AN EXAMINATION OF THE FACTOR STRUCTURE

OF THE SCI-PANSS

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Paul Thomas Dudek

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Dedication

In memory of my grandfather,

Dr. Jan Stanislaw Dudek
por. lek.
2 Korpus Wojska Polskiego
Pułk 4 Pancerny ‘Skorpion’
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Abstract
An Examination of the Factor Structure of the SCI-PANSS
Paul Thomas Dudek
Michael Lowe, Ph.D.

Schizophrenia is a debilitating disorder with far reaching effects on individual functioning. The characteristic symptoms include positive symptoms which are described as psychosis and bizarre behavior. Then there are the negative symptoms which are more numerous in presentation. Negative symptoms include problems in communication, affect, cognition, and behavioral control. While the positive symptoms are more readily defined, the negative symptoms are less so. All of these symptoms present in complex patterns, which has led to difficulty in the accurate measurement of symptom severity. The SCI-PANSS has sought to measure the severity of schizophrenic symptoms. There has been considerable debate centered on the number and composition of dimensions that make up the phenomenon of schizophrenia. The goals of this project were (1) to examine the factor structure of the PANSS rating scale in a sample of individuals diagnosed with schizophrenia, and, (2) simultaneously compare on a single sample the obtained factor structure with several previously derived multi-factorial models of the SCI-PANSS.

This study describes a latent structure of SCI-PANSS symptoms using an exploratory factor analysis (EFA). This model was compared to previously
derived models through a confirmatory factor analysis (CFA). Previous models have been described using a variety of patient samples. This left the competing models vulnerable to variation caused by these varied samples. This study improves upon the present literature by removing this confound through the comparison of multiple models on one sample.

An EFA was conducted on a large sample of subjects diagnosed with schizophrenia. This analysis produced a five factor solution. These dimensions include: positive symptoms, negative symptoms, cognitive symptoms, an excitement dimension, and an anxiety/depression component.

This derived factor solution was compared to a number of other competing models that have been derived through other factor analytic studies. These included a null model, a three and four factor solution, several five factor models, and a seven factor model. While none of these models met adequate fit, the results suggest that a pentagonal model reflects the latent structure of schizophrenia. Implications of these findings are discussed with recommendations to improve model specification.
I. Introduction

The measurement of symptom severity is an essential aspect of clinical psychology and psychiatry. However, the measurement of symptomatology in psychology is rarely as simple as indicating the presence or absence of a symptom. More often symptoms present along a spectrum of intensity. To complicate matters, symptoms generally do not occur in isolation. Disorders are defined by a set of these correlating features. The design of any instrument intended to measure symptom severity must not simply define these features but should also reflect the natural or latent structure of these symptoms as they occur.

Andreasen et al. (1994) have outlined the goals of the study of psychopathology. The questions they ask are as follows: what are the characteristic symptoms? The symptoms of the disorder must be identified and defined. What are the boundaries of the disorder? A clinician needs to be able to accurately determine when a disorder exists and when it does not. What are the subtypes? Some disorders evidence multiple clinical presentations, and these various presentations must be defined. What are the characteristics of the disorder’s longitudinal course? Some disorders change in presentation over the life span and the presentation may change from an acute stage to a chronic stage. What is the link between clinical presentation and neural mechanisms? The etiology of a disorder can often shape treatment and prognosis. And finally, can it be explained parsimoniously? The validity
of the conceptualization of any disorder is improved by clear well defined descriptions. Each of these questions must be given consideration in the design of instruments to measure psychopathology accurately and reliably. Instruments used in the measurement of psychopathology and its severity should reflect the current universe of knowledge and understanding of any particular disorder.

**Aims of this Study**

This study seeks to accomplish several goals. The study will first outline the difficulties that have emerged in the conceptualization of symptom dimensions in a complex and debilitating psychiatric disorder, schizophrenia. Additionally, limitations of instruments designed to assess the positive and negative symptoms of schizophrenia will be described. This study will attempt to demonstrate that the dichotomous categorization of these symptoms is problematic and that such categorization inadequately describes the multi-faceted nature of the disorder. The development and psychometric properties of the SCI-PANSS, an instrument designed to correct for limitations of prior assessment tools of schizophrenia symptoms will then be described. The factorial validity of this instrument however, has been the subject of considerable debate. Numerous models of the latent structure of the SCI-PANSS have emerged in the psychometric literature, but none have been conclusive. The main goals of this project are (1) to examine the factor
structure of the PANSS rating scale in a sample of individuals diagnosed with schizophrenia, and, (2) simultaneously compare on a single sample of individuals with schizophrenia, the obtained factor structure with several previously derived multi-factorial models of the SCI-PANSS identified in the literature.

The Background and Significance of Schizophrenia

As a clinical syndrome, schizophrenia is a psychiatric disorder that presents in a wide variety of manifestations. Although it is possible that a single etiological or pathogenic process accounts for this diversity, it is very likely that the syndrome has multiple courses of illness, which accounts for the variety of presentations. An individual diagnosed with schizophrenia is usually identified by the observation of psychotic symptoms, delusional beliefs, and bizarre behavior. However, many, if not most, patients also have negative symptoms. These negative symptoms can include low levels of emotional arousal, mental activity, and social drive. Given their presence throughout the course of the illness, these negative symptoms are often the most debilitating aspects of the long-standing impairment observed in patients with schizophrenia.

According to the DSM-IV (APA,1994), the characteristic symptoms of schizophrenia involve a range of cognitive and emotional dysfunction that affect perception, inferential thought, language, attention, behavioral
monitoring and control, affect, and volition. There is no single symptom that is pathognomonic to schizophrenia. Instead, the syndrome is a constellation of signs and symptoms that is related to impairment in social and occupational functioning. The characteristic or primary symptoms of schizophrenia can be conceptualized as falling into two broad types, positive or negative. The positive symptoms include delusions, hallucinations, disorganized speech, and disorganized or catatonic behavior. The negative symptoms, of which the DSM-IV identifies three as specific criterion, are symptoms which reflect an absence of cognitive abilities which are normally present in most individuals. These include affective flattening, alogia, and avolition. A number of other negative symptoms are included as associated symptoms, but are not necessarily identified as specific criterion for the disorder. While positive symptoms are often readily evident in presentation, the negative symptoms are more difficult to evaluate. This is associated with the understanding that negative symptoms occur along a continuum with normality, are nonspecific, and may be due to other factors such as a consequence of the positive symptoms, medication side effects, or demoralization related to behavior secondary to the positive symptoms.

In order to meet the criteria for the diagnosis of schizophrenia, an individual must present with two or more of the characteristic symptoms for more than one month. During a significant portion of the time since the onset of these symptoms, the individual should demonstrate difficulties in
functioning in one or more major areas of life functioning. These can include interpersonal relationships, self care, and occupational functioning. Additionally, there needs to be continuous signs that the disturbance persists for at least six months. In most cases, these signs will predominantly be the negative symptoms. As exclusionary criteria, the dysfunction cannot be due to an affective disorder, substance abuse, or the direct effects of a medical condition. Depending upon which of the characteristic symptoms is most significant in presentation, schizophrenia can also be identified by sub-type in the DSM-IV system. These sub-types include paranoid, disorganized, catatonic, undifferentiated, or residual. The paranoid, disorganized, and catatonic sub-types are related to a dominance of a specific positive symptom. The presence of characteristic symptoms, but no one symptom is dominant note the undifferentiated sub-type. The residual subtype presents with a lack of positive symptoms, but there is evidence of the presence of negative symptoms. Often this is the postdromal presentation of the disorder.

Schizophrenia is not only debilitating to the individual but it is also a syndrome with a profound influence on public health. Schizophrenia has been called “arguably the worst disease affecting mankind, even AIDS not excepted” (Carpenter & Buchanan, 1994). The worldwide lifetime prevalence of the disorder is estimated between 0.20-1% across diverse geographic, cultural, and socioeconomic categories. In some areas, the prevalence of the disorder has been reported to be as high as 2% of the population (APA, 1994).
According to the DSM-IV (APA, 1994), the incidence rate of schizophrenia is estimated to be approximately 1 per 10,000 individuals per year. The onset of the illness occurs relatively early in life, predominately in the mid- to early twenties. While the onset may be acute or insidious, a majority of cases are marked by a slow and gradual development. Significant others often have difficulty understanding these changes and family discord often follows. Eventually, most individuals decompensate into an active phase, often marked by psychosis. For many, it is not until this point that they enter into treatment for the syndrome. Most patients suffer from long-lasting adverse effects such as impaired social, familial, and vocational functioning as well as the internal distress caused by the symptoms. While some individuals suffer through a chronic, unremitting illness, others follow a course of periodic exacerbation and remissions. Complete remission or a return to pre-morbid functioning is probably not common with schizophrenia. The chronic nature of schizophrenia may be accounted for by the abnormal brain functions found when compared to control subjects. As a group, structural abnormalities in the brain have been found consistently in schizophrenic individuals. Most commonly, the abnormalities are the enlargement of the ventricular system and of the prominent sulci of the brain. Specifically, enlargement of the ventricular system has been associated with negative symptoms. Abnormalities of the prominent sulci have been correlated with the presentation of positive symptoms such as psychosis.
In 1990, the direct and indirect costs of schizophrenia in the United States amounted to an estimated $33 billion. It was estimated at that time that treatment costs accounted for 2.5 percent of the total U.S. healthcare expenditure. Inpatient treatment is still common, despite deinstitutionalization in the 1960's and 70's. Many communities are ill prepared to provide adequate long term care and shelter for patients with schizophrenia. Even more troubling is the stigma associated with schizophrenia, which can create more difficulty in creating treatment programs with ready access for patients. Even the most up-to-date treatments are only palliative, and a significant fraction of patients with this disorder are refractory to any known treatment (Kane, 1996). A majority of psycho-pharmacological treatments available target the positive symptoms and have a significant side effect profile. It has only been in the last decade that medications have entered the market that has demonstrated significant effects in the treatment of both positive and negative symptoms. Finally, given that between one third and one half of homeless Americans have been estimated to suffer from schizophrenia (Carpenter & Buchanan, 1994), the scope of the problem of providing care for these patients is clearly widespread and far reaching.
The Positive Symptoms

The positive symptoms have historically been conceptualized as hallucinations, delusions, thought disorders, and bizarre behavior. Hallucinations are the abnormal perception of stimuli that in reality do not exist. Delusions represent an abnormality in inferential thought where the perceptions are normal but the interpretation is aberrant. Problems associated with thought disorders are related to the distortion of normal speech that occurs in abundance. That is, an individual presents with a pervasive problem in the production, comprehension, and logic of speech that is not related to an organic cause. While historically thought disorders have been associated with positive symptoms, increasing numbers of authors have described them as negative symptoms (Klosterkotter, et al., 1995). Bizarre behavior is the aberration in behavioral organization and control where the individual performs inappropriate social and sexual behaviors as well as perseverative acts. Collectively, the positive symptoms are usually described as being distinctly absent or present given the ease in observing these types of behaviors (Andreasen, 1990).

The positive symptoms of schizophrenia are readily assessed, leaving little difficulty for researchers and clinicians in making reliable and valid decisions as to their presence (Johnstone, 1989). In clinical diagnosis, these positive symptoms have been utilized as first rank symptoms of schizophrenia (APA, 1994). First rank symptoms are those which are required...
to be present in order to meet the full criteria for diagnosis. However, some have suggested the positive symptoms have begun to play too predominant a role in the description of schizophrenia. Many authors believe that since positive symptoms are transitory and episodic, whereas negative symptoms tend to be stable over time, more emphasis should be shifted to the multi-dimensional nature of the disorder (Klosterkotter, et al., 1995). In addition, these symptoms may have too low a base rate to be used in isolation for diagnostic purposes. This is especially relevant given the transitory nature of positive symptoms being dominant primarily in acute phases and the finding that they are not predictive of long term outcome (Klosterkotter, et al., 1995).

The Negative Symptoms

Negative symptoms are a complex pattern of behavioral and emotional states (Mundt, Kasper, & Huerkamp, 1989). The negative symptoms may be an expression of an elementary deficiency of mental or cognitive functions, the reactions and attitudes reflective of personality styles, and the presentation of medication side effects. It has been generally accepted that positive and negative symptoms are independent variables with differing underlying pathologies and time courses. Rarely do positive symptoms correlate with negative symptoms (Crow, 1989). Often, negative symptoms are found to exist prior to the onset of positive symptoms, but do not come into clinical awareness until positive symptoms surface (Klosterkotter, et al.,
Primary negative symptoms are those whose causality is attributed directly to the disorder. Secondary negative symptoms would be those associated to the effect of medication.

Due to the great variability in the presentation of negative symptoms in psychiatric patients, the use of negative symptoms is problematic in discriminating schizophrenic from non-schizophrenic patients (Klosterkotter, et al., 1995). Only thought blocking and inadequate affect appears consistently as a negative symptom across many schizophrenic patients, with the remainder varying widely (Mundt, Kasper, & Huerkamp, 1989). Also, withdrawal behaviors, apprehension, and resignation features often overlap with other disorders, especially those in the depressive spectrum (Mundt, Kasper, & Huerkamp, 1989). It is this overlap of negative symptoms with depressive symptoms and other problems that has given positive symptoms their discriminative power.

