been given to ensure against unreliable or random responding; however, responses made by subjects were fairly stable across trials.

Practice effects. To analyze the advantage of practice over the five sets of stimuli, a two-way ANOVA (group x order) was performed on the mean frequency of "p" plus "pq" responses. Figure 3 shows group data on the frequency of "p" plus "pq" responses across the five sets. In this analysis, order is confounded by type of stimulus materials. The first and second sets each consist of responses to abstract and thematic stimuli. The third set consists only of responses to the personally-relevant stimuli as the order of presentation of this set remained constant across subjects. The fourth and fifth sets, like the first and second, consist of responses to abstract and thematic stimuli. This analysis also collapses across the three trials included in the analysis (first
Figure 3. Mean frequency of "p" and "pq" responses (CBRs) by order of presentation by group.
response to the sample problem, second response to the sample problem, and the response to trial one).

The ANOVA demonstrated a significant main effect of group (F=11.91, df=5,78, p<.001). A Newman-Keuls post hoc test indicated that: (A) the paranoid schizophrenics and delusional depressives exhibiting more (p<.05) CBRs than the nonpsychotic psychiatric controls and normal controls; (B) the nonparanoid schizophrenics made more (p<.05) CBRs than all other groups except the paranoid schizophrenics. The main effect of order was significant (F=9.19, df=4,75, p<.001) due to subjects making more (p<.05) CBRs on the first and second sets than on the fifth set. The group by set interaction was not significant.

Abstract versus thematic versus personally-relevant stimuli. To analyze the differences in the frequency of subjects using CBRs with abstract and thematic stimuli, a two-way ANOVA (group x stimulus type) was performed on the mean frequency of "p" plus "pq" responses made during the initial presentation of the thematic and abstract stimuli, regardless of sequence of presentation. The group effect was significant (F=9.71, df=5,78, p<.001), results already demonstrated in previous analyses. There were no effects of stimulus type nor a group by stimulus type interaction (p < .05). Another two-way ANOVA was performed on the second presentation of the thematic and abstract stimuli, regardless of sequence of presentation. Again, group effects were significant (F=6.55,
df=5,78, p<.001). The type of stimulus effect was also significant (F=8.05, df=1,78, p<.01), indicating more CBRs demonstrated during presentation of the abstract stimuli than the thematic stimuli. The group by type of stimulus interaction was not significant.

A two-way ANOVA (group x stimulus type) was performed on the mean frequency of "p" plus "pq" responses made during all five presentations. This analysis did not indicate any significant differences beyond those described above (p<.05). Responses to the personally-relevant stimuli did not differ from those of the other four sets.

Response time. Response time for every selection, except the initial presentation of the sample problem, was recorded. Because the distribution of data was noticeably skewed and variances were heterogeneous, a logarithmic (X + 1) transformation was performed prior to analyses of the response times.

A three-way ANOVA (group x order x type of stimulus), with repeated measures on the last two factors, yielded significant group effects (F=5.4, df=5,53, p<.001). A Newman-Keuls post hoc test indicated that the nonparanoid schizophrenic group exhibited a greater (p<.05) mean response time (log = 1.00) than all other groups. The paranoid schizophrenics (log=.77), nondelusional major depressives (log=.72), and delusional major depressives (log=.72) had greater (p<.05) mean response times than the psychiatric controls (log=.61) and normal controls (log=.62), which did not
differ. The order effect was significant ($F= 7.91, \ df=4, \ 212, \ p \ .001$), with the third set presented (personally relevant) requiring longer ($p<.05$) response times ($\log=.80$) than the first two sets presented, which did not differ ($.75$ and $.73$). The final two sets presented required the shortest ($p<.05$) response times and did not differ (0.68 and 0.69). The type of stimulus effect was not significant. The group by order effect was significant ($F=2.22, \ df=20, \ 212, \ p<.01$). This effect is displayed in Figure 4.

**Session duration.** A one-way ANOVA was performed to analyze group differences on duration of the experimental procedures. Group differences were significant ($F=4.52, \ df=5,78, \ p<.001$). The paranoid schizophrenic group ($M=27.9$ minutes) and nonparanoid schizophrenic group ($M=32.0$) took significantly longer ($p .05$) to complete the session than did all other groups (delusional major depressives $M=22.9$; nondelusional major depressives $M=24.9$; psychiatric controls $M=17.4$; normal controls $M=24.3$). No other significant group differences were obtained.
Figure 4. Mean response time (log transformation) by order of presentation by group.
The primary hypothesis of this study was that paranoid schizophrenics would exhibit "normal" confirmation biases but to a greater degree than other subjects. It was further hypothesized that this bias would be especially evident in anxiety-provoking situations and a manipulation intended to enhance anxiety was included in the study. Finally, the paranoid schizophrenics were expected to benefit less from feedback because of their characteristic rigidity.