Thus, negative symptoms seem to have much in common with symptoms of multiple disorders (Mundt, Kasper, & Huerkamp, 1989). While many negative symptoms occur most frequently in individuals suffering from schizophrenia, they present quite commonly in the mood disorders and organic disorders. They are also found in the anxiety disorders, phobias, and personality disorders with lesser frequency. Mundt and his colleagues (1989) report that at any given time point, seven percent of individuals without a psychiatric diagnosis present with negative symptoms. This would be a
particularly large problem if the negative symptoms were used in isolation to
describe schizophrenia. The problem is overcome by the inclusion of positive
symptoms in defining schizophrenia. However, this same overlap among the
negative symptoms in multiple disorders is also responsible for the emphasis
placed on the positive symptoms for diagnosis. This, as noted earlier, has
generated concern that the negative symptoms are given too little
consideration in comparison to their pervasive nature in schizophrenia.

Negative symptoms have not readily lent themselves to measurement,
especially in terms of severity. Problems with speech and incongruity of affect
have been difficult to rate due to problems in defining the limits of normality
of these features (Johnstone, 1998). Given the overlap of negative symptoms
in their presentation with non-psychotic diagnosis, it has often been difficult
to differentiate which symptoms are due to schizophrenia, depression, and
even medication side effects (Wolthaus, et al., 2000).

Negative symptoms posses several unique features when attributed
specifically to schizophrenia. In acute or first episodes, negative symptoms
are sparse and are linked tightly to the presence of other manifestations of
psychosis, notably the delusions and hallucinations (Moller, 1995). However,
the idiosyncratic presentation of negative symptoms appears to be more
stable in chronic and sub-acute patient samples, whereas positive symptoms
are transitory and episodic in nature. Additionally, individuals with
schizophrenia have proportionately greater abnormalities within the
ventricular system of the brain (d'Amato, et al., 1992) which has been
associated with the presentation of negative symptoms. Positive symptoms,
however, have been associated with abnormalities in the sulci of the brain.

The syndrome of schizophrenia is comprised of a complex pattern of
symptoms. Certain features, those identified as positive, lend themselves to
be readily identified by their uniqueness and gross deviation from normal
perception. Indeed, schizophrenia is classified in the DSM-IV with related
disorders under the general order of “Psychotic Disorders”. Though merely a
classification title, the name can be related to an emphasis on positive
symptoms. However, schizophrenia is comprised of more than just the
positive symptoms. It is the negative symptoms that present in a more
chronic fashion, are more resistant to treatment effects, and are related to
the long term debilitation of the individual. While the negative symptoms are
generally well defined, how they are incorporated within the structure of
schizophrenia is in debate. By understanding the latent structure of
schizophrenia symptoms and designing instruments which accurately reflect
this structure, researchers and clinicians can be more sensitive to clinical
presentations of the disorder as well as the overt and subtle effects of
treatment.
Difficulties with the Conceptualization of Positive and Negative Symptoms

The historical origins of the use of positive and negative terminology can be attributed to Hughlings Jackson in the 1880's (Moller, 1995). Jackson was a British neurologist who developed these concepts in order to delineate from primary and secondary neurological phenomena. Later, Kraepelin (1919) and Bleulur (1950), using a similar conceptualization of the disorder, described a core set of symptoms which were the modern equivalent of the negative symptoms of schizophrenia (Moller, 1995). Gradually, Kraepelin and Bleulur's conceptualization was replaced by an emphasis on the productive features of schizophrenia. It was these productive, or positive, features that became a prerequisite for the diagnosis of schizophrenia as formalized by the Diagnostic and Statistical Manual model (American Psychiatric Association, 1994).

Throughout this history, the definitions of the positive and negative symptoms of schizophrenia have remained fundamentally the same (Moller, 1995). Positive symptoms are indicated by the presence of a behavioral function not normally present in an individual. Negative symptoms are those marked by the absence of a behavioral function usually present in an individual. However, the classification of specific symptoms has varied across time and authors (Moller, 1995). Those symptoms that have been universally accepted as positive features of schizophrenia include hallucinations and delusions, and most authors agree that blunt affect and poverty of speech are
representative negative symptoms. However, more problematic are those symptoms such as thought disorders, bizarre behavior, and inappropriate affect, each of which has been described as either positive or negative symptoms across various studies. This inconsistency reflects one of the fundamental goals of this paper; that the dichotomous categorization of these problematic symptoms of positive or negative does not reflect the complex multi-dimensional nature of schizophrenia.

Crow (1980) was most responsible for the modern clinical utilization of the terms positive and negative symptoms. Crow proposed a dichotomous model of schizophrenia. Type I schizophrenia was defined by Crow as consisting of predominate positive symptoms, acute onset, good pre-morbid adjustment, good response to treatment, intact cognition, intact brain structure, a mechanism that is neuro-chemical (dopaminergic) in action, and is reversible. Type II schizophrenia was described as being marked by a dominance of negative symptoms, insidious onset, poor pre-morbid adjustment, poor response to treatment, impaired cognition, structural brain abnormalities, an underlying neural mechanism of neural loss and is therefore irreversible. Crow’s “dual process” model provided a parsimonious explanation of the schizophrenia phenomenon. The simplicity and clarity of the model initiated a great deal of research on the symptoms of schizophrenia throughout the 1980's.
However, there were two fundamental problems with Crow’s dual process theory (Andreasen, et al., 1994). First, there was no clear method of measuring positive and negative symptoms. Second, the theory failed to indicate if those symptoms which overlapped in both dimensions should be considered as independent or dependent constructs from positive or negative symptoms. Additionally, the model failed to define specific sets of symptoms that should be used to reliably describe the syndromes. Crow later modified the dual process theory by describing the positive and negative symptoms as independent, non-overlapping constructs. However, additional research indicated that individuals presented with a great deal of overlap of both types of symptoms (Andreasen, et al., 1994).

The of assessment of positive and negative symptoms as independent sub-types of schizophrenia persisted due to its utility in describing a broad range of symptoms regardless of the oversimplification this caused. Additionally, many of the instruments developed to measure symptoms of schizophrenia treated the features as occurring within two distinct syndromes (Andreasen, et al., 1994). This contradicted the abundance of literature which indicated that there is a considerable degree of overlap within these syndromes. For historical and clinical reasons, cognitive disorganization symptoms were often grouped with the positive symptoms. The rationale behind this was that these particular features are florid, and
like hallucinations, tend to be a presenting problem that brings a patient to medical attention.

Shortcomings with conceptualizations were not the only difficulty in measuring positive and negative symptoms. Prior to the late 1980’s, difficulties in reliably and validly measuring these symptoms became evident. The instruments that grew out of the dual process model, though well conceived, lacked standardization and the psycho-metric properties to adequately measure these symptoms (Kay, Fiszbein, & Opler, 1987). It was not until this time frame that a number of standardized instruments were published which had a positive effect on reliable measurement (Moller, 1995). Examples of such instruments include The Scale for the Assessment of Negative Symptoms (SANS) (Andreasen, 1983) and The Scale for the Assessment of Positive Symptoms (SAPS) (Andreasen, 1984). Both of these instruments are rating scales completed by clinicians based on observation of individuals and noted the presence or absence of symptoms. Each of these instruments demonstrated a satisfactory level of internal consistency, reliability, and validity (Andreasen, et al., 1994).

However, these instruments still regarded positive and negative symptoms on two separate dimensions. In nearly all studies involving a broad spectrum of negative symptoms, at least three separate dimensions emerged with positive and negative symptoms as two factors in addition to a disorganized dimension (Moller, 1995). Numerous factor analytic studies
have demonstrated this three-factor solution which is highly reproducible (Andreasen, et al., 1995) and has emerged in a variety of research settings using various instruments (Thompson & Meltzer, 1993). The positive dimension is clearly delineated by delusions and hallucinations. Features such as avolition, anhedonia, and affective flattening define the negative dimension. The third dimension generally includes symptoms associated with thought disorder such as poverty of speech, blocking, perseveration, and inattention. This third dimension has also been referenced as the disorganization dimension.

These three factors appear to be uncorrelated and follow separate longitudinal courses as the illness progresses (Arndt, et al., 1995). Negative symptoms showed little variation over time, being present in acute and chronic stages. Positive symptoms showed the most rapid amount of change due to their quick response to medication treatments. Disorganized symptoms however, showed the greatest amount of variability over time.

As such, the current model of schizophrenic symptoms assumes a dimensional approach (Andreasen et al., 1994). This approach differs in that symptoms, not patients, are separated into groups that define properties that co-occur within individuals. This allows for the description of disorders to be comprised of multiple domains of symptoms which can present in individuals in a broad variety of combinations. Dimensions also differ from categorical sub-types, in that dimensional approaches allow for overlap within an
individual while subtypes force individuals into independent non-overlapping sets. In addition, dimensional approaches are continuous and allow for different degrees of severity (Andreasen et al., 1995).

Some have suggested that in light of the limitations of the conceptualization of these symptoms and the categorization of them by measurement tools, three factors may not be adequate in describing schizophrenia, or in addressing the role of symptom overlap (Rey, et al., 1994). Rey and his colleagues followed 163 schizophrenic patients over the course of five years and tracked symptomology with a wide range of measurements of pathology related to the psychotic disorders. They revealed a five-factor model of the disorder that remained stable over the five years. These five factors were:

1. **Reduced Affect**: blunt affect, poverty of speech, and other negative symptoms.
2. **Anhedonia**: avolition, anhedonia, and inattention
3. **General Neurotic**: anxiety and depression related symptoms
4. **General Positive**: excitability and incoherent speech
5. **Delusions and Hallucinations**

It has been strongly argued in the most recent literature that a five component structure would be more in line with the complexity of schizophrenic symptoms and may be more useful in describing effects found in treatment studies (Wolthus, et al., 2000). This argument becomes more
salient with a more in depth understanding of the specific nature of the positive and negative symptoms of schizophrenia.

Further Considerations of the Schizophrenia Construct

Schizophrenia is demographically and symptomatically heterogeneous (Andreasen, et al., 1995). Two individuals suffering from schizophrenia may have totally different and non-overlapping patterns of symptoms. Additionally, positive and negative symptoms do not possess stable clinical presentations in either the short or long term course of the disorder. Thus, they should not be taken as indicators of specific biological or phenomenological subtypes (Moller, 1995). This complexity reinforces the concept that the schizophrenias are a multi-dimensional construct.

In most modern diagnostic systems, psychiatric disorders are conceptualized as multi-layered, inter-connected constructs (Wing, 1989). Additionally, a vertical hierarchical model is evident in most diagnostic systems, including the DSM-IV system (APA, 1994). Diagnostic systems give priority to symptoms associated with individual disorders. That is, diagnostic systems generally describe symptoms with a relative importance to the disorder. Symptoms can range from being necessary and required to being of tertiary importance. The highest priority is given to organic symptoms which are those related to lesions in the brain. First rank symptoms are those symptoms that do not have a clear physiological cause and are required to be
present to meet the criteria for diagnosis. Severe affective symptoms are generally accepted as the third level of priority as they often occur as a result of the presence of first rank symptoms. Anxiety / obsessive features are considered to be at the fourth level. These symptoms also occur secondary to the first rank symptoms but are less frequent across disorders. Finally there are non-specific features which are usually not used in the criteria for the disorders but are problems associated with the effects of the symptoms. The higher order features are associated with lower ones, but not vice versa. In schizophrenia, the key first rank symptoms such as delusions and hallucinations often disappear with treatment or as the disorder progresses, but lower level ones, specifically the negative symptoms, often persist (Wing, 1989). Frequently, non-specific and affective symptoms such as depression recur as prodromal symptoms of relapse in schizophrenia (APA, 1994).

The development of any instrument to measure the symptoms of schizophrenia must be sensitive to a number of issues that arise out of this complex disorder. First, this instrument must be reflective of the independent, multi-dimensional nature of the disorder. Second, the instrument should possess adequate sensitivity to allow for the control, or partialing out, of variation explained by symptom overlap. The overlap of symptoms often contributes to intensifying overall symptom severity. By controlling for this overlap, the true severity of any one symptom can become more apparent. Third, clear operational definitions and discreet points of
measurement must guide the evaluation of constructs. Fourth, the constructs must be able to be measured in a standardized, reliable, and psychometrically sound manner. Finally, the instrument must be sensitive to the overt and the subtle changes that occur through the disorder’s longitudinal course and from therapeutic change.

These basic considerations guided the authors of the Structured Clinical Interview for the Positive and Negative Syndrome Scale (SCI-PANSS) (Kay, Opler, Fiszbein, 1992). The SCI-PANSS has demonstrated a resiliency to many of these demands. However, as a focal point of this paper, the dimensional or factor structure of the SCI-PANSS has been a continued source of debate.

The Conceptual Foundation of the SCI-PANSS

A number of critiques and discussion of limitations exists regarding the many instruments used to measure positive and negative symptoms in schizophrenia prior to the SCI-PANSS (Kay, Fiszbein, Opler, 1987). Many of these instruments measured the presence of a symptom, but not the severity, which complicated their ability to be sensitive to therapeutic changes. Some scales demonstrated an imbalance in the number of items representative of positive and negative symptoms. Most scales were inapplicable to both typological and dimensional assessment of syndromes. None of the scales included a measurement or ratio of the preponderance of positive to negative
syndromes, nor did any of the scales include a measurement of general psychopathology.

The authors of the SCI-PANSS sought to overcome these limitations, while at the same time attempting to achieve the requisite goals of such an instrument. To achieve this, three principals guided the selection of items for the SCI-PANSS (Kay, Opler, Lindenmayer, 1989). The items had to be consistent with the theoretical concepts of positive and negative symptoms and include symptoms that can be unambiguously differentiated from one another. In addition, the symptoms should be considered primary rather than derivative or secondary features. Finally, to optimize content validity, items should sample from diverse realms of functioning such as cognitive, affective, social, and communicative.

**Administration of the SCI-PANSS**

The Positive and Negative Syndrome Scale (PANSS) was developed initially as a pencil and paper rating system to evaluate the severity of symptoms associated with schizophrenia (Kay, Fiszbein, & Opler, 1987). The PANSS was a thirty item, seven point rating instrument that was carefully operationalized to assess these symptoms. The PANSS was initially formulated as a special adaptation of two psychiatric rating scales; the Brief Psychiatric Rating Scale (BPRS) (Overall & Gorham, 1962) and the Psychopathology Rating Scale (PRS) (Singh & Kay, 1975). As the PANSS
evolved out of these instruments, the authors recognized the need for a rigorous set of guidelines to aid in eliciting data in a systematic way during the course of the interview (Kay, Opler, Fiszbein, 1992). Therefore, a semi-structured interview was developed with precise directions for the conduct of the evaluation. Additionally, clear definitions were developed for each parameter assessed and distinct criteria were defined for rating all seven levels of symptom severity.

The SCI-PANSS contains four basic scales: Positive, Negative, general Psychopathology, and a Composite scale (Kay, Opler, Fiszbein, 1992). The Positive Scale measures symptoms that are features which are not normally a part of the normal mental status. The Negative Scale assesses features that are absent from a normal mental status such as poverty of speech and blunted affect. A General Psychopathology Scale gauges the severity of 16 symptoms associated with schizophrenia but not necessarily defined to be positive or negative in nature. The Composite Scale is a bipolar scale derived by subtracting the Negative Scale score from the Positive Scale score. This provides a measure of the preponderance of positive to negative symptoms. The SCI-PANSS also includes five additional scores for clusters of symptoms that the authors did not find to be independent syndromes but were descriptive of problems associated with schizophrenia. Scores are available to measure Anergia, Thought Disturbance, Activation, Paranoid/Belligerence, and Depression.
SCI-PANSS ratings are based on ratings of information describing a user defined time period, typically the week prior to the interview. These ratings are based upon information gleaned from a variety of sources including the clinical interview, chart records, hospital staff, and family members. The information from multiple sources assists in the accurate rating of a number of items that may not immediately present in the course of the 30 to 45 minute interview.

An interview booklet guides the interview itself. This booklet contains prompts to systematically establish the presence then the severity of schizophrenia symptoms. The booklet contains both yes – no questions and open-ended questions. This format allows the interviewer to establish the existence, nature, and impact of the manifestations of each symptom. The interview also has a decision tree sequence so that the follow up questions depend upon the answer to the previous question. Often, this allows for the interviewer to skip out of unnecessary sections.

The interview is generally conducted in three stages that include a rapport building stage, the formal interview, and a scoring stage (Kay, Opler, Fiszbein, 1992). During the rapport building stage the interviewer should take approximately ten minutes to establish a relationship with the participant and allow the participant to state from the outset their areas of concern. The interviewer takes a non-directive and unchallenging posture,
allowing the participant to elaborate on current life circumstances and current concerns.

The formal interview calls for the collecting of specific information relevant to the thirty items. The instrument does allow for the assessor to conduct the interview in semi-structured manner. This allows the interviewer to begin with domains that may be more relevant to the participant based upon information gathered during the rapport building phase. The objective during this stage is to reliably assess the symptoms mainly from the report and elaboration of the participant. The severity of the symptom is weighted according to the person’s report of manifestation, frequency, and impact on daily functioning. The final stage is the rating of the thirty symptoms assessed by the SCI-PANSS.

Rating The SCI-PANSS Items

Each of the thirty items of the SCI-PANSS is accompanied by a specific definition (see Appendix B). In turn, each of these definitions is accompanied by detailed anchor criteria for the seven rating points. The seven rating points represent increasing levels of severity. The rating points are labeled as:

1 – Absent
2 – Minimal
3 – Mild
4 – Moderate
5 – Moderate Severe
6 – Severe
7 - Extreme
In assigning these ratings, the evaluator is encouraged to consider all available information. Judging by the item definition, the evaluator must first determine if that symptom is present. If it is absent, then the item is scored 1. If it is present then the evaluator must determine the severity of the symptom by referencing the criteria for the item’s anchoring points. The highest applicable rating point is always assigned, even if the participant meets criteria for lower ratings as well. The rater must use a holistic approach in deciding which anchoring point best characterizes the participant’s current functioning.

The rating points are considered to be incremental levels of symptom severity (Kay, Opler, Fiszbein, 1992). A rating of 2 (minimal) generally describes questionable or suspected pathology or behavior representative of the outer limits of the normal range. A rating of three (mild) denotes a symptom whose presence is clearly pronounced but has minimal interference with day to day functioning. Ratings of 4 (moderate) characterize symptoms that are serious problems but occur infrequently or intrude in daily life only to a moderate extent. The moderate severe rating of 5 indicate symptoms that distinctly impact functioning but are not all consuming and can be contained. A rating of 6 (severe) defines gross psychopathology and is highly disruptive to daily functioning. The most serious level of 7 (extreme) represent symptoms that profoundly interfere with daily functioning and usually require supervision or assistance. Summing the items associated with
each domain (Positive, Negative, and General Psychopathology) derives the scale scores.

**Reliability of the SCI-PANSS**

One of the strongest features of the SCI-PANSS is the consistent finding of the instrument reliably measures the symptoms of schizophrenia. Additionally, in multiple studies the scales are reported to be independent. In rare circumstances the positive and negative symptoms may show modest correlations. However, by extracting the shared variance with the General Psychopathology scale, the Positive and Negative scales consistently demonstrate an inverse relationship (Kay, Fiszbein, Opler, 1987). This is a particularly useful feature of the SCI-PANSS in that the instrument allows a researcher to control for the influence of affective and non-specific symptoms on the severity of positive and negative features.

The authors of the instrument reported that in the initial reliability assessments of the PANSS, each item correlated strongly with the appropriate scale total (Kay, Fiszbein, & Opler, 1987). The mean item total correlation’s of .62 (positive) and .70 (negative) far exceeded cross correlation’s of .17 (positive items with negative scale) and .18 (negative items with the positive scale). Alpha coefficients of single items ranged from .64 to .84. No gains in the alpha coefficients could be made by removing any items. Test – retest Pearson correlations were all significant in the positive
direction ranging from .60 for General Psychopathology to .80 for the Positive Scale. Additional assessments of inter-rater reliability demonstrated consistently strong correlations between .89 and .94 (Kay, Opler, Lindenmayer, 1988) (vonKnorring & Lindstrom, 1995).

The SCI-PANSS has also demonstrated to be well correlated to other measures of schizophrenia symptoms (Norman, et al., 1996) such as the Scale for the Assessment of Positive Symptoms (Andreasen, 1984) and the Scale for the Assessment of Negative Symptoms (Andreasen, 1983). Additionally, the SCI-PANSS correlates well with its predecessor (Bell et al., 1992), the Brief Psychiatric Rating Scale (Singh and Kay, 1974). While prior clinical experience does not appear to make for substantial differences in the training of PANSS evaluators, an inter-rater concordance rate of 80% is usually achieved after three training sessions (Muller, et al., 1998).

The SCI-PANSS is no less impressive in terms of assessments of the validity of the measure. There have been a large number of studies that demonstrate the instrument’s validity in assessing the dimensional nature of schizophrenia. These investigations have covered a wide range of independent clinical, genealogical, psychometric, and historical measures. These assessments of validity include discriminate and convergent validity (Kay, Opler, & Fiszbein, 1985; Opler & Kay, 1985; Opler, Kay, & Fiszbein, 1987; Kay & Opler, 1987), criterion related validity (Kay, Opler, & Lindenmayer, 1988; Lindenmayer, Kay, & Opler, 1984), predictive validity
(Kay & Opler, 1985; Kay & Lindenmayer, 1987; Lindenmayer, Kay, & Friedman, 1986) and concurrent validity (Peralta & Cuesta, 1994).

The Factor Structure of the SCI-PANSS

Since the publication of the SCI-PANSS, there has been a serious debate with regards to its factor structure. A series of factor analytic studies on the SCI-PANSS have demonstrated inconclusive results. While some authors report as few as three factors, others report as many as seven. While a number of studies describe a variety of models individually, few have sought to compare several models simultaneously.

In the original normative sample of 240 schizophrenics, a principle components factor analysis was performed to address whether the positive and negative symptoms constitute two major components of schizophrenia symptoms (Kay & Sevy, 1990). Seven orthogonal factors were revealed in this study accounting for 64.7% of the variance. The first two factors with eigenvalues greater than two were a positive and a negative factor. Two additional factors with eigenvalues greater than two were found that described an excited domain and a depressed factor. While included in describing a four-factor model of schizophrenia by Kay and Sevy (1990) these two factors were included as supplemental measures in the PANSS to be used for descriptive purposes of the individual. Three remaining factors (cognitive dysfunction, suspiciousness, and depressed) were generally
disregarded by Kay and Sevy (1990) in describing what they interpreted as a four factor model. These three factors were also included, though in altered form, in the symptom profile that can be utilized in scoring. The findings of Kay and Sevy (1990) were replicated during a drug treatment study in France (Peuskens, 1992). Liu and associates (1997) also reported a four-factor model comprised of a negative, a disorganization, an excitement, and a delusions/hallucinations factor. However, one critique of this study was the dropping of the General Pathology Scale items from the analysis. While this did demonstrate that the positive and negative symptoms separated into a total of four factors, it did not account for a large number of other negative symptoms, depressive symptoms, and cognitive items often related to schizophrenia.

Several studies report a five factor model of the SCI-PANSS items that are similar to each other (Lepine, 1991; Lindstrom & von Knorring, 1993; Lindenmayer, et al., 1994; and Bell, et al., 1994). The five factor solutions have explained between 57 to 70 percent of the total variance. This model includes a positive, a negative, an excited, an anxious/depressive, and a cognitive factor. The positive factor is comprised of delusions, unusual thought content, hallucinations, and grandiosity. The negative component was described by blunt affect, lack of spontaneity, motor retardation, poor rapport, emotional withdrawal, and passive social withdrawal. The excited factor includes hostility, uncooperativeness, poor impulse control, and
The anxious/depressive domain includes anxiety, guilt, and somatic concerns. The cognitive factor is comprised of poor attention, disorientation, preoccupation, conceptual disorganization, and difficulties in abstract thinking. The remaining eight symptoms were dropped from these models due to low communalities. These symptoms include suspiciousness, stereotyped thinking, tension, mannerism and posturing, lack of judgement, disturbance of volition, and active social avoidance. These particular items may occur with such infrequency that they are rarely seen in patient populations or be better accounted for by other variables (von Knorring & Lindstrom, 1994).

There are several other competing five-factor models. One alternative model revealed factors very similar to prior five-factor models, but the composition of these models was more unique (Mass, et al., 2000). After the initial exploratory factor analysis, five components were extracted which explained 68.9% of the variance. Only three items (suspiciousness, somatic concern, and motor retardation) were dropped due to low communalities. The resulting model then explained 72.3% of the variance.

The first factor, labeled hostile excitement, was comprised of hostility, excitement, poor impulse control, tension, uncooperativeness, grandiosity, and mannerisms. Passive social withdrawal, emotional withdrawal, blunted affect, poor rapport, active social avoidance, and lack of spontaneity defined the negative syndrome. A cognitive syndrome was comprised of difficulty in
abstract thinking, poor attention, and conceptual disorganization. The positive symptom domain was made up of delusions, hallucinations, and unusual thought content. Depression, guilt, and anxiety symptoms defined the depressive factor.