The results of this study indicate that, as expected, all of the groups exhibited confirmation-bias responses. The performance of the six groups appeared to cluster into three pairs associated with the degree of pathology in the subjects: (1) paranoid and nonparanoid schizophrenics; (2) delusional and nondelusional depressives; and (3) normal and psychiatric controls. Although the differences between any two groups within a pair were not statistically significant, the nonparanoid schizophrenics consistently made more CBR's when compared to paranoid schizophrenics on this cognitive task (Bourne, et al., 1977; Zigler & Glick, 1984). The greater response times of the nonparanoid schizophrenics than all other groups also suggested a greater level
of disorganization in this group.

The personally-relevant materials were intended to increase anxiety in subjects which would lead to an increase in the use of confirmation bias responses. Subjects did report greater state anxiety after presentation of the personally-relevant materials, however, reported anxiety levels apparently did not relate to use of confirmation biases. There was a negative correlation between state anxiety and use of confirmation biases on the nonpersonal materials only in the nonparanoid schizophrenic group. However, this finding did not relate to the anxiety reported after presentation of those materials increasing state anxiety. The nondelusional major depressives and the nonpsychotic psychiatric controls, reported much greater levels of state and trait anxiety than other groups. Actually, upon closer inspection of the items in the State-Trait Anxiety Inventory (Spielberger, 1983), it is obvious that many of the "anxiety" items could be related to depression (Reynolds, 1984).

Three different types of stimuli were presented to investigate the effects of different content on the tendency to make confirmation bias responses. Earlier studies have indicated that thematic materials facilitate performance on the selection task (Johnson-Laird et al., 1972; Wason & Shapiro, 1971), though these findings are not unequivocal (Evans, 1982; Manktelow & Evans, 1979). In this study, it appears that the differences in performance on the initial presentations of the abstract and thematic materials were masked by practice effects, which were clearly evident throughout
this task. However, with the second presentation of the thematic and abstract materials, after subjects had had experience with the task, the differences between the abstract and thematic materials emerged, with fewer confirmation biases (more correct responses) exhibited during the presentation of thematic materials. Unlike other studies that have attempted to induce falsification strategies (Wason, 1969; Wason & Johnson-Laird, 1970), almost all of the subjects in the normal control and nonpsychotic psychiatric control groups demonstrated insight into the nature of the task. This might be due to either the manner in which feedback was given in this study or the considerable number of problems which the subjects solved.

A positive feature of this study was the inclusion of various control groups which were included to investigate the effects of different variables (Neale & Oltmanns, 1980). The inclusion of a normal group, which consists of subjects who were not in psychiatric treatment, receiving medications, nor met criteria for a mental disorder, provided an anchor point for initial analyses and replication of previous studies reported in the literature. However, a finding of global differences between the performance of schizophrenics and normals is for the most part, trivial (Chapman & Chapman, 1973); schizophrenic subjects are almost always found deficient on cognitive measures. In this study, normal controls, though comparable in terms of education and verbal abilities, demonstrated better performance compared to the four psychotic
psychiatric groups. The nonpsychotic psychiatric group which was included to investigate effects of psychiatric hospitalization, performed quite similarly to the normal control subjects.

The two depressed groups, delusional and nondelusional, were included to investigate the characteristics of affect and delusions. Recent reports have revealed that depressed patients have particular difficulties in thinking and processing information (Hemsley & Zawada, 1976; Miller, 1979). These results have been difficult to interpret since the poor performance might be related to emotional disturbance regardless of diagnosis, or to a closely related symptom like thought disorder, or to a host of other variables. Even though including control groups to deal with related variables does not provide unambiguous results, failure to include them can lead to misleading interpretations of the results. Unfortunately, most of the earlier studies in schizophrenia failed to include control groups other than normals.