White and associates (1997) conducted an extensive evaluation of PANSS models on a large sample of 1,233 schizophrenic subjects. Twenty models were entered into a confirmatory factor analysis. These models include: those described previously in this study; a one factor model reflecting the PANSS total score (the sum of all PANSS items); a three factor model implied by the PANSS positive, negative, and global pathology scores; and a number of unpublished models available only to the PANSS study group (White, et al., 1997). None of these twenty models demonstrated an adequate fit. The models reflective of the PANSS total score and the PANSS three factor model demonstrated the worst goodness of fit of all the models.

These authors continued by examining an exploratory factor analysis on this large sample. This examination revealed a five factor model, but one different from prior models. This model was subsequently run through an additional confirmatory factor analysis. Within this model five items were dropped due to loadings on more than two factors. Seven additional items had dual loadings that contributed to a moderate correlation between many of the five factors. The final model was a 25 item, five-factor solution. The factors
were labeled positive, negative, activation, dysphoric mood, and autistic preoccupation.

The results suggest that the criteria for certain items were too diffuse in definition and may need revision. Specifically, these items were: lack of judgement, suspiciousness, active social avoidance, and disorientation. The conceptual disorganization item loaded positively on the negative factor and loaded negatively on the autistic preoccupation factor while these two factors were positively correlated. This again suggested that the definition of this item was too diffuse in attempting to measure a broad characteristic of thought disorder.

While four of the five factors were very similar to previous models, the fifth was very much unlike the disorganization factor found in other solutions. This factor included poor attention, preoccupation, difficulty in abstract thought, stereotyped thinking, disturbed volition, and hallucinations. This is unlike disorganization factors usually described by inappropriate affect, thought disorder, and bizarre behavior. White suspected that the PANSS items may not be sensitive to the thought disorder symptoms given so many of these items were dropped or had dual loadings, thereby not detecting a disorganization factor. The multiple dual loadings were found with hallucinations, uncooperativeness, impaired volition, impulsivity, somatic concerns, poor rapport, and tension. Dual loadings are rarely found in exploratory factor analysis, instead being a feature of confirmatory factor
analysis. While these loadings may be in part caused by overlap in definitions of items, they also suggest that these items may have more than one causal influence or are correlated to the severity of other symptoms.

The consistent finding of a five factor model suggests that the use of four is too restrictive (von Knorring & Lindstrom, 1995). The use of five factors is given further support by indications that all five factors are sensitive to change during the course of psycho-pharmacological studies (Lindenmayer, Growchowski, & Hyman, 1995; Lindenmayer, Growchowski, & Mabugat, 1994).

The findings of the PANSS study group (White, et al., 1997) are unique from all other reports on the factor structure of the SCI-PANSS in that they encompasses a comparison of many models of the PANSS structure. There was one prior study utilizing confirmatory factor analysis (Cuesta & Peralta, 1995). However, this study contained serious limitations in its findings. In the comparison of alternative models of positive and negative symptoms, only those below four factors were considered, including a null model. The null model, one, and two-dimensional models were not supported. The best goodness of fit was found for three-dimensional models that were defined by positive, negative, and disorganized. Little was gained by adding a fourth dimension. No models of five dimensions were evaluated. The generalizability of these results is severely limited by the use of only items within the positive and negative scales. This shortcoming does not allow for testing models of
schizophrenic symptoms that consider the role of affective, cognitive, and social functioning syndromes.

The SCI-PANSS appears to be a reliable and valid instrument to assess the severity of a wide range of symptoms associated with schizophrenia. However, the factorial validity of the SCI-PANSS is in question. Various reports of the factor structure of the instrument described conflicting models that ranged from three factors to as many as seven. While it has been suggested that five factors provide a balance between parsimony and a comprehensive description of the phenomenon of schizophrenia, the construction of these models vary significantly. When the models are compared simultaneously, no one model is clearly established as describing the structure of these complex symptom domains. However, the majority of factor analytic studies of the SCI-PANSS have derived but one model based upon one patient sample. There has been considerable variation across these studies as to the composition of these samples. While some studies used inpatients only, others utilized outpatients or a mixture of both. This leaves the findings of these studies vulnerable to variations in the samples that are inescapable such as some samples being in more acute stages than others. Only one study has compared multiple models using one sample. However, this study reported findings that are inconsistent with prior factor analytic studies. Further evaluation of the factorial validity of the SCI-PANSS is
needed in order to accurately describe and measure the symptoms of this debilitating disorder.
II. Method

Overview of Research Design

The main goals of this proposed project are (1) to examine the factor structure of the PANSS rating scale in a sample of individuals diagnosed with schizophrenia and (2) to compare the obtained factor structure with previously obtained factor structures identified in the literature. PANSS ratings were made on 2,358 participants drawn from psychiatric hospital inpatients. Participants were first administered the SCI-PANNS interview, and ratings on the PANNS criteria were then made. The data was first subjected to an exploratory factor analysis to determine the factor structure of the obtained data set. The resulting factor solution was then compared to previously described factor solutions for the PANNS using confirmatory factor analysis and goodness-of-fit analysis.

Participants

The study included 2,358 participants who were psychiatric inpatients. Participants were volunteers who agreed to participate in clinical outcome trials of psychotropic medication conducted at psychiatric hospitals while being treated for chronic schizophrenia. While PANSS assessments were conducted over a long time frame, only those administered at time of admission to the clinical outcomes study were used for this study. The assessments were conducted from September 2002 through June 2004. This
data was collected prior to the initiation of this study thereby making this a retrospective study of archival data. As this data is being used retrospectively, it should be noted that the description of data collection is a generalization of what has occurred at multiple sites by multiple researchers, not what done by this author.

**Inclusion Criteria:** Participants are individuals diagnosed with schizophrenia, based on DSM-IV diagnostic criteria. Diagnoses were obtained based on chart information. Only those participants diagnosed with schizophrenia by a licensed psychiatrist were included in this study. Participants were enrolled based on the inclusionary criteria that they have a primary Axis I diagnosis of schizophrenia and be between the ages of 18 to 65. The upper age limit of 65 was selected due to evidence of increased occurrence of dementia beyond that age, and the need to differentiate psychotic from dementia related processes.

**Exclusion Criteria:** Exclusion criteria were as follows:
- Primary Axis I diagnosis other than schizophrenia
- Diagnosis of moderate to severe mental retardation (I.Q. score of 55 or below)
- Diagnosis of organic brain syndrome
- Current use of drugs or alcohol
- Non-English speaking subjects

As the focus of this project is on the factor structure of the PANSS in individuals diagnosed with schizophrenia, individuals with other primary Axis I diagnoses, including schizo-affective disorder, were excluded.
**Human Subjects**

Written informed consent was obtained from all participants. A parent, relative or guardian was required to give consent if a participant is unable to legally do so. The consent form provided an explanation of the assessment procedure, risks, benefits, and the participant’s rights in being a part of this study.

Potential risks included the confidentiality of the participant information and testing results, distress caused by the sensitive nature of the results, and feeling uncomfortable about the study before, during, and / or after the interview has ended. In order to minimize potential risks, participant data can only be identified through code numbers instead of names. Participants were informed that no personnel other than those directly related to conducting this study had access to this coded data. The treatment of all participants was conducted in accordance with “The Ethical Principles of Psychologists and Code of Conduct” (American Psychological Association, 1992).

The consent form was individually read to each of the participants. All participants were told the following: (a) that they could withdraw from the study at any time; (b) they would have the opportunity to review the testing procedure with the evaluator; (c) and they would have the opportunity to discuss their feelings about the study and procedures used.
Procedure

Screening Procedure

Participants were screened through the clinical trials admission criteria based upon the admission diagnosis of schizophrenia made by a licensed psychiatrist, and evidence of a six month drug and alcohol free period. Evidence for this drug free period was ascertained from chart records indicating clean urine drug screens performed to detect the presence of drugs and alcohol.

Evaluators and Training Procedure

The evaluators for this study include trained psychiatric and psychological treatment providers on placement for graduate training or full time employed researcher assistants in a state psychiatric hospital. They were trained in the use and scoring of the SCI-PANSS by an experienced licensed psychologist with expertise in the utilization of the instrument. Training was conducted in three sessions of two hours duration each. Training sessions will address the theoretical foundations of the SCI-PANSS, the foundations for good psychiatric interviews, and the use of rating criteria for each of the thirty items of the PANSS.

Training included watching videotaped model interviews as well as participation in mock interviews. These interviews were scored by each of the trainees, as well as the trainer. The set of scores were then compared. This was followed by discussion when the item scores are greater than one point.
Rehearsal of interviews and ratings continued until at least 80% concordance is reached between the evaluators. The psychologist responsible for training the evaluators provided ongoing supervision for the evaluators as they proceeded with the interviews.

*Interview Procedure*

Interviews were conducted under the supervision of a licensed clinical psychologist. At the start of the initial meeting, the evaluator explained the purpose of the evaluation, obtained written informed consent, and answered any questions the participant may have.

The interviewers conducted the interview as outlined in the SCI-PANSS Manual (Kay, Opler, Fiszbein, 1992) and in accordance with the American Psychological Association ethics code (APA, 1992). All participants interviewed individually in a private room at the facility where they were enrolled for treatment. After obtaining the informed consent, the interviewer commenced administering the SCI-PANSS according to the instructions outlined in the SCI-PANSS manual (Kay, Opler, Fiszbein, 1992). Following the interview the participants were given the opportunity to ask any questions about the procedure and express any concerns about the study. At the conclusion of the interview the participant was debriefed by the evaluator and be given an opportunity to ask questions and express reactions to the testing procedure. Additionally, the evaluators conferred with the facility
staff regarding the individual’s functioning and review records of the individual’s charts as appropriate to the interview.

If, during the course of the interview, the participant reported having serious suicidal or homicidal ideation with a plan / intent, the evaluator contacted a staff member who was required to be onsite during the interviews. Care would have been transferred to the facility staff who then became responsible for appropriate care.

**Ratings and Scoring**

After the interview, evaluators independently scored the individual items using the SCI-PANSS scoring sheet. The constructs that are evaluated by the PANSS can be seen in Appendix A. The items were then rated on the seven point rating system included with the PANSS manual.

**Data Analysis**

*Overview of Data Analyses*

The analysis of the data proceeded in two stages. At the outset of each stage there was an examination of the descriptive characteristics of the entire sample, including basic demographics. In addition, basic characteristics of the data, such as mean scores for each item, were examined in each stage.

Stage one of the statistical evaluation was the exploratory factor analysis of the SCI-PANSS items. In utilizing large data sets where
confirmatory factor analysis is to be used, it is common practice to randomly split the data set in half. One subsequent set of data is used in exploratory factor analysis to identify feasible factor structures. The second remaining data set is then used for the confirmatory factor analysis to simplify and refine this basic model. In this method the data sets are used in tandem to identify factors and build theory (Moore & Neimeyer, 1991). This analysis extracted the number of factors for a model that best explains the shared amount of variance accounted for by the variables with this particular sample. This determined the best fitting factor structure, and provided a reference for the analyses to be conducted in the second stage.

In the second stage, a confirmatory factor analysis was performed on the data that stipulated several models reflected in prior studies. While the majority of prior studies have analyzed the goodness of fit for one only model using principal components analysis or exploratory factor analysis, this study capitalizes on the strength of CFA in comparing the goodness of fit of several competing models, which is a useful tool in theory testing (Bryant & Yanold, 1995). Seven competing models were compared.

The second stage of the analysis is perhaps the most important in terms of this study. The obtained factor structure from the exploratory factor analysis was compared to several other previously described models, as appropriate. These included a null model; a three factor model as outlined by Kay and his associates (1992); a four factor model proposed by Kay and Sevy
PANSS Factor Structure

(1990), a five factor model which has been found by a number of authors (Lindenmayer, et al., 1995), a five factor model proposed by White and his colleagues, and a seven factor model as outlined by Kay and Sevy (1990).

The Utility of Factor Analysis

Factor analysis is a data reduction technique, or more accurately, a dimension reducing procedure (Bryant and Yarnold, 1995). The primary purpose of factor analysis is to uncover the underlying structure in a data matrix. By defining a number of underlying dimensions, or factors, through examining the correlations of a large number of variables, the latent structure of multiple variables is described. A smaller number of underlying dimensions comprised of correlated variables can be uncovered. This reduces a multitude of variables into several dimensional constructs. All the variables are considered simultaneously with each related to all others in the set. This forms a set of factors which maximizes the explanation of entire variable set.

Exploratory Factor Analysis (EFA) can identify a small set of synthetic variables, termed eigenvalues or factors. These factors explain most of the common variation present in the original variable. The EFA seeks to uncover the simplest structure of a group of continuous data. EFA works with the assumption that the total variance of a variable is the sum of three different types of variances. The common and specific variances are reliable and stable while the third, error variance is unreliable. The common variance is the
portion of total variance that is shared with other variables in the analysis. The specific variance is the portion of the total variance that does not correlate with the other variables. The error variance is inherently random variation. EFA seeks to find factors that maximize the amount of common variance. EFA does not work with any a priori constraints on the estimation of the number of factors to be derived. Instead, EFA provides a structure that is inherent in the data which best explains the variation. As such, EFA can be described as a model or theory building technique that proposes a theoretical structure of a construct.