The delusional/nondelusional distinction in depression is a fairly recent one (Charney & Nelson, 1981; Glassman & Roose, 1981; Kantor & Glassman, 1977; Sweeney, Nelson, & Bowers, 1978) but there is accumulating data that these two groups vary in treatment response. The delusional depressives were included as a control group to investigate whether an excess use of confirmation biases might be related to the presence of delusions or paranoid schizophrenia. Actually, the delusional depressives performed more similarly to the nondelusional depressives than to the two
schizophrenic groups on the hypothesis testing task but more similarly to the two schizophrenic groups than to the nondelusional depressives on the anxiety measures. While previous studies have suggested that the presence of depressive delusions relates to poorer prognosis in delusional patients (c.f., Zigler & Glick, 1984) this group did not demonstrate greater pathology or poorer cognitive performance.

While this research study was primarily concerned with investigating group differences in performance on this hypothesis-testing task, it also allows for an analysis of the task itself. The task was selected to test the use of confirmation biases as was its original purpose (Wason, 1966). While most investigators have adhered to Wason's original model in interpretations of results of the selection task, Evans (1982, 1984, 1985), has recently proposed a model which argues against Wason's basic premise that subjects' responses indicate attempts to verify the hypothesis.

To solve this problem correctly subjects must successfully follow a series of steps. First they must attend to each card individually and consider each of the two logical possibilities on the other side of the card. Then the subject must apply a truth table to evaluate all eight combinations. Finally, a decision rule is applied such that only those cards which might produce a falsifying combination must be selected (Evans, 1984).

Evidently most subjects deviate from this ideal in one way or another. Evans (1982, 1984, 1985) has proposed that most
individuals initially use a form of heuristic, a matching bias, when making a selection in this task. Empirical considerations aside, clinical observations of the subjects in the present study would support Evans' model (1985) more so than that of Wason (1966; Johnson-Laird & Wason, 1972). When subjects in this study were initially presented with the stimuli, it appears they relied on a strategy which would be efficient in most situations, matching relevant dimensions— that is, subjects gave as their responses the names of the dimension values mentioned in the statement they were to prove false. However, after receiving feedback that the original selection was inaccurate or that a different level of analysis was required for this problem, most subjects began to understand the logic of the task. These results are similar to those of earlier studies which found subjects to not gain insight into the logical structure of the task even when feedback as to the accuracy of the response is provided (Wason, 1969; Wason & Johnson-Laird, 1970). In this study, however, training was extensive and subjects did eventually learn the correct response. The nonparanoid schizophrenic group seemed to gain the least from feedback and practice. While all other groups showed at least a gradual improvement in performance, the nonparanoids persisted in their use of heuristics or matching.

Once subjects discovered the correct solution to the problem, they again used a time-saving heuristic, again matching, using different values of the dimensions. Many subjects reported using a
"pattern" of responding, that is, selecting a match of the first dimension (p), such as a square, and the opposite of the second dimension (not-q), such as the color "red." Even those subjects who arrived at an incorrect solution, usually responded according to the pattern they ascertained as correct.

Overall, the results suggest that, even though schizophrenics, both paranoid and nonparanoid, show a general problem-solving deficit, performance can improve markedly if practice and repetition are allowed. All of the groups were apparently able to take account of feedback and disconfirmatory evidence to improve their performance, though the degree of improvement varied across subject groups, and all but the nonparanoid schizophrenics were able to sustain these improvements.
LIST OF REFERENCES


APPENDIX A

UNIVERSITY OF WASHINGTON
CONSENT FORM I
CONFIRMATION BIASES

Principal Investigator:
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Associate:
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INVESTIGATOR’S STATEMENT

PURPOSE AND BENEFITS

The purpose of this study is to better understand how individuals test hypotheses. It is being conducted to provide information that may help us understand how individuals differ in the way they use information that is given to them in both abstract and personal situations. The study is being conducted in partial fulfillment of the requirements for a doctorate degree in clinical psychology.

PROCEDURES

Your participation will involve meeting together with the associate investigator for two one-hour sessions. During the first session, an interview will be conducted, asking you questions about your thoughts and feelings during the past week. You will be asked questions such as, "Have you been depressed?" and "Have you felt that you committed a crime, or have done some terrible thing and deserve punishment?". In order to save time, some information will be obtained from things you have told your treatment team and is written in your medical chart, such as your age and education. During this first session, you will also be asked to sort cards indicating how you feel about certain topics, such as religion, sexual behavior, politics and also about the way you are feeling.
now, you will be administered a vocabulary test and a similarities test. A second session will be scheduled within five days of the first session. During the second session, you will be asked to prove several statements true or false by turning over index cards. Some of these statements will be abstract and others will be personally relevant to your beliefs and thoughts. The personally relevant statements will be designed according to the information you give us in the interview in the first session. Your participation in this study is completely voluntary, and you will be free not to answer any questions which you find objectionable. Your performance on these tests will in no way affect your treatment during your current or future hospitalizations.