Confirmatory Factor Analysis (CFA) is more akin to a theory testing technique in that it allows for a researcher to specify a certain number of factors to be derived based upon preconceived thoughts about the data. The CFA can compare multiple, previously derived models simultaneously. The analyst can assess the degree to which the data meet the expected structure of the concept. CFA assumes that there are two main sources of variation. The first is due to the influence upon individual responses by latent structures within the concept being measured. The subject’s scores on observed indicators are dependent upon a structure that is brought into the assessment and exists a priori. The second source of variation is due to random error or the influence of unmeasured variables. In CFA, this source of variation can be partialed out leaving only that variation due to the latent structure.
III. Results

All analyses were conducted with the Statistical Package for the Social Sciences, Release 11.5 for Windows operating system. Additional analysis of the confirmatory factor analysis was conducted utilizing the SPSS add-on, AMOS which is a statistical package developed for model and theory building and evaluation including CFA.

Description of the Complete Sample

The complete subject pool of this investigation represented the broad spectrum of individuals diagnosed with psychotic disorders. A total of 2,371 subjects were administered the SCI-PANSS. Subjects ranged from age 18 to 65 years of age, with a mean age of 39.7 years. While there were 808 women participating in the study, men outnumbered women almost 2:1. Of the subjects for whom a subcategory was identified in their diagnosis the majority of subjects were diagnosed as Paranoid (1101 cases). The Undifferentiated and Disorganized subtypes represented the next largest groups with 269 and 249 cases respectively. Residual sub-types (88 cases) and Catatonic (15 cases) were also represented. This suggests that the data is fairly representative of the full spectrum of the psychotic disorders and in relative proportion to epidemiological findings (APA, 1994).

The majority of the subjects were Caucasian, representing 74% of the sample. Only five percent of the population identified themselves as African
– American with another 3% identified as Hispanic. The remaining subjects identified themselves as Asian, mixed, or of some other racial identity.

There were over 1,500 cases for which a number of years since first diagnosis were identified. While 14.4% of the sample had been diagnosed for less than one year, the average number of years since initial diagnosis was 10.8 years. Another ten percent of the subjects had been struggling with the effects of schizophrenia for 25 or more years. This also suggests that this sample represented a broad spectrum of individuals diagnosed with schizophrenia in that there were individuals for whom the diagnosis was recent and likely to have been in a more acute stage of the disease. Likewise there are a large number of subjects for whom this had been a life long affliction. This sample then likely reflected changes in the predominate symptoms throughout the course of the disorder from initial diagnosis to more chronic presentations. That is, the sample was not unduly affected by possibly different presentations of early stages of the disorder where psychosis is more predominate or by those suffering more negative symptoms rather than the more intrusive psychosis or delusions in later stages.

The Exploratory Factor Analysis

The Sample

A sub-set of 1,195 subjects was selected randomly from the main data set with the aim of conducting an initial exploratory factor analysis. This
derived structure will then be compared to other models of the SCI-PANSS described in previous studies. This sample includes 817 men and 378 women all diagnosed with schizophrenia. Subjects ranged from 18 to 65 years old with a men age of 39.5 years. Three quarters of the sample was comprised of Caucasians while five percent of the subjects were African American. The remaining subjects were spread between Hispanic, Asian, or other categories.

Diagnostic sub-types were available for all but 11 of the subjects. Paranoid sub-type made up the majority of the subjects (n=742). Undifferentiated (n=220) and Disorganized (n=165) made up the next largest groups of diagnostic subtypes. The remaining cases were represented by subjects diagnosed with Residual sub-type (n=45) and Catatonic (n=12). The average number of years since initial diagnosis in this sample was 10.7 years.

The descriptives and frequencies of the exploratory factor analysis sample demographics and SCI-PANSS scores can be found in Table 1 and 2.
### Table 1 EFA Sample Demographics

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<th>Variable</th>
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### Table 2 EFA Sample SCI-PANSS Scores Summary

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The Exploratory Factor Analysis

To begin with, distribution characteristics for all SCI-PANSS items were calculated. As shown in Table 3, Disorientation (Item G10) was an uncommon item. In all, 81% of subjects were rated with a 1 (“Absent”) or 2 (“Minimal”). Hence the distribution of this one item demonstrates a trend away from normality (kurtosis = 2.67; skewness = 1.67). While this item was rather uncommon or absent in a majority of cases, it remained in the initial factor analysis with the consideration that if it is an outlier and does not contribute to the model, it would be unlikely to be associated with any derived factors.

In conducting factor analysis, some degree of multi-collinearity is desirable because the objective is to identify interrelated sets of variables (Hair, et. al., 1995). In keeping with this, evaluation of the data matrix should ensure that sufficient correlations to justify the application of factor analysis exist. One measure is the “measure of sampling adequacy” or MSA. This index ranges from zero to one, reaching one when each variable is perfectly predicted without error by other variables. The measure can be interpreted with the following guidelines (Hair, et. al., 1995): .90 or above, use of factor analysis is appropriate and more than a significant degree of multi-collinearity exists. .70 or above suggests an acceptable level of multi-collinearity but interpretation should be done with caution; and below .50 suggests that factor analysis is inappropriate. A Kaiser-Meyer-Olkin
Measure of Sampling Adequacy derived a score of .912 for this data set. This clearly indicates that factor analysis is appropriate and more than a significant degree of multi-collinearity exists.

Additionally, the Bartlett’s Test of Sphericity is a statistical test for the presence of correlations among the variables. It provides the statistical probability that the correlation matrix has significant correlations among at least some of the variables. The Bartlett’s Test of Sphericity demonstrated that this indeed existed with this data ($X^2 = 15464.39, \text{df} = 435, p=.0001$).

To evaluate the dimensional structure of the SCI-PANSS an exploratory principal components analysis (PCA) with orthogonal varimax rotation and application of the eigenvalue criterion were carried out. The use of orthogonal varimax rotation was utilized in an effort to maximize the separation of factors (Hair, et. al., 1995). PCA extracted six components with eigenvalues greater than 1. This represented 59.24% of the variance. However, three items reached only small communalities, thus being hardly represented in a six factor model. That is, these items demonstrate multiple correlations across factors or weak correlations to any one factor. The first item, Lack of Judgment and Insight (G12) achieved multiple loadings on two factors (.406 on factor 2 and .400 on factor 3). As such, this item may be a constituent of both factors and likely influenced heavily by the cognitive and reality testing nature of these factors. The item Disorientation (G10) achieved a loading of .400 on the sixth factor and was the only item that
significantly loaded on this factor. Finally Somatic Concern (G1) achieved a loading of .46 on the fifth factor. Given these low communalities, these items created a degree of indeterminacy in defining the factors. This suggests a re-specification of the factor model by deriving a new factor solution with the non-loading variables eliminated.

While there is some debate regarding the criteria for the significance of a factor loading, one general guideline is the use of “practically significant” findings (Hair, et. al., 1995). Generally factor loadings greater than +.30 are considered to meet the minimal level; loadings of +.40 are considered more important; and if the loadings are +.50 or greater, they are considered practically significant. A loading of .30 translates to approximately ten percent explanation of variance and a loading of .50 denotes that 25 percent of the variance is accounted for by the factor. These guidelines are applicable when the sample size is greater than 100 subjects. When considering only loadings greater than or equal to 0.50 as substantial (corresponding to a common variance between factor and variable of 25%), the following factor solution results (see also Table 3):

- Factor 1 (Negative Syndrome) = Blunted Affect, Emotional Withdrawal, Poor Rapport, Passive Social Withdrawal, Lack of Spontaneity, Motor Retardation, Active Social Avoidance
- Factor 2 (Cognitive Syndrome) = Conceptual Disorganization, Difficulty in Abstract Thinking, Stereotyped Thinking, Mannerisms
and Posturing, Poor Attention, Disturbance of Volition,
Preoccupation, Poor Judgment

- Factor 3 (Positive Syndrome) = Delusions, Hallucinatory Behavior,
  Grandiosity, Suspiciousness/Persecution, Unusual Thought
  Content, Poor Judgment

- Factor 4 (Hostile Excitement Syndrome) = Excitement, Hostility,
  Uncooperativeness, Poor Impulse Control

- Factor 5 (Depression Syndrome) = Anxiety, Guilt Feelings, Tension,
  Depression, Somatic Concern

- Factor 6 (Disorientation Syndrome) = Disorientation

Of these derived factors, no single one accounted for more than fifteen
percent of the variance (this being the first factor or Negative Syndrome. The
second factor (Cognitive Syndrome) accounted for an additional 13% of the
variance with the third or Positive Syndrome accounting for an additional ten
percent. Factors 4 and 5 (Hostile excitement and Depression Syndromes
respectively) each accounted for an additional 8% of variance. A small
percentage of 3.8 was accounted for by the remaining sixth factor which was
described only by the Disorientation item.

Given the low loadings achieved by several items and the multiple
loadings achieved by the Disorientation item with only a small amount of
variance being accounted for by it in the sixth factor, it becomes prudent to
remove these items in a second factor analysis. This process of eliminating
items with low communalities and loadings serves to build the robustness of the derived model. By eliminating items that contribute little or not at all to the model (i.e. data reduction), a clearer picture of the latent structure becomes clearer.

A second principal components analysis with orthogonal varimax rotation and application of the eigenvalue criterion were again carried out. This analysis extracted five components with eigenvalues greater than one. This represented 59.01% of the variance. Removal of three items appeared to have changed little the amount of variance explained by this model.

With this analysis there were no statistical outliers, items with low or shared communalities. With reference to the assumptions regarding multicollinearity, the K-M-O Measure of Sampling Adequacy resulted in a score of .907 which again suggests that factor analysis is appropriate. The Bartlett’s Tests of Sphericity \( (X^2 = 14306.72, \text{ df } = 351, p = .0001) \) was significant. This indicates that sufficient correlations were found within the correlation matrix.

The resulting factor structure remained almost identical to the original structure, with some resulting clarity gained by the deletion of the three items. When considering only loadings greater than or equal to 0.50 as substantial (corresponding to a common variance between factor and variable
### Table 3 PCA Factor Loadings

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<td>Poor Spontaneity</td>
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<td>Motor Retardation</td>
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<td>Active social avoidance</td>
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<td>Conceptual Disorganization</td>
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<tr>
<td>Abstract Thinking</td>
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<td>Stereotyped Thinking</td>
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<td>Posturing</td>
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<td>Disorientation</td>
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<td>Poor Judgment</td>
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of 30%), a five factor solution results (see also Table 4). It should be noted that these dimensions do not represent subtypes, but rather components that make up the greater concept of schizophrenia. While factors are statistically independent, they can and usually do, overlap within given patients.

**Table 4 Revised Factor Loadings**

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<th>Factors</th>
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The Confirmatory Factor Analysis

The remaining sub-set of 1,176 subjects that were selected randomly from the main data set for use in the confirmatory factor analysis. It should be noted that the two samples did not overlap and were comprised of completely different individuals. This sample included 767 men and 409 women all diagnosed with schizophrenia. Subjects ranged from 18 to 65 years old with a mean age of 40.3 years. Seventy four percent (n= 868) of the sample was comprised of Caucasians while six percent (n= 70) of the subjects were African American. The remaining twenty two percent of the sample subjects were spread between Hispanic, Asian, or other categories.

Diagnostic sub-types were available for 1,168 of the subjects. Paranoid sub-type made up the majority of the subjects (n=732). Undifferentiated (n=230) and Disorganized (n=156) made up the next largest groups of diagnostic subtypes. The remaining cases were represented by subjects diagnosed with Residual sub-type (n=43) and Catatonic (n=7). The average number of years since initial diagnosis in this sample was 10.63 years.
Table 5 CFA Sample Demographics

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<th>Variable</th>
<th>Frequency</th>
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- 18-65 40.3 12.5
- 0-43 10.6 9.4
Table 6 CFA Sample SCI-PANSS Scores Summary

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<td>Unusual Thought Content</td>
<td>1-7</td>
<td>3.72</td>
<td>1.44</td>
</tr>
<tr>
<td>Disorientation</td>
<td>1-7</td>
<td>1.71</td>
<td>1.07</td>
</tr>
<tr>
<td>Poor Attention</td>
<td>1-7</td>
<td>2.81</td>
<td>1.33</td>
</tr>
<tr>
<td>Poor Judgment</td>
<td>1-7</td>
<td>3.80</td>
<td>1.41</td>
</tr>
<tr>
<td>Poor Volition</td>
<td>1-7</td>
<td>3.16</td>
<td>1.38</td>
</tr>
<tr>
<td>Impulse Control</td>
<td>1-7</td>
<td>2.31</td>
<td>1.27</td>
</tr>
<tr>
<td>Preoccupation</td>
<td>1-7</td>
<td>3.22</td>
<td>1.40</td>
</tr>
<tr>
<td>Active social avoidance</td>
<td>1-7</td>
<td>3.27</td>
<td>1.43</td>
</tr>
</tbody>
</table>

The CFA consisted of seven competing models of the SCI-PANSS factor structure (see Appendix D for a detailed comparison of each model’s factor structures. These included a three factor model as implied by the SCI-PANSS scoring system (Positive, Negative, and General). This model included all
thirty items scored from the interview. The second model is the original four factor model suggested by Kay and Sevy (1992) in the development of the interview. As with the prior model, all thirty items were used, though in a different structure than reflected in a positive, negative, and general breakdown. Additionally, the seven factor model originally found by Kay and Sevy (1992), though disregarded by them, is included in this analysis. The five factor model with 27 items derived from exploratory factor analysis described previously from this study is included. Finally, two competing five factor models were identified. A model described by Lindmyer and his associates (1995) was used as representative of the most commonly derived model with 22 items used. The five factor model utilizing 25 items described by White et al (1997) was entered given its robustness and uniqueness in describing the factors. Finally a null model was entered that implied no latent dimensions among the SCI-PANSS items.