RISKS, STRESS OR DISCOMFORT

It is not expected that the interview or testing will be particularly stressful. Some people may feel discomfort as they talk about personal feelings, while others may find the interview a useful way to express some of their feelings. Some people might also feel uncomfortable being asked to test out some of their beliefs. If the interview or testing session is particularly upsetting to you, you may terminate the session and the principal investigator or ward staff will be available to provide counseling.

OTHER INFORMATION

The information that you provide in the initial interview will be summarized in your medical chart and made available to your treatment team. Your performance during the second session will not be recorded in the chart. You may refuse to participate and may withdraw from the study at any time without penalty or loss of benefits to which you may otherwise be entitled or without jeopardizing future care. Information obtained during the study will be kept for no longer than five years in a locked file, after which it will be destroyed. Of course, the information you share will be treated as strictly confidential. The only people who will have access to the information, other than your treatment team, will be the principal investigator and his associate. When completed, the results of the study will be placed in the Ohio State University Library. Should this study be published in a journal, no identifying data will be used.

Signature of Investigator/Date
Subject’s Statement:

The study described above has been explained to me and I voluntarily consent to participate in this research. I have had the opportunity to ask questions and understand that future questions I may have about the research or about subject’s rights will be answered by the investigator listed above.

_____________________________
Signature of Subject/ Date

Copies to: Subject
Investigator's File
APPENDIX B

UNIVERSITY OF WASHINGTON
CONSENT FORM II
CONFIRMATION BIASES

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INVESTIGATOR'S STATEMENT

PURPOSE AND BENEFITS

The purpose of this study is to better understand how individuals test hypotheses. It is being conducted to provide information that may help us understand how individuals differ in the way they use information that is given to them in both abstract and personal situations. You are being asked to participate as a comparison subject. Your performance will be compared to hospitalized psychiatric patients. The study is being conducted in partial fulfillment of the requirements for a doctorate degree in clinical psychology.

PROCEDURES

Your participation will involve meeting together with the associate investigator for two one-hour sessions. During the first session, an interview will be conducted, asking you questions about your thoughts and feelings during the past week. You will be asked questions such as, "Have you been depressed?" and "Have you felt that you committed a crime, or have done some terrible thing and deserve punishment?" During this first session, you will also be asked to sort cards indicating how you feel about certain topics, such as religion, sexual behavior, politics and also about the way
you are feeling now. You will be administered a vocabulary test and a similarities test. A second session will be scheduled within five days of the first session. During the second session, you will be asked to prove several statements true or false by turning over index cards. Some of these statements will be abstract and others will be personally relevant to your beliefs and thoughts. The personally relevant statements will be designed according to the information you give us in the interview in the first session. Your participation in this study is completely voluntary, and you will be free not to answer any questions which you find objectionable.

RISKS, STRESS OR DISCOMFORT

It is not expected that the interview or testing will be particularly stressful. Some people may feel discomfort as they talk about personal feelings, while others may find the interview a useful way to express some of their feelings. Some people might also feel uncomfortable being asked to test out some of their beliefs. If the interview or testing session is particularly upsetting to you, you may terminate the session.

OTHER INFORMATION

You may refuse to participate and may withdraw from the study at any time. Information obtained during the study will be kept for no longer than five years in a locked file, after which it will be destroyed. Of course, the information you share will be treated as strictly confidential. The only people who will have access to the information will be the principal investigator and his associate. When completed, the results of the study will be placed in the Ohio State University Library. Should this study be published in a journal, no identifying data will be used.

Signature of Investigator/Date
**Subject's Statement:**

The study described above has been explained to me and I voluntarily consent to participate in this research. I have had the opportunity to ask questions and understand that future questions I may have about the research or about subject's rights will be answered by the investigator listed above.

________________________
Signature of Subject/ Date

Copies to: Subject
           Investigator's File
APPENDIX C

PERSONAL ISSUES

Instructions:

"I would like to get an idea of how you feel about certain topics. I will give you this stack of cards. Each has a different statement printed on it. Indicate how you feel about each issue by putting the card beneath the heading that describes how strongly you feel about the issue."