Of the seven models tested for goodness of fit in the confirmatory factor analysis, five were derived empirically through EFA. Of note with each of these, several items were dropped due to poor or dual loadings. The three factor model tested was derived a priori by the authors of the SCI-PANSS and was thought to separate symptoms through accepted definitions of
positive and negative symptoms plus more general non-specific symptoms of schizophrenia.

The goal of a good model is to fit the observed data well, or in other words, to explain as much of the covariance present in the obtained data as possible within the specifications of the model. In evaluating the congruence between a latent structure model and observed data (i.e. goodness of fit) the chi-square statistic is used and the principle for interpreting it is the larger the chi-square, the better the fit (Bentler, 1992). If the chi square is statistically significant (e.g., \( p < .05 \)), then the residual matrix still has significant covariance in it and one may conclude that the model being tested does not fit the data well. If the chi-square is not statistically significant, then the null hypothesis is accepted, and one may conclude that the pre-specified model fits the observed data well, leaving little covariance in the residual matrix.

Typically, a non-significant \( \chi^2 \) statistic is the criterion for a model that fits the data. Since substantial sample size can lead to large \( \chi^2 \) for even good fitting models, conventions for adequate fit have been developed on the basis of comparative fit indices. Because symptom scale data contains a relatively high proportion of low intensity ratings that can result in violations of normal theory assumptions, robust statistics with Satorra-Bentler \( \chi^2 \) and robust comparative fit index were used primarily to evaluate model adequacy, though some consideration is given to an alternate fit index, the GFI or
Goodness of Fit Index. These estimators have been found to hold under violation of distribution assumptions. Following the recommendations of Bentler (1992), the threshold for an adequate model fit was set at robust CFI = 0.90. Equality of correlation matrices was evaluated by the CFI using maximum likelihood normal distribution estimates. In utilizing the GFI, a perfect fit between model and data would generate a fit index of 1.00. The goodness of fit measure that is adjusted for degrees of freedom is the Adjusted Goodness of Fit (AGFI). This particular index is the most conservative but less adaptive to any violations of distribution assumptions. A small and non-significant chi-square with a high AGFI (>0.8) were considered indicators of a well fitting model.

The results of the confirmatory factor analyses are presented in Table 7. None of the seven models met criteria for an adequate fit. The largest robust CFI was 0.873 which is smaller than the minimum criteria (0.90) for an adequately fitting model. Specifically, this was the Lindenmeyer (1994) Five Factor model.
Table 7 CFA Results

<table>
<thead>
<tr>
<th>Model</th>
<th>Chi-Square</th>
<th>df</th>
<th>p</th>
<th>GFI</th>
<th>AGFI</th>
<th>CFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null</td>
<td>8943.04</td>
<td>434</td>
<td>&lt;.001</td>
<td>0.525</td>
<td>0.491</td>
<td>0.446</td>
</tr>
<tr>
<td>PANSS 3 Factor Model</td>
<td>6149.32</td>
<td>402</td>
<td>&lt;.001</td>
<td>0.687</td>
<td>0.638</td>
<td>0.626</td>
</tr>
<tr>
<td>Kay-Sevy 4 Factor (1992)</td>
<td>3583.38</td>
<td>269</td>
<td>&lt;.001</td>
<td>0.777</td>
<td>0.731</td>
<td>0.733</td>
</tr>
<tr>
<td>White 5 Factor (1997)</td>
<td>2230.96</td>
<td>265</td>
<td>&lt;.001</td>
<td>0.859</td>
<td>0.827</td>
<td>0.841</td>
</tr>
<tr>
<td>Lindenmeyer 5 Factor (1994)</td>
<td>1501.14</td>
<td>199</td>
<td>&lt;.001</td>
<td>0.893</td>
<td>0.864</td>
<td>0.873</td>
</tr>
<tr>
<td>Current 5 Factor</td>
<td>2717.83</td>
<td>314</td>
<td>&lt;.001</td>
<td>0.841</td>
<td>0.808</td>
<td>0.832</td>
</tr>
<tr>
<td>Kay Sevy 7 Factor (1992)</td>
<td>5513.17</td>
<td>397</td>
<td>&lt;.001</td>
<td>0.728</td>
<td>0.681</td>
<td>0.667</td>
</tr>
</tbody>
</table>

df= degrees of freedom  GFI= Goodness of Fit  AGFI= Adjusted Goodness of Fit  CFI= Comparative Fit Index

The first model estimated was the null model (the no latent structure model), which revealed a relatively large and highly significant chi-square and low goodness of fit indices. These data indicated that a model assuming no latent structure underlying schizophrenic symptomatology fit the data poorly, and in fact, they suggested that the presence of a latent structure was likely. That is, to assume no latent structure is a worse crime than underspecifying a latent structure.

The three factor model suggested by the structure of the SCI-PANSS scoring (Positive, Negative, and General dimensions) as developed by its authors (Kay, et al, 1992) resulted in an under-identified model ($X^2=6149.32$, $df=402$, $p < .001$, GFI= 0.687, CFI = 0.626). The observed data demonstrated a very poor fit to this model. This strongly demonstrated that greater refinement is necessary in identifying fewer constraints on the model while
identifying more endogenous variables (i.e. the unobserved variables defined by the observed data) described by the actual observations.

Likewise, the seven factor model (Kay and Sevy, 1992) resulted in an over identified model that also did not fit the observed data well ($X^2=5513.17$, df = 397, $p < .001$, GFI= 0.728, CFI = 0.667). That is, too many factors were identified. These factors were the endogenous variables or variables that were described by the observed variables (i.e., the SCI-PANSS items). The poor fit suggested that too many of the observed variables which co-vary with each other were separated into separate factors. This separation removed from the results a more meaningful and representative structure.

Kay and Sevy (1992) had reduced this seven factor model to a four factor model of positive, negative, anxiety/depression, and cognitive dimensions. This model too resulted in a poorly fitting model well ($X^2=3583.38$, df = 269, $p < .001$, GFI= 0.777, CFI = 0.733). This variation of their proposed latent structure of schizophrenia symptomatology appeared to reflect an under-specification of the symptom dimensions.

These results suggested that a five factor model is superior to a three, four or seven factor model of schizophrenia symptomology. However, the three five factor models evaluated appeared very similar with regard to their goodness of fit. Each of these five factor models though resulted in significant chi-square values in the confirmatory factor analysis. This indicated that further refinement of these models, regardless of which has the absolute best
fit, is still warranted. Further exploration and testing of their chi-square values is warranted to distinguish the best fitting model. When the three models were compared the incremental chi-square was statistically significant in each case:

\[ X^2 \text{ Lindenmeyer, Current model} = 1216.69, \text{ df} = 115, p<.001 \]

\[ X^2 \text{ Lindenmeyer, White} = 729.82, \text{ df} = 66, p<.001 \]

\[ X^2 \text{ White, current model} = 486.87, \text{ df} = 49, p<.001 \]

One important consideration to bear in mind about these statistical evaluations is that the chi-square evaluates the likelihood of Model B under the assumption that Model A is correct (Arbuckle & Wothke, 1999). These results indicate that with the Lindenmeyer (1994) model, the least number of constraints have been placed on the model and has resulted in the best relative fit of all three models bearing in mind that the model can still improve given a CFI< 0.90. However, the additional constraints of the White (1997) five factor model had less support by the data and the new five factor model from the previous EFA had the least, relatively speaking, of the three. Within these three 5 factor models, there is some overlap in the items included in the models. The comparison of these models can then be seen as reflecting variations on a theme as it were of any number of five factor solutions. Therefore, it is necessary to examine problems that may be occurring for the SCI-PANSS at the item level.
IV. Discussion

One of the most important findings of this study is the clear indication that a five factor syndrome conceptualization of schizophrenia symptomatology best reflects that latent structure of this insidious disorder. Schizophrenia is best described as a disorder comprised of five dimensions. The components that describe schizophrenia are: positive, negative, cognitive, excitement, and an anxiety/depressive dimension.

The Positive Dimension is comprised of the most active and first rank symptoms that define the disorder. These include: delusions and hallucinatory behavior, grandiosity, and unusual thought content. It is primarily with these symptoms that a diagnosis is made clinically of schizophrenia.

The Negative Dimension is most clearly defined by the presence of blunted affect, emotional withdrawal, poor rapport with others, and passive or apathetic social withdrawal. Additional features of the negative spectrum include lack of spontaneity and flow in conversation as well as motor retardation. This spectrum reflects the difficulties in social relatedness often exhibited in many schizophrenic patients.

The third component, or Cognitive Dimension, is marked by difficulty in abstract thought, difficulties in conceptual organization, and poor attention. This specific dimension has a number of problems with it which will be discussed below. However, taken as a whole, it reflects the
presentation of formal thought disorders often present in schizophrenia and the challenges presented in the production, organizing, and retention of ideas and constructs.

The Excitement Dimension is clearly defined by symptoms of hostility, hyper-vigilance, hyperactivity, uncooperativeness, and poor impulse control. Collectively, these symptoms represent the difficulties in regulating behavior and at times the output related to the prior syndromes.

Finally, the Affect or mood Dimension is marked by depression, anxiety, and guilt. Additionally, somatic concerns and tension refer to the physiological reactions to disturbances in mood. Examples of these can include sweating, shaking, aches and pains without physiological cause, and fidgeting.

With the reduction of the data to a five-factor or pentagonal model, there are several implications for the conceptualization of schizophrenia. First and foremost, there is a more concise definition of the disorder. This assists in promoting clearer clinical communication about the disorder. Clinicians and researchers can more concisely describe the presentation of the disorder and those diagnosed with it. It also serves as a guide for ongoing research regarding the prognosis of schizophrenia and its etiology.

Additionally, there have been clear indications that all five factors of this model are sensitive to treatment with new anti-psychotic medications (Lindstrom, et al., 1994). Consequently this model might be of great interest
in future drug studies and clinical outcomes research when differences are sought between more and more selective pharmacological and psychological treatments.

These findings also suggest that any examination of schizophrenic subtypes and their causes, differentiating characteristics, or sequelae ought to consider a five factor model consisting of positive, negative, cognitive, mood, and excitement symptomatological factors. While the five factors of this model were distinct and constructed from co-varying items, an individual can be observed to experience symptoms from multiple factors. That is, multiple factors/dimensions can co-occur and are not exclusive in any one person. Unlike categories, dimensions define multiple properties that can co-occur within individuals (Andreasen et. al., 1994.) This then suggests that any attempt to classify individuals as positive or negative may be conceptually flawed (Dollfus, et. al, 1996), especially without consideration of at least the cognitive spectrum (Peralta and Cuesta, 1994). As noted by Andreasen (1990), the dualistic positive – negative distinction, although useful for some research strategies, is likely an oversimplification that needs significant modification and refinement.

While the etiology of some dimensions of schizophrenia symptoms remains obscure (Eaton, et al., 1995), there is substantial evidence that at least some of the dimensions of psychopathology in schizophrenia are related to different patterns of regional cerebral brain flow (Liddle et al., 1992). For
example, disorganization is consistently associated with abnormal blood flows in four parts of the brain. Psychotic symptoms are associated with abnormal blood flow in four other separate regions of the brain. These findings are consistent with disruptions in interrelated but independent circuits that may account for differences in clinical presentation. A heuristic approach into the etiology of schizophrenia would be to regard each of the five symptom dimensions as representing a distinct pathophysiology (Andreasen, et al., 1995).

The results also implicated some problems with the validity of the SCI-PANSS as the dimensions are currently configured when used to assess symptoms of schizophrenia. All the models evaluated in this confirmatory factor analysis, several of which figure dominantly in the literature, failed to meet CFA criteria for a model with adequate fit to a very large sample of empirical data. The three factor model (Kay, et al, 1992) with all 30 items utilized in the SCI-PANSS scoring was among the models with the poorest fit to empirical data.