Category headings: 0 No Strong Feelings
1 Somewhat of a Strong Feelings
2 Moderately Strong Feelings
3 Very Strong Feelings
4 Extremely Strong Feelings

1. My personal feelings about a life hereafter.
2. The extent to which I feel there is only one true religion.
3. How I would feel about marrying a person of a different religion.
4. The reasons why I am or am not religious.
5. Any doubts I have ever had about my religious beliefs.
7. My feelings about atheists.
9. My feelings about Protestants.
10. My feelings about Catholics.
11. My beliefs concerning the existence of Heaven or Hell.
12. Whether or not I want to have any children when I get married.
13. How important I think sex will be in making my marriage a good one.
14. The way in which I want to raise my children.
15. My feelings about separation or divorce.
16. How often I think children should be spanked.
17. What I would do if my child stole a bicycle.
18. My reactions if my child came home with a black eye.
19. My ideas about who should manage the money in a marriage.
20. What I would do if I found out that my marriage partner had lied to me.
21. Habits I wouldn't tolerate in a marriage partner.
22. What I would do if I caught my marriage partner playing around with some other person.
23. How I would feel about having sexual relations with another person after I was married.
24. My feelings about standards of sexual behavior before marriage.
25. My feelings about sexy movies.
26. The amount of sexual freedom I feel women and men should have.
27. What a man should do if he gets a girl pregnant.
28. What I think makes a person look "cheap".
29. The kind of person I like to date.
30. My views on sexual morality - how I feel that I and others ought to behave in sexual matters.
31. What I think about girls or boys who will have sexual relations on a first date.
32. My feelings about girls who are not virgins.
33. My feelings about birth control.
34. Whether or not I feel that I am attractive to the opposite sex.
35. My opinions about swearing and cursing in the presence of girls.
36. How I have felt or might feel if I ever saw my mother drunk.
37. Times when I felt like running away from home.
38. Times when my parents have been angry with me.
39. Times when I have been angry with my parents.
40. How I might feel (or actually felt) if I saw my father hit my mother.
41. Bad habits my father or mother have.
42. Whether or not I would marry against the will of my parents.
43. How I might (or did) feel if my mother and father were divorced or separated.
44. Diseases that seem to run in my family.
45. Things I like/dislike about my father.
46. Things I like/dislike about my mother.
47. What foods I feel are best for my health.
48. Times when I have wished that I could change something about my physical appearance.
49. How I feel about getting old.
50. Long-range worries or concerns that I have about my health, e.g. cancer, ulcers, heart trouble.
51. My feelings about gambling.
52. How important money is for my happiness.
53. Whether or not I would ever steal money if I had to have it.
54. What I would do if someone stole money from me.
55. How much money I owe.
56. How I would feel if someone of a different race moved right next door to where I live.
57. What I would do if I saw someone breaking the law.
58. Whether or not I think the Federal Government should support persons who cannot find work.
59. My opinion on the best way to solve racial problems.
60. Mistakes which I feel our Government has made.
61. My feelings about people who dislike Jews.
62. My feelings about people who dislike Negroes.
63. My feelings about the amount of control that the Government should have over individuals.
64. My thoughts about how I would run the country if I was in the President's position.
65. What I think is the best form of government.
66. What I think about killing during the war.
67. My opinion on whether or not abortions should be made legal.
68. The degree to which whites should accept Negroes into their activities.
69. My views on the racial integration of schools, transportation, etc.
70. How I feel about mercy killings.
71. My feelings about whether or not there should be a draft and who should be drafted.
72. How I would feel about going to war.
73. How I feel about capital punishment.
74. My views on communism.
75. What I think our Government's policy toward Russia should be.
76. My feelings about how good a job the President is doing.
77. My political opinions.
78. What annoys me most in people.
79. My feelings when I see a sick or hurt animal.
80. Situations in which I become nervous.
81. Things which disgust me.
82. What animals make me nervous.
83. Events in weather that frighten me (windstorms, thunder, hurricanes, etc.).
84. What happens when I see blood.
85. My drinking habits.
86. My smoking habits.
87. Things which would cause me to break up a friendship.
88. Times when other people have made me feel uncomfortable.
89. My views of the people who try to take advantage of me.
90. Degree to which I am understood by most other people.
91. Whether or not I think there are situations in which lying is o.k.
92. How I feel about people who make fun of others' faults and handicaps.
93. My attitudes about smoking.
94. My views on drinking.
95. Superstitions that I have.
96. The worst pressures and strains in my work.
97. What I dislike most about bosses I have had.
98. How much my work is appreciated by others (bosses, fellow-workers, teachers, spouse, etc.).
99. Times when I have been embarrassed by a teacher or instructor.
100. Times when I felt like telling off my boss.