There are several results from this large scale study that have implications for revision of the SCI-PANSS items. Review of the items and which factor they loaded on can readily demonstrate the most troublesome items. Some items loaded inconsistently across several studies. One specific item, Lack of Judgment and Insight (G12) failed entirely to load on any factors across a number of studies. With this particular item, a lack in clarity
in definition may be the source of the diffuse character of ratings (White, et al., 1997). “Lack of Judgment and Insight” combines into a single rating components of general social judgment, insight into the disorder, and the acceptance of the need for treatment. It may well be that these are in and of themselves discrete phenomenon.

The “Disorientation Item (G10) was only reflected in the Lindenmeyer model (1994) as part of the cognitive syndrome. The source of the diffuse loadings for the disorientation item may be a lack of clarity in definition of alternative levels of disorientation which compress evaluations of persons place and time at several levels (White, et al., 1997). An alternative approach to this problem is to rate the severity of disorientation as a progression first for time, then place, and lastly and most severely for person (Berg, 1988).

Another item that infrequently loads on any factor across studies is G16 or ‘Active Social Avoidance”. The lower anchor points reflect social patterns of being ill at ease with others, a preference to spend time alone, and participation in social functions only when required. The upper limits of this item are then suddenly described as few or no social activities due to fear or hostility of others especially if due to delusions. This particular item may lack in any discriminate validity by merging social skills deficits due to thought disorder at a moderate level or in more severe cases due directly due to active psychosis (Toomey et al., 1997). Alternatively, is the lack of social interaction and its severity due to other sequelae of the disorder or social phobias? Or
possibly an awareness of the disorder and the sense of embarrassment or social stigma attached to schizophrenia. Clearly, different routes of pathogeneses of this item could yield very different scorings and overlap of other items with this (i.e. delusions) could contaminate the scoring of this item (Mueser et al., 1994).

The rating of “Suspiciousness and Persecution” demonstrated very inconsistent loading across studies. It only loaded significantly in the EFA model derived in this study. Again, definitional issues may play an influence in rating this item. However, it may be that the subjective experience of suspiciousness or of being persecuted is typically a flavor of delusions rather than a discrete category in itself (Toomey et al., 1997). As such, it could be strongly influenced by large percentage of a sample being comprised of the DSM-IV subtype of Paranoid. However, it should be noted that problems with this particular item may stem from methodological difficulties of the studies rather than any intrinsic definitional problems with the item. That is, a selection bias may occur in terms of some subjects not agreeing or choosing not to participate based on their own suspiciousness or sense of paranoia.

While several studies have identified “Conceptual Disorganization” as a symptom of the cognitive syndrome and others as part of the positive syndrome, there are serious concerns with this item. The fundamental problem with this item derives from the attempt to scale the multi-dimensional construct of thought disorder into a single item (White, et al.,
1997). As presently defined the anchor point for “mild conceptual disorganization” includes evidence of circumstantial or tangential thinking (positive thought disorder) but at the upper end of the scale anchors define a negative thought disorder (mutism). However, deletion of conceptual disorganization from a dimension or the whole latent structure, results in a scale lacking any assessment of formal thought disorder, which is clearly a primary feature of schizophrenia (APA, 1994). Additional measures of thought disorder are needed for this scale to validly assess schizophrenia.

The item of “Stereotyped Thinking” (N7) measures on the lower end a rigidity of beliefs which in itself may be influenced by delusions or other psychotic processes. At the upper end, communication is severely restricted by repetitiveness or limitations in phrasing which may well be mediated by psychosis or a formal thought disorder (Toomey, et al., 1997). Adding further complexity to this dimension is the common presentation of inappropriate affect in schizophrenia. While often considered a part of conceptual disorganization it is not considered as a part of this scale nor is it considered independently (White, et al., 1997). This complexity, on the face of it, would suggest that not all conceptual disorganization factors are equivalent.

The inconsistent loadings of “Somatic Concerns” (G1) across factor analytic studies may demonstrate less of a problem with definitional issues than it does of causality. That is, this item combines elements of somatic concern that are common in dysphoric and anxious moods with somatic
delusions that often occur with active positive symptoms (Francis, First, & Pincus, 1995). Clearer guidelines for the differential decisions regarding this rating are likely needed in the interview stage and ratings.

It is here that this study meets with certain limitations. The process of factor analysis certainly allows for additional models that could be entered in different variations of entering or removing the most controversial items. However, this would require an enormous number of variations, numbering well into the hundreds or thousands. Within any derived factor structure, the removal or dropping of any number of items in refining a model can have significant even dramatic effects on the number of factors. Additionally, further elaboration of the five factor model needs to occur at the item level. Specifically, there needs to be further defining of certain items as previously described or the inclusion of more items to adequately describe more complex, multi-dimensional items such as conceptual disorganization (White, et al., 1997). Without this being done, little more can be gained in adjusting the five factor models of schizophrenia.

It may be difficult to compare the findings of this study directly with those of other studies that used assessment scales other than the SCI-PANSS. This is due to the fact that the factor structure of symptoms depends highly on the rating instrument used for assessing the symptoms. Schizophrenic symptoms assessed with other rating scales likely result in a different factor structure (Dollfus, et al., 1996). The only exception to this, of
course, is if the other assessments utilized similar criteria, items, and constructs thereby generating some degree of concurrent validity.

One limitation of the method of evaluating latent structures involves the statistical methodology utilized in this study. Factor analysis is a data reduction method that shows which items are highly correlated with each other (Grimm and Yarnold, 1995). Demonstrating that they co-occur does not prove a conceptual or an etiological relationship. One cannot infer from the results of factor analysis that these items have a common mechanism nor does it imply the existence of diagnostic sub-types.

The agreement to participate in drug trials by a group of individuals diagnosed with schizophrenia may have presented an element of selection bias into the data pool. As noted earlier in terms of suspiciousness and persecution, individuals manifesting these symptoms may refuse to participate in research based upon the very nature of paranoia. Additionally, many individuals who exhibit profound difficulties in abstract thought, disorientation, and / or lack the ability to provide informed consent may not be represented in this study. They may have been underrepresented due to their inability to enter the drug trials without the ability to consent to the original treatment. This selection bias may have had some effect on reducing the heterogeneity of the sample. This reduction in heterogeneity in turn may reduce the amount of variance accounted for in the final solutions.
Statistical analysis of psychiatric rating scales seeks to refine insights into the dimensions of schizophrenia based upon clinical observation. The test of the validity of defined dimensions remains the same; a guide to research on etiology and prognosis, detection of clinical change, and concise clinical description of the disorder useful in clinical communication. Compared to other proposed models for the SCI-PANSS, a pentagonal structural model of schizophrenia described in this study most closely meets empirical criteria for increased precision of measurement. The model is more complex than the earliest described models of schizophrenia. The complexity of the model is a function of the wide range of symptoms examined and the precision of confirmatory factor analysis (White, et al., 1997).
V. Conclusion and Summary

Schizophrenia is a chronic and debilitating disorder marked by the manifestation of a complex set of symptoms. Individuals diagnosed with schizophrenia typically respond to hallucinatory behavior and unshakeable delusions. Cognitive abilities and social interactions become severely impaired. Additionally, there are disturbances in subjective mood often related to the direct and indirect sequelae of the disorder. Its cost to individuals and society are extreme. The individual distress and financial costs touching many lives has certainly brought schizophrenia to the forefront of psychological and pharmacological research for decades.

While volumes have been written about schizophrenia, the increase in knowledge leads to the need for fine tuning of definitional issues and the description of the disorder. While early definitions of schizophrenia focused on a dual process theory, current evidence suggests that it is far more complex than this. Yet research needs to find a sense of clarity balanced with completeness in describing this disorder in a way that reflects naturally occurring phenomena.

This study helps build upon earlier foundations that suggest that schizophrenia is likely comprised of five syndromes that complete a pentagonal model of this illness. These syndromes are likely co-occurring with independent pathogenic routes. Their interactions likely make
schizophrenia as debilitating as it is. These syndromes can be described as positive, negative, cognitive, excitement, and mood related.

The clarity of the definitions of syndromes and the latent structure of schizophrenia serves many purposes. Chief among them is and accurate and clear description of the disorder. This promotes clearer clinical and scientific communication regarding etiology, treatment, and prognosis. Future work may lead to a clearer understanding of clinical sub-types. Clearly, the progress in pharmacological treatment targeting multiple symptoms warrants a clearer understanding of the many dimensions of schizophrenia.

However, there remains the need for further specification of these models. Further clarity is needed in definitional issues of some criteria. Others, especially in terms of symptoms of thought disorder, are need of isolation of specific components as multiple domains of cognitive related symptoms.
Works Cited


Andreasen, N. C. (1983) the Scale for the Assessment of Negative Symptoms (SANS). Iowa City, University of Iowa.


Appendix A

Items represented in the positive and negative syndrome scale

Positive Syndrome Scale
P1. Delusions
P2. Conceptual Disorganization
P3. Hallucinatory Behavior
P4. Excitement
P5. Grandiosity
P6. Suspiciousness/Persecution
P7. Hostility

Negative Syndrome Scale
N1. Blunted Affect
N2. Emotional Withdrawal
N3. Poor Rapport
N4. Passive/apathetic social withdrawal
N5. Difficulty in abstract thinking
N6. Lack of spontaneity and flow of conversation
N7. Stereotyped thinking

General Psychopathology Scale
G1. Somatic concern
G2. Anxiety
G3. Guilt feelings
G4. Tension
G5. Mannerisms and posturing
G6. Depression
G7. Motor retardation
G8. Uncooperativeness
G9. Unusual thought content
G10. Disorientation
G11. Poor attention
G12. Lack of judgement and insight
G13. Disturbance of volition
G14. Poor impulse control
G15. Preoccupation
G16. Active social avoidance
Appendix B

Sample item from the PANSS

P3. Hallucinatory behavior

Definition
Verbal report or behavior indicating perceptions which are not generated by external stimuli. These may occur in the auditory, visual, olfactory, or somatic realms.

Basis for Rating
Verbal report and physical manifestations during the course of interview as well as reports of behaviors by primary care workers or family.

1. *Absent.* Definition does not apply.
2. *Minimal.* Questionable pathology; may be at the upper extreme of normal limits.
3. *Mild.* One or two clearly formed but infrequent hallucinations, or else a number of vague abnormal perceptions which do not result in distortions of thinking or behavior.
4. *Moderate.* Hallucinations occur frequently but not continuously, and the patient’s thinking and behavior are affected only to a minor extent.
5. *Moderate severe.* Hallucinations are frequent, may involve more than one sensory modality, and tend to distort thinking and/or disrupt behavior. Patient may have a delusional interpretation of these experiences and respond to them emotionally and, on occasion, verbally as well.
6. *Severe.* Hallucinations are present almost continuously, causing major disruption of thinking and behavior. Patient treats these as real perceptions, and functioning is impeded by frequent emotional and verbal responses to them.
7. *Extreme.* Patient is almost totally preoccupied with hallucinations, which virtually dominate thinking and behavior. Hallucinations are provided a rigid delusional interpretation and provoke verbal and behavioral responses, including obedience to command hallucination.
Appendix C

The Structured Clinical Interview for the Positive and Negative Syndrome Scale (SCI-PANSS)

Patient Name:
Interviewer:
Date:

Data on Lack of Spontaneity and Flow of Conversation,” (N6) “Poor Rapport,” (N3) and “Conceptual Disorganization” (P2)

“Hi, I’m... We’re going to be spending the next 30 to 40 minutes talking about you and your reasons for being here. Maybe you can start out by telling me something about yourself and your background?”

(Instructions to interviewer: Allow at least 5 minutes for a non-directive phase serving to establish rapport in the context of an overview before preceding to the specific questions listed below.)

Data on “Anxiety” (G2)
Have you been feeling worried or nervous in the past week?
IF NO: Would you say that you’re usually calm and relaxed?
IF YES: What’s been making you feel nervous (worried, uncalm, unrelaxed)?
Just how nervous have you been feeling?
Have you been shaking at times, or has your heart been racing?
Do you get into a state of panic?
Has your sleep, eating, or participation in activities been affected?

Data on “Delusions” (P1) and “Unusual Thought Content” (G9)
Have things been going well for you?
Has anything been bothering you lately?
Can you tell me something about your thoughts on life and its purpose?
Do you follow a particular philosophy?
Some people tell me they believe in the Devil; what do you think?
Can you read other people’s minds?
IF YES: How does this work?
Can other people read your mind?
IF YES: How can they do that?
Is there any reason that someone would want to read your mind?
Who controls your thoughts?

**Data on “Suspiciousness/Persecution,” (P6) “Passive/Apathetic Social Withdrawal,” (N4) “Active Social Avoidance,” (G16) and “Poor Impulse Control” (G14)**

How do you spend your time these days?
Do you prefer to be alone?
Do you join in activities with others?
   IF NO: Why not...Are you afraid of people, or do you dislike them?
   IF YES: Can you explain?
   IF YES: Tell me about it.
Do you have many friends?
   IF NO: Just a few?
   IF NO: Any?...Why?
   IF YES: Why just a few friends?
   IF YES: Close friends?
   IF NO: Why not?
Do you feel that you can trust most people?
   IF NO: Why not?
Are there some people in particular that you don’t trust?
   IF YES: Can you tell me who they are?
   Why don't you trust people (or name specific person)?
      IF “DON'T KNOW” OR “DON’T WANT TO SAY”: Do you have good reason not to trust...?
   Is there something that...did to you?
   Perhaps might do to you now?
      IF YES: Can you explain to me?
Do you get along with others?
   IF NO: What’s the problem?
Do you have a quick temper?
Do you get into fights?
   IF YES: How do these fights start?
   Tell me about these fights.
   How often does this happen?
Do you sometimes lose control of yourself?
Do you like most people?
   IF NO: Why not?
Are there perhaps some people who don’t like you?
   IF YES: For what reason?
Do others talk about you behind your back?
   IF YES: What do they say about you?
   Why?
Does anyone ever spy on you or plot against you?
Do you sometimes feel in danger?
IF YES: would you say that your life is in danger?
Is someone thinking of harming you or even perhaps thinking of killing you?
Have you gone to the police for help?
Do you sometimes take matters into your own hands or take action on those who might harm you?
  IF YES: What have you done?

Data on “Hallucinatory Behavior” (P3) and associated delusions
Do you once in a while have a strange or unusual experience?
Sometimes people tell me that they can hear noises or voices inside their head that others can’t hear. What about you?
  IF NO: Do you sometimes receive personal communications from the radio or TV?
    IF NO: From God or the Devil?
    IF YES: What do you hear?
    Are these as clear and loud as my voice?
    How often do you hear these voices (noises, messages, etc.)?
    Does this happen at a particular time of day or all the time?
    IF HEARING VOICES: Can you recognize whose voices these are?
    What do the voices say?
    Are the voices good or bad?
    Pleasant or unpleasant?
    Do the voices interrupt your thinking or your activities?
    Do they sometimes give you orders or instructions?
      IF YES: For example?
      Do you usually obey these orders (instructions)?
What do you make of these voices (or noises): where do they come from?
Why do you have these experiences?
Do ordinary things sometimes look strange and distorted to you?
Do you sometimes have “visions” or see things others can’t see?
  IF YES: For example?
  Do these visions seem very real or life like?
  How often do you have these experiences?
Do you sometimes smell things that are unusual or that others don’t smell?
  IF YES: Please explain.
Do you get any strange or unusual sensations from inside your body?
  IF YES: Tell me about this.

Data on “Somatic Concern” (G1)
How have you been feeling in terms of your health?
  IF OTHER THAN” GOOD”: What has been troubling you?
  IF “GOOD”: Do you consider yourself in top health?
  IF NO: What has been troubling you?
Do you have any medical illness or disease?
Has any part of your body been troubling you?
   IF NO: how is your head? Your heart? Stomach? The rest of your body?
   IF YES: Could you explain?
Have your head or body changed in shape or size?
   IF YES: Please explain.
   What is causing these changes?

Data on “Depression” (G6)
How has your mood been in the past week: mostly good, mostly bad?
   IF MOSTLY GOOD: Have there been times in the last week that you
   were feeling sad or unhappy? IF YES, NEXT QUESTION:
   IF ‘MOSTLY BAD”: Is there something in particular that is making
   you sad?
   How often do you feel sad?
      Just how sad have you been feeling?
      Have you been crying lately?
      Has your mood in any way affected your sleep?
      Has it affected your appetite?
      Do you participate less in activities on account of your mood?
      Have you had any thoughts of harming yourself?
         IF YES: Any thoughts about ending your life?
         IF YES: Have you attempted suicide?

Data on “Guilt Feelings” (G3) and “Grandiosity” (P5)
If you were to compare yourself to the average person, how would you come
out: a little better, maybe a little worse, or about the same?
   IF WORSE: Worse in what ways?
      Just how do you feel about yourself?
   IF BETTER: Better in what ways?
   IF ABOUT THE SAME: Are you special in some ways?
      IF YES: In what ways?
      Would you consider yourself gifted?
Do you have any talents or abilities that most people don’t have?
   IF YES: Please explain.
Do you have any special powers?
   IF YES: What are these?
      Where do these powers come from?
Do you have extrasensory perception (ESP), or can you read other
people’s minds?
Are you very wealthy?
   IF YES: Explain please.
Can you be considered to be very bright?
   IF YES: Why would you say so?
Would you describe yourself as famous?
Would some people recognize you from TV, radio, or the newspaper?
   IF YES: Can you tell me about it?
Are you a religious person?
   IF YES: are you close to God?
      IF YES: Did God assign you some special role or purpose?
         Can you be considered one of God’s messengers or angels?
            IF YES: What special powers do you have as God’s messenger (angel)?
   Do you perhaps consider yourself to be God?
Do you have a special mission in life?
   IF YES: What is that mission?
      Who assigned you that mission?
Did you ever do something wrong – something you felt bad or guilty about?
   IF YES: Just how much does that bother you now?
   Do you feel that you deserve punishment for that?
      IF YES: What kind of punishment do you deserve?
         Have you at times thought of punishing yourself?
            IF YES: Have you ever acted on these thoughts of punishing yourself?

Data on “Disorientation” (G10)
Can you tell me what is today’s date (i.e. the day month, and year)?
What is the name of the place you are in now?
(If hospitalized :) What ward are you on?
What is the address of where you stay now?
If someone had to reach you by phone, what number would that person call?
What is the name of the doctor that is treating you?
(If hospitalized :) Can you tell me who else is on staff and what they do?
Do you know who is now the President?
Who is our Governor?
Who is the Mayor of this city?

Data on “Difficulty in Abstract Thinking” (N5)
I’m going to now say a pair of words, and I’d like you to tell me in what important way they are alike. Let’s start, for example, with the words “apple” and “banana”. How are they alike...what do they have in common?
   IF “THEY ARE BOTH FRUIT”: Good. Now what about...?
   (Select three other items from the Similarities list at varying levels of difficulty from Appendix A.)

IF AN ANSWER IS GIVEN THAT IS CONCRETE, TANGENTIAL, OR IDIOSYNCRATIC, E.G., “THEY BOTH HAVE SKINS,” “YOU CAN EAT
THEM," “THEY'RE SMALL," OR “MONKEYS LIKE THEM”: Ok, but they’re both fruit. Now how about…and…. how are these alike? (Select three other items from the Similarities list at varying levels of difficulty from Appendix A.)

Appendix A

1. How are a ball and an orange alike?
2. Apple and banana?
3. Pencil and pen?
4. Nickel and dime?
5. Table and chair?
6. Tiger and elephant?
7. Hat and shirt?
8. Bus and train?
9. Arm and leg?
10. Rose and tulip?
11. Uncle and cousin?
12. The sun and the moon?
13. Painting and poem?
14. Hilltop and valley?
15. Air and water?
16. Peace and prosperity?

Note on Appendix A: Similarities are generally assessed by sampling four of the items at different levels of difficulty (i.e., one item selected from each quarter of the full set). When using the PANSS longitudinally, items should be systematically alternated with successive interviews so as to provide different selections from the various levels of difficulty and thus minimize repetition.

You have probably heard the expression, “Carrying a chip on the shoulder.” What does that really mean?
There’s a very old saying, “Don’t judge a book by its cover.” What is the deeper meaning of this proverb? (Select two other proverbs from the list in Appendix B at varying levels of difficulty.)

Appendix B

What does the saying mean:
1. "Plain as the nose on your face".
2. “Carrying a chip on your shoulder”.
3. “Two heads are better than one”.
4. “Two many cooks spoil the broth”.
5. “Don’t judge a book by its cover”.
6. “One man’s food is another man’s poison”.
7. “All that glitters is not gold”.
8. “Don’t cross the bridge until you come to it”.
9. “What’s good for the gander is good for the gander”.
10. “The grass is always greener on the other side”.
11. “Don’t keep all your eggs in one basket”.
12. “One swallow does not make the summer”.
13. “A stitch in time saves nine”.
14. “A rolling stone gathers no moss”.
15. “The acorn never falls far from the tree”.
16. “People who live in glass houses should not throw stones at others”.

Note on Appendix B: Proverb interpretation is generally assessed by sampling four of the items at different levels of difficulty (i.e., one item selected from each quarter of the full set). When using the PANSS longitudinally, items should be systematically alternated with successive interviews so as to provide different selections from the various levels of difficulty and thus minimize repetition.

**Data on “Lack of Judgment and Insights” (G12)**

How long have you been in the hospital (clinical, etc.)?
Why did you come to the hospital (clinical, etc.)?
Did you need to be in the hospital (clinical, etc.)?
  IF NO: Did you have a problem that needed treatment?
  IF YES: Would you say that you had a psychiatric or mental problem?
  IF YES: Why?...would you say that you had a psychiatric or mental problem?
  IF YES: Can you tell me what it consists of?
  IF YES: In your own opinion, do you need to be taking medicine?
  IF NO:
  (If medicated :) Why then are you taking medication.
  (If undedicated:) Why are you still in the hospital (clinical, etc.)
  IF YES: Why?...Does the medicine help you in some way?
Do you at this time have any psychiatric or mental problems?
  IF NO: For what reason are you still in the hospital (clinical, etc.)?
  IF YES: Please explain.
  Just how serious are these problems?
  (If hospitalized:)
    Are you ready yet for discharge from the hospital?
    Do you think you’ll be taking medicine for your problems after discharge?
What are your future plans?
What about your longer range goals?
## Appendix D

### The CFA Compared Factor Structures

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| Models                        | PANSS General |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|-------------------------------|---------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                               | G1       | G2       | G3       | G4       | G5       | G6       | G7       | G8       | G9       | G10      | G11      | G12      | G13      | G14      | G15      | G16      |         |         |         |         |         |         |         |         |         |         |         |         |         |
| Null*                         | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   |         |         |         |         |         |         |         |         |         |         |         |         |
| PANSS 3 Factor                | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   | G   |         |         |         |         |         |         |         |         |         |         |         |         |         |
| Kay Sevy 4 Factor             | A   | A   | A   | E   | N   | A   | N   | E   | P   | N   | P   | N   | E   | A   | N   |     |         |         |         |         |         |         |         |         |         |         |         |         |         |
| Lindenmeyer 5 Factor          | A   | A   | A   | A   | N   | A   | N   | E   | P   | C   | C   | E   | C   | N   |     |     |         |         |         |         |         |         |         |         |         |         |         |         |         |
| Current 5 Factor              | A   | A   | A   | C   | A   | N   | E   | P   | C   | C   | E   | C   | N   |     |     |     |         |         |         |         |         |         |         |         |         |         |         |         |         |
| White 5 Factor**              | A   | A   | A   | A   | A   | N   | A   | N   | E   | P   | C   | C   | E   | C   | N   |     |     |     |         |         |         |         |         |         |         |         |         |         |         |
| Kay Sevy 7 Factor             | A   | A   | A   | A   | E   | N   | A   | N   | E   | P   | C   | N   | P   | N   | E   | A   | N   |         |         |         |         |         |         |         |         |         |         |         |         |         |

* Each of the SCI-PANSS items was considered as an independent dimension
**In White (1997) the Cognitive dimension was titled Autistic and the Excitement dimension titled Activation

Key: P = Positive, N = Negative, C = Cognitive, E = Excitement, A = Affect/Anxiety/Depressive, G = General, St = Stereotypen, S = Suspicious

The above table lists all 7 models of the SCI-PANSS that were entered in the confirmatory factor analysis. Each item (symptom) of the SCI-PANSS is listed. Each item is designated by letter to the factor structure of each model. Blank cells indicate that the item was dropped from the final factor structure. In the CFA, each model was entered using the factor structures described above.
VITA

Paul Dudek, Ph D.

Education

Drexel University, Philadelphia, PA
Ph.D. in Clinical Psychology (APA Accredited Program) November 2005

Loyola College in Maryland, Baltimore, MD
Master of Science Degree in Clinical Psychology May 1997

Glassboro State College, Glassboro, NJ
Bachelor of Arts Degree in Psychology May 1992

Professional Experience

Staff Clinical Psychologist III
Special Treatment Unit- Annex, Rahway, NJ

Doctoral Internship
Ancora Psychiatric Hospital, Hammonton, NJ

Senior Psychology Extern
MCP/Hahnemann University, Philadelphia, PA

Site Coordinator/Project Director
Program Evaluation For Homeless Persons with Mental Illness, Philadelphia, PA

Project Coordinator
CMHC for Gloucester County, Woodbury, NJ

Dual Diagnosis Therapist
CMHC for Gloucester County, Woodbury, NJ

Psychological Evaluator
Adolescent Assessment Program, Phila., PA

Honors

MCP/Hahnemann University Award for Outstanding Student Research 1999

Cum Laude
Glassboro State College 1992

Dr. Thomas Robinson Senior Medallion Award for Outstanding Student Leadership 1992
Glassboro State